Office for National Statistics

Article

National Accounts articles: Analysis of revisions in Blue Books and Pink Books, 2018

Reasons for revisions to UK National Accounts estimates introduced during Blue Book 2018 and Pink Book 2018. It includes analysis of the quarterly profile of gross domestic product (GDP) in recent years and examines various features of how GDP is produced.

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Table of contents

1 . Main points

- The methodological improvements introduced in Blue Book 2018 have had a modest impact, with smaller revisions to the level of nominal gross domestic product (GDP) and real GDP growth relative to the average revision across previous Blue Books.
- Revisions to GDP in the initial vintages, which largely reflect the incorporation of new information, continue to be small and not statistically significant; revisions to later vintages, which reflect methodological improvements, provide a larger and statistically significant source of revision.
- There is no evidence of residual seasonality in the latest estimates of GDP, so this is not considered to be a factor in the recent profile of quarterly GDP growth.

2 . Introduction

It is our role to produce timely estimates of economic activity using all information available at that point. As additional information becomes available, we have a more complete picture of economic activity in that quarter, which we reflect in our latest estimates. This process can lead to revisions to gross domestic product (GDP).

We are committed to explaining the reasons for these revisions to be transparent to our users. It can be difficult to quantify how much of the revision is due to any one reason in any given period as several explanations will almost certainly apply to each vintage of GDP. That said, the main reasons for why revisions occur are:

- revisions to source data and replacing forecasts with outturns
- annual benchmarks
- the supply and use table compilation process
- revised seasonal adjustment factors and updated output weights
- new methods and international standards

UK National Accounts, The Blue Book is an annual publication, which includes the process in which we produce fully reconciled and balanced annual estimates of economic activity. It also offers the opportunity for major methodological improvements to be introduced. Revisions that reflect an increase in data content usually occur only during the first and second Blue Books in which the data are included, with subsequent revisions being almost completely due to methodological changes.

This article will focus on the revisions that were introduced as part of Blue Book 2018, outlining the main improvements that were introduced and comparing the size of these revisions with previous Blue Books. It will also show the revisions performance over time, providing some insight into the quality of early estimates of GDP. It then concludes with new analysis that looks at the recent quarterly profile of GDP, specifically in the context of the recent US experience where there has been a tendency for estimates of GDP growth in the first quarter to be noticeably weaker than in other quarters reflecting residual seasonality.

3 . Blue Book 2018 revisions

The first estimate of quarterly gross domestic product (GDP) is published approximately 40 days after the end of the reference quarter, while further information is then published as part of the quarterly national accounts (QNA), approximately 85 days after the end of the quarter[1]. The annual Blue Book process enables balancing to take place at a more detailed level, while allowing for major methodological improvements to be introduced. We published an article that provided a comprehensive overview of all the improvements incorporated into Blue Book 2018. The main changes included the following:

Net spread earnings

Improved estimates of the margins where financial companies buy assets at a price that is typically lower than the prevailing market price and sell them at a price that is typically above the market price. Traders are compensated for such transactions and the improvements to how this is recorded are reflected in higher estimates of those earnings by financial traders based in the UK. As a financial service is typically embedded in the price of the assets when sold to foreign investors by traders based in the UK, this led to revisions to trade in services.

Purchased software

Amendments to the estimation of other machinery and equipment, and information and communication technology equipment to fully correct for previous updates to how elements of purchased software are recorded.

Pensions

Updated estimates of funded public sector employee pensions in financial corporations, where the employer or pension manager is in central or local government. These changes impacted upon estimates of compensation of employees and the operating surplus of financial corporations.

Trade in goods processing systems

Revisions to trade in goods can in part be attributed to the development of new processing systems, improving the quality and the granularity in which we are able to report trade figures.

Nominal revisions will in most cases feed through to affect the volume estimates. The only exceptions will be those where there is a significant change to how deflation is applied in the national accounts – for instance, the switch from Retail Prices Index (RPI) to Consumer Prices Index (CPI) in Blue Book 2011. However, this was not the case in Blue Book 2018, so these improvements are the basis for the revisions analysis to the volume estimates.

There are numerous ways that can be used to summarise revisions, including:

- the mean revision (MR) shows whether there is a systematic tendency for estimates to be revised upwards or downwards from the initial estimates and gives an indication of how reliable the initial estimate is
- the mean absolute revision (MAR) measures its absolute size so upward revisions are not offset by downward revisions of the same magnitude
- the mean square revision (MSR) incorporates both the degree of bias and the variance of the revision, as large revisions are treated more seriously than small revisions

Revisions to nominal GDP: Blue Book 2018

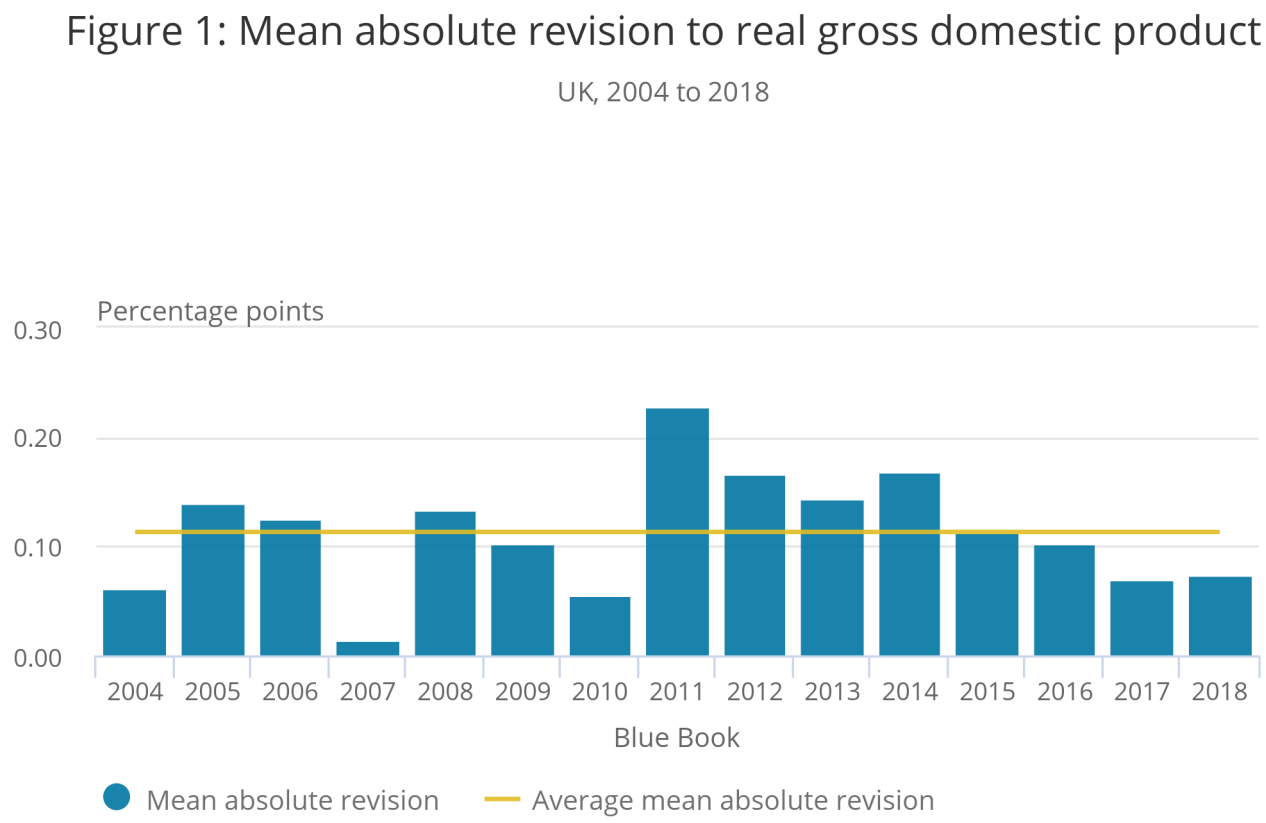
Revisions in Blue Book 2018 had a relatively modest impact, increasing the level of nominal GDP by 0.3% on average from 1997 while leaving its profile largely unchanged. This is smaller than the revisions seen in recent Blue Books, where the average revision to nominal GDP has been 0.9% from those published from 2004 to 2017. Annex A provides an overview of the methodological changes in each of these earlier Blue Books.

Revisions to real GDP: Blue Book 2018

Figure 1 shows the MAR from Blue Book 2004 to Blue Book 2018, illustrating how the size of the most recent set of revisions to quarterly real GDP growth compares with those in previous Blue Books. Revisions to Blue Book 2018 were relatively small compared with previous Blue Books, with a MAR of 0.07 percentage points compared with an average of 0.12 percentage points across Blue Book 2004 to Blue Book 2017.

Figure 1: Mean absolute revision to real gross domestic product

UK, 2004 to 2018



Source: Office for National Statistics - UK National Accounts

Notes:

1. The revisions in each Blue Book relate to the period from Quarter 1 1997 to the latest quarter available in that publication.

2. Blue Book 2007 and Blue Book 2010 were closed for revision.

3. Blue Book 2011 includes the switch from RPI to CPI, while Blue Book 2014 captures the incorporation of ESA 2010 in the national accounts.

4. The chart is calculated on the revisions between a Blue Book round and the preceding vintage – for example, the 2018 revisions here relate to May and June 2018.

Historical revisions to real GDP

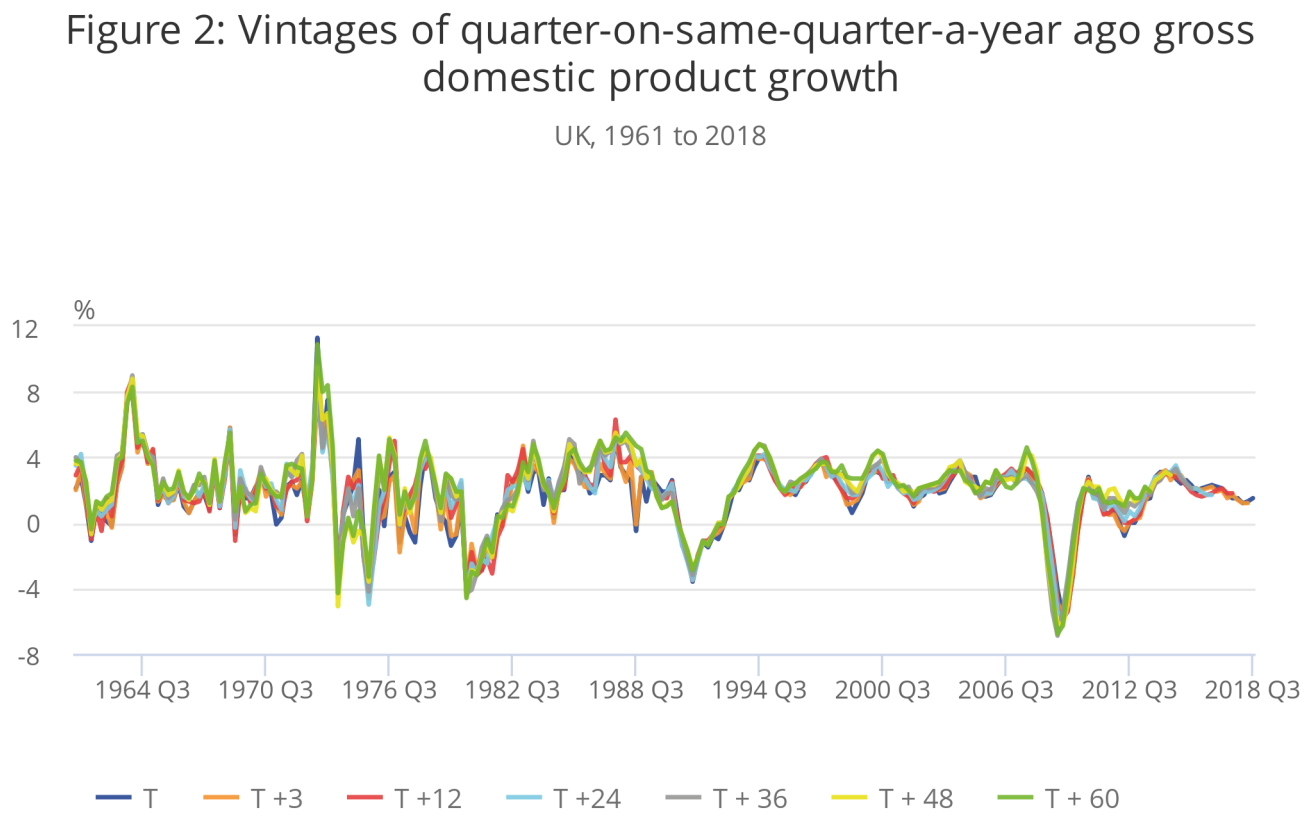
A “final” estimate of GDP does not exist in principle as all periods are generally open for revision in Blue Book rounds. However, for the purposes of revisions analysis, it is necessary to define a vintage as being “final”. We consider T+60 (first estimate + 60 months) to be an appropriate vintage as it is considered sufficient for all data content revisions to have been included, leaving only further definitional and methodological revisions to follow.

Figure 2 shows selected vintages of quarter-on-a-quarter-a-year-ago GDP growth, including the first estimate (T) and the “final” estimate, published five years later (T+60 months), which are broadly in line with the typical timing of data revisions explained earlier. This provides an insight into the scale of GDP revisions that have been reflected in the UK National Accounts, showing how the increased data content and methodological improvements lead to revisions in the five years after the initial estimate is published.

The closer the vintages around an observation at any point in time, the less the scale of revisions for that quarter. For instance, if an estimate has been unrevised from its initial estimate, then all of these vintages would coalesce around the same quarterly GDP figure.

Figure 2: Vintages of quarter-on-same-quarter-a-year ago gross domestic product growth

UK, 1961 to 2018



Source: Office for National Statistics - UK National Accounts

Notes:

1. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).

It can be seen that the last 30 years have been characterised by relatively small revisions – the only exceptions are the late 1990s and early 2000s, and the recovery after the financial crisis, where there is a wider range in the quarterly profiles on each of these vintages.

The “final” vintage shows that quarterly growth has been revised up from earlier estimates in these periods, with initial estimates pointing to a weaker picture of economic growth. In contrast, economic activity was much more volatile in the 1970s and subject to higher levels of revision, which may reflect that it tends to be easier to record early estimates of economic activity with more precision in more stable times.

Figure 3 shows the MR and MAR between the first published estimate of quarterly GDP growth and those published after 3, 24 and 60 months.

There is a zero MR at T+3, implying that on average there is no tendency for the first estimate to be revised up or down in these early vintages. The MR is a little higher when comparing the first published estimate with the “final” vintage, as one might expect – there has been a much larger window in which more information has been made available that relates to that quarter.

We find that the initial revisions of the quarterly round (T+3) and those revisions that tend to reflect the incorporation of annual benchmarks and balancing in a supply and use framework (T+24) are not statistically significant. This is not the case for those revisions in the “final” estimate (T+60), although these revisions tend to reflect more structural changes to how GDP is compiled in the national accounts, such as the introduction of CPI (Blue Book 2011) and the move to European System of Accounts: ESA 2010, which included the capitalisation of Research and Development (Blue Book 2014). These revisions tend not to be forecastable, as these methodological changes cannot be anticipated at the time of the first estimate so are less a reflection of the quality of early estimates.

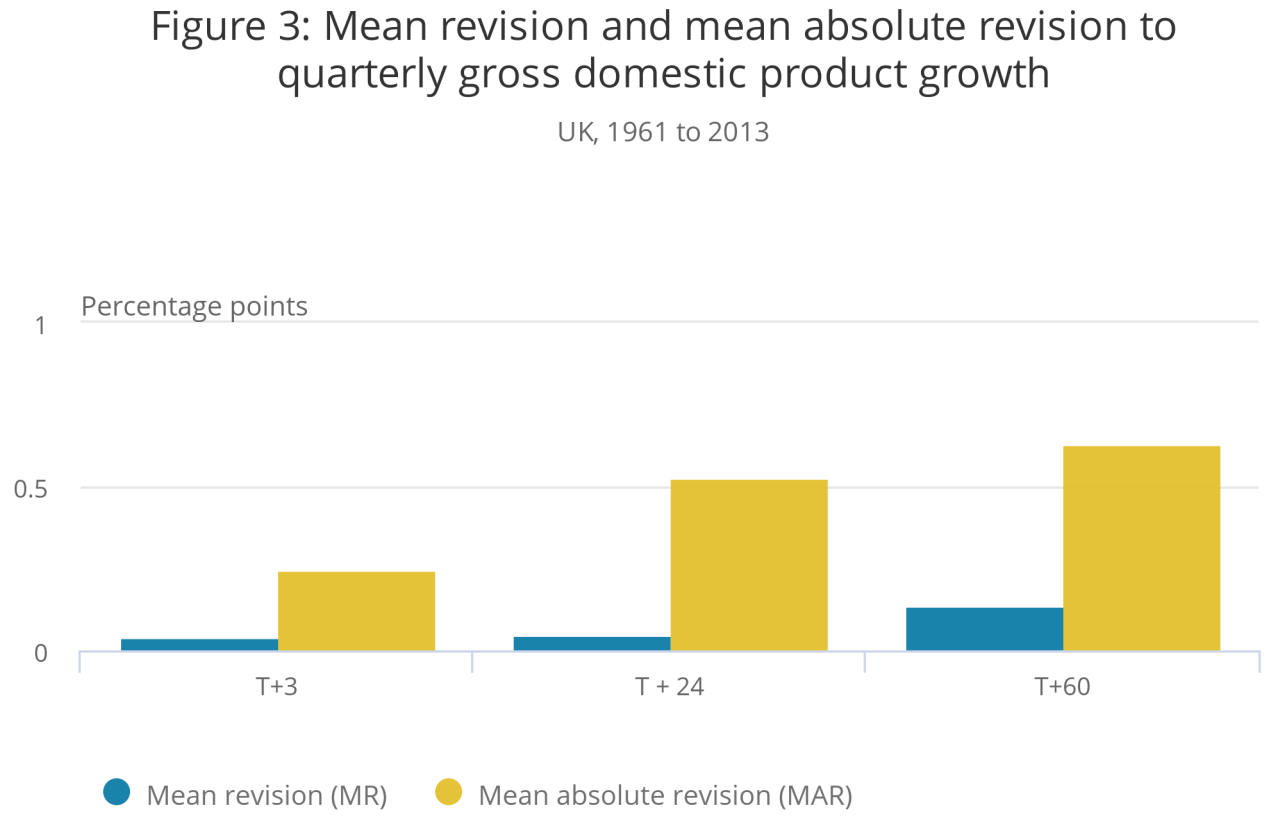
The MAR is an alternative indicator of the quality of the early estimates, as positive and negative revisions are not able to offset one another, as is the case in the MR. Therefore, a low MR can be a misleading signal of quality, as it might reflect a high frequency of larger offsetting revisions. That said, Figure 3 shows that the profile of MAR is very similar, reinforcing the picture that revisions tend to be larger when compared with the “final” estimate.

It is interesting to note that the profile shows that it is more likely that there will be a higher number of offsetting revisions in the first two years, relative to the subsequent revisions to the “final” vintage. This is shown by the MR largely being the same at T+3 and T+24, but there being a more marked increase in the MAR.

In contrast, there is more of a tendency for there to be upward revisions to more mature estimates of GDP. This is likely to corroborate the view that the revisions at this stage are likely to be more structural in nature in that these refer to a change in the concept of economic activity that is being recorded.

Figure 3: Mean revision and mean absolute revision to quarterly gross domestic product growth

UK, 1961 to 2013



Source: Office for National Statistics - UK National Accounts

Notes:

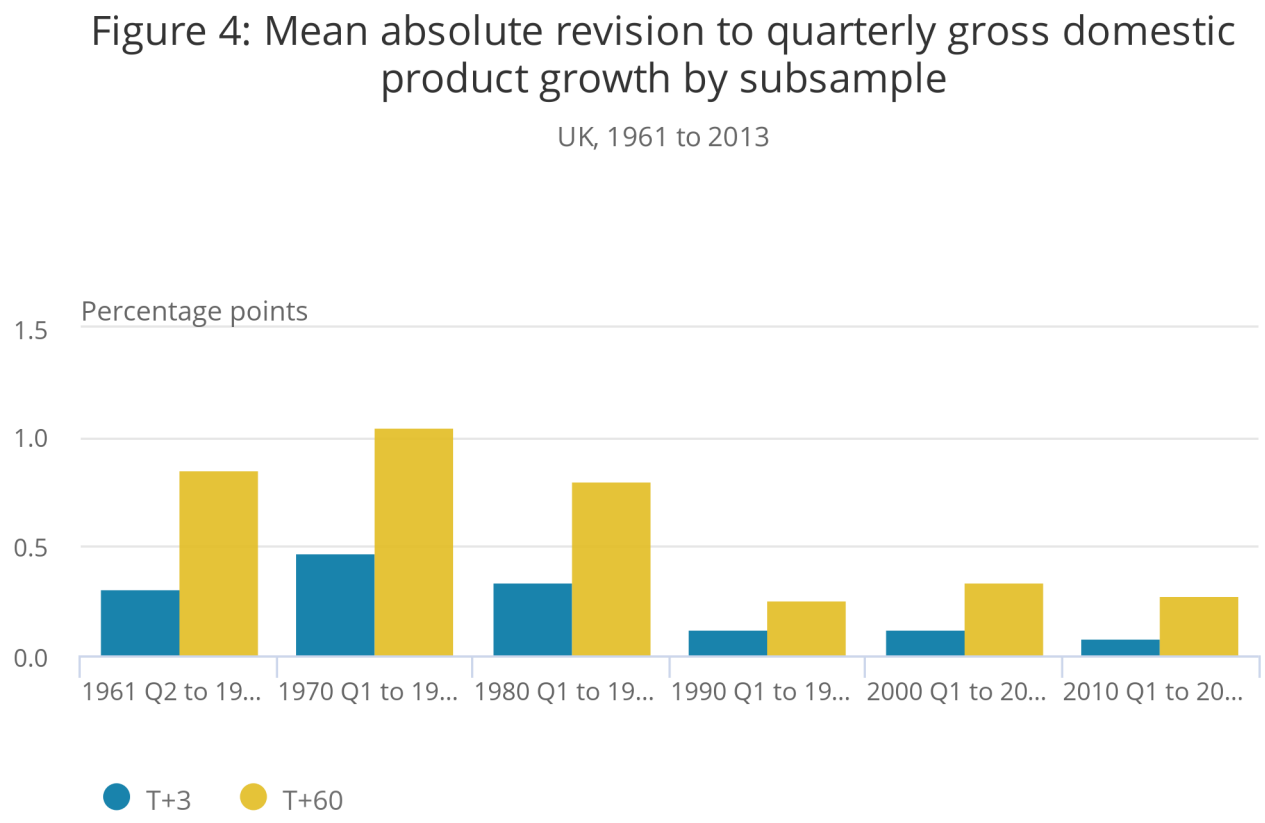
1. This covers the period Quarter 2 1961 to Quarter 3 2013.

Figure 4 shows the MAR in each of the last six decades as it can be helpful to look at how the revisions profile has changed over time. This can provide some insight as to whether the quality of early estimates of GDP has improved, though it is important to realise that the underlying state of the economy is likely to vary over time – it might be expected that the size of revisions is correlated with how the economy is performing.

This seems to verify that the quality of early estimates has improved over time, with a lower MAR in the most recent periods compared with those recorded through the 1960s and 1970s. This is likely to reflect to some extent a range of improvements to the measurement of GDP introduced following the Pickford Review of 1989, as well as a less volatile UK economy.

Figure 4: Mean absolute revision to quarterly gross domestic product growth by subsample

UK, 1961 to 2013



Source: Office for National Statistics - UK National Accounts

Notes:

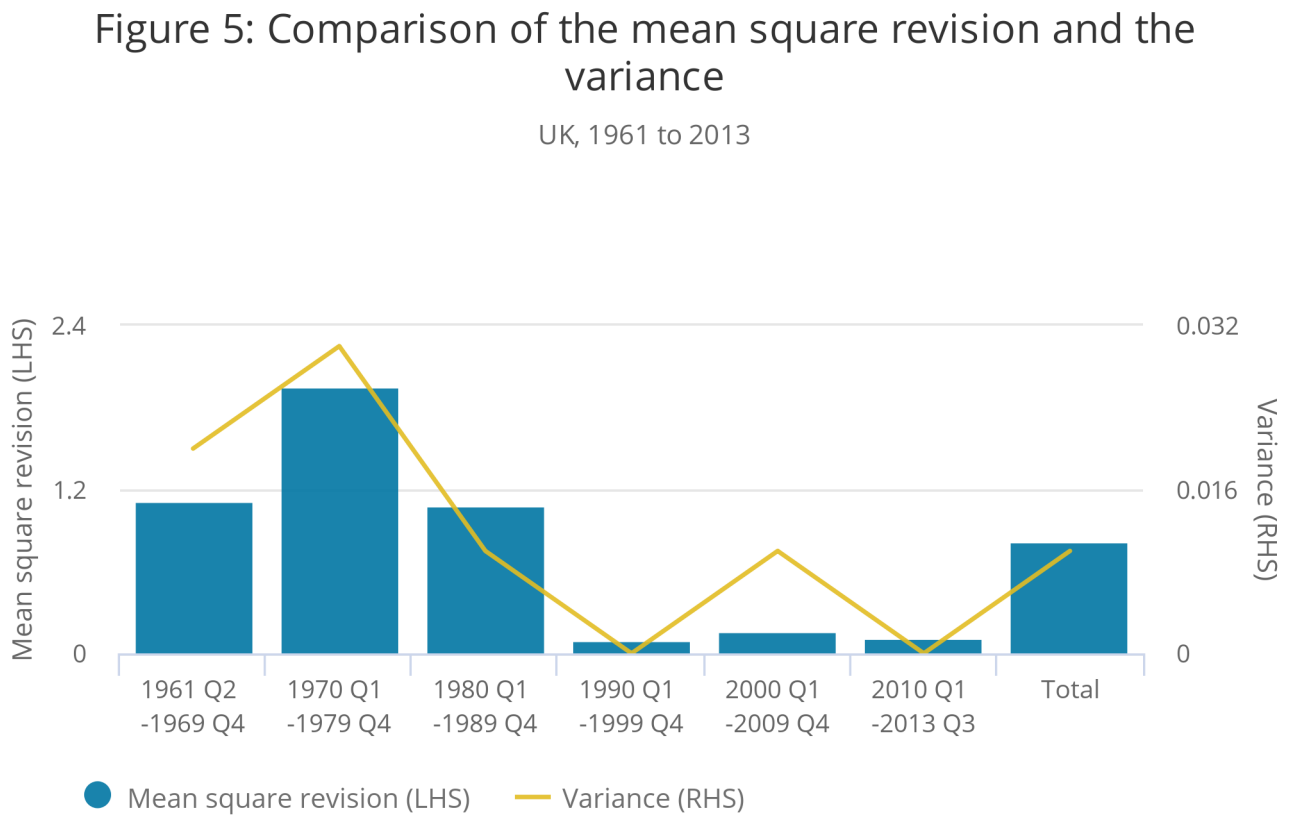
1. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).

The variance in the GDP estimates can be shown alongside the MSR to indicate how the revision compares with the volatility of GDP movement in that period.

Figure 5 helps explain why data revisions have been larger in earlier periods, which were inherently more volatile for the UK economy. In contrast, the most recent periods have experienced much less volatility, which has also been reflected in there being lower revisions between the first and “final” estimate. There have also been improvements in how we record GDP estimates in the UK, which is likely to be another explanation for the lower MSR in these years.

Figure 5: Comparison of the mean square revision and the variance

UK, 1961 to 2013



Source: Office for National Statistics - UK National Accounts

Notes:

1. The MSR refers to the revision between the vintages T and T+60, while the variance refers to the vintage T+60.

2. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).

Notes for: Blue Book 2018 revisions

1. We launched a new GDP publication model in July 2018, in which we moved to producing two estimates of quarterly GDP. Previously, there were three such quarterly estimates – the first published 25 days after the reference quarter, based only on the output measure of GDP, while the second was published 55 days after that quarter. The quarterly national accounts remained unaffected.

4 . Recent UK quarterly profile

In the first quarter (Jan to Mar) of 2018, it was initially estimated that the UK economy had increased by only 0.1%. There had not been a weaker figure in the UK since the effects of the financial crisis, excluding the one-off effects of the London Olympics in 2012.

At the time, there was much debate as to the extent to which this underlying weakness reflected the weather or the economic climate, as the UK was hit by adverse weather in early 2018, which was likely to have weighed on economic activity. However, it was also seemingly another example of there being an apparent weakness in the first three months of a calendar year.

A comparison of the latest forecast errors produced by the Office for Budget Responsibility (OBR) with those based on the first estimate highlights how early estimates of Quarter 1 have a tendency to be lower than expected, but that this was revised away to some extent in 2015 and 2017. Given that this is the quarter where it is likely that the most information is available, reflecting the timing of the forecast in the year, this has been highlighted as an area of further research.

This profile has not been a phenomenon that is specific to the UK. In recent years, there has been much focus on the figures published in the US, with there being evidence of residual seasonality in their headline gross domestic product (GDP) figures. There had been a tendency for estimates of GDP growth in the first quarter to be noticeably weaker than in other quarters, even after adjusting for seasonality. This had led to some commentators debating whether early US estimates had been understated, which would subsequently be revised up in line with other quarters in the year.

5 . GDP production process

Figure 6 shows how the first estimates of gross domestic product (GDP) in each quarter have been revised compared with those published two years later, looking over the period 2000 to 2015. Unless otherwise stated, this revisions analysis will refer to these years for consistency.

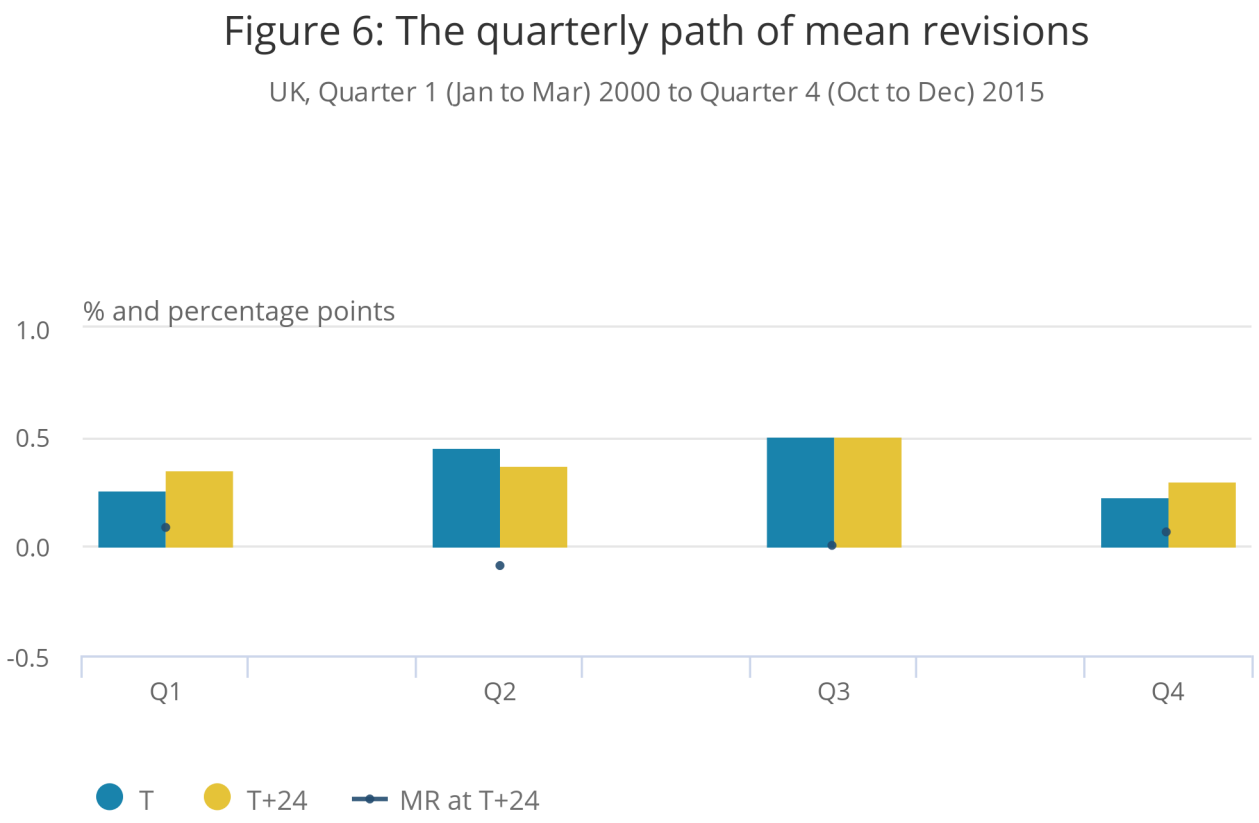
The “final” vintage in here is taken as T+24 months, as additional information after this point tends to be annual in nature with a focus on fitting a quarterly path through new annual levels. As such, the impacts on individual quarters tend to be small. It also allows us to analyse the most recent years as that vintage is now available, allowing insights into these highlighted figures.

There is a mean revision (MR) of 0.02 percentage points over this period, but the size and direction of the MR varies by each quarter. For instance, Quarter 1 tends to see the largest upward revision, while in contrast there is a downward revision in Quarter 2. This pattern is also evident if you compare the first estimate to the one that is published five years afterwards for the estimates that are available over this period, while the mean absolute revision (MAR) paints a similar picture.

It may be that this pattern of revisions is random, simply reflecting the incorporation of new information that is available as the vintages mature. However, it could also reflect how GDP estimates are compiled in the UK. Annex B provides further information on the quarterly pattern of revisions to the expenditure components of GDP.

Figure 6: The quarterly path of mean revisions

UK, Quarter 1 (Jan to Mar) 2000 to Quarter 4 (Oct to Dec) 2015



Source: Office for National Statistics - UK National Accounts

Notes:

1. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).

Another way to analyse revisions is to show how quarterly estimates of GDP evolve over the production cycle. It is possible that some of these revisions will take place at a fixed point in time – that is, it is specific to a certain publication of GDP. As such, it is possible to offer some insights as to whether these quarterly revisions are truly random or not. If the revisions are being driven by a specific feature of the production process, then it might imply that the way early estimates are produced could be improved, as it might point to the pattern of revisions being predictable.

Figure 7 shows how GDP has evolved over the initial two years after it was first published, showing the average quarterly growth rate. The staggered nature of the chart reflects the timing of when the first estimate for each quarter was published – for instance, GDP for Quarter 1 in this period was first published in April, while the initial estimate for Quarter 2 was first released in July and so on. As such, at any point in time, the quarterly estimates will have a different data content. However, it allows specific milestones in the production process to be identified, in which revisions other than those driven by increase in data content take place.

February

All four quarters of the previous calendar year are open to revision in the February publication. This reflects an update of seasonal adjustment factors that is applied as the estimates for the full calendar year are first available. This is also when the constraint that alignment adjustments must be neutral within a year – that is, they must sum to zero in any calendar year – first comes into effect.

April

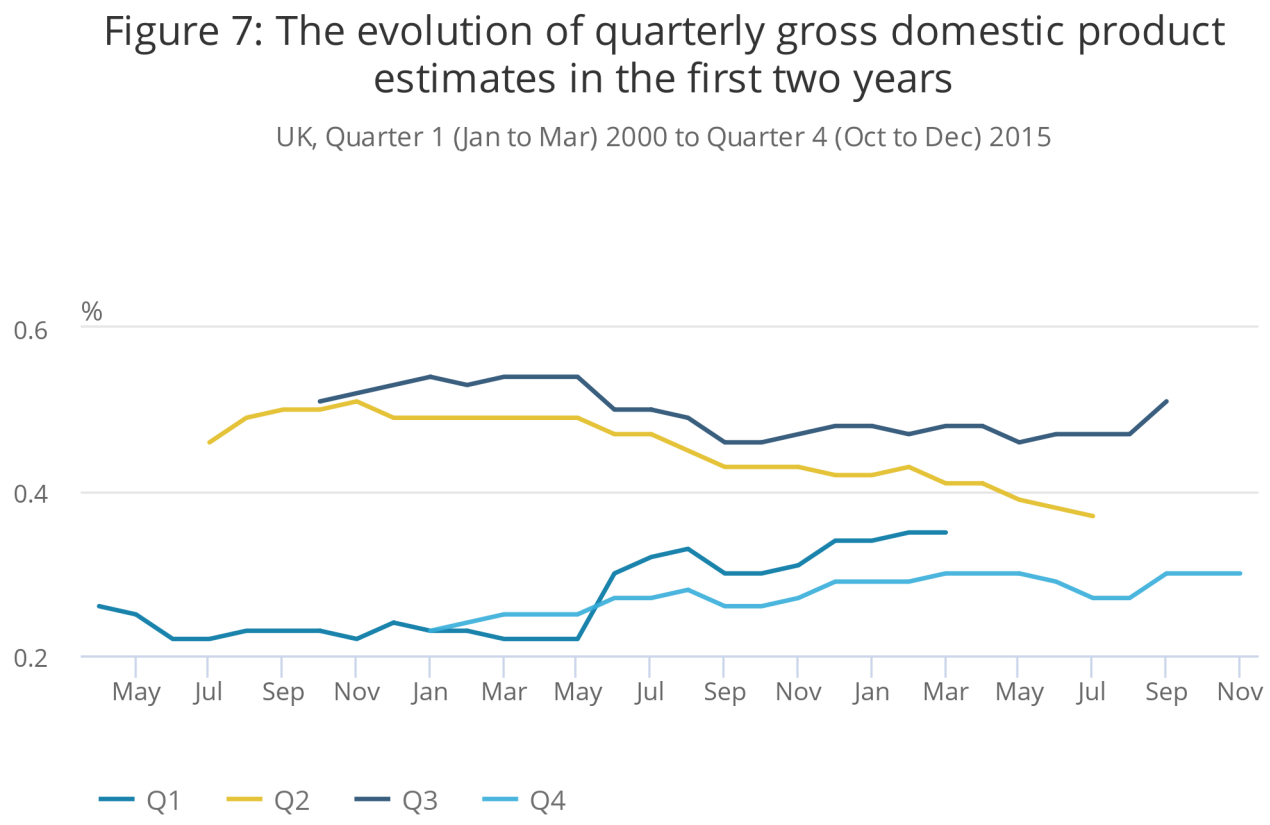
This is when historically the first estimate of Quarter 1 has been published. There is some evidence that this estimate may have been impacted by annual updates to the sample frame of businesses, which takes place early in the calendar year, requiring responses to be imputed in these estimates, which may be more uncertain and so more prone to revision.

December

The latest seven quarters are open to revisions here, including all quarters of the previous calendar year. This is when a range of annual benchmarks are introduced into the national accounts, which allows for a more comprehensive estimate of economic activity to be recorded.

Figure 7: The evolution of quarterly gross domestic product estimates in the first two years

UK, Quarter 1 (Jan to Mar) 2000 to Quarter 4 (Oct to Dec) 2015



Source: Office for National Statistics - UK National Accounts

Notes:

1. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).

There appears little evidence that there are marked revisions at these particular points in time to average quarterly GDP estimates throughout the initial two years of that estimate [1]. There are some quarters that experience some notable revisions at specific points in time, such as for the Quarter 1 estimate that is published some 15 months later, whereby there is an average upward revision of 0.08 percentage points. However, this is the effect of large revisions to specific quarterly vintages, including some particularly large revisions from the volatile period during and after the 2008 financial crisis.

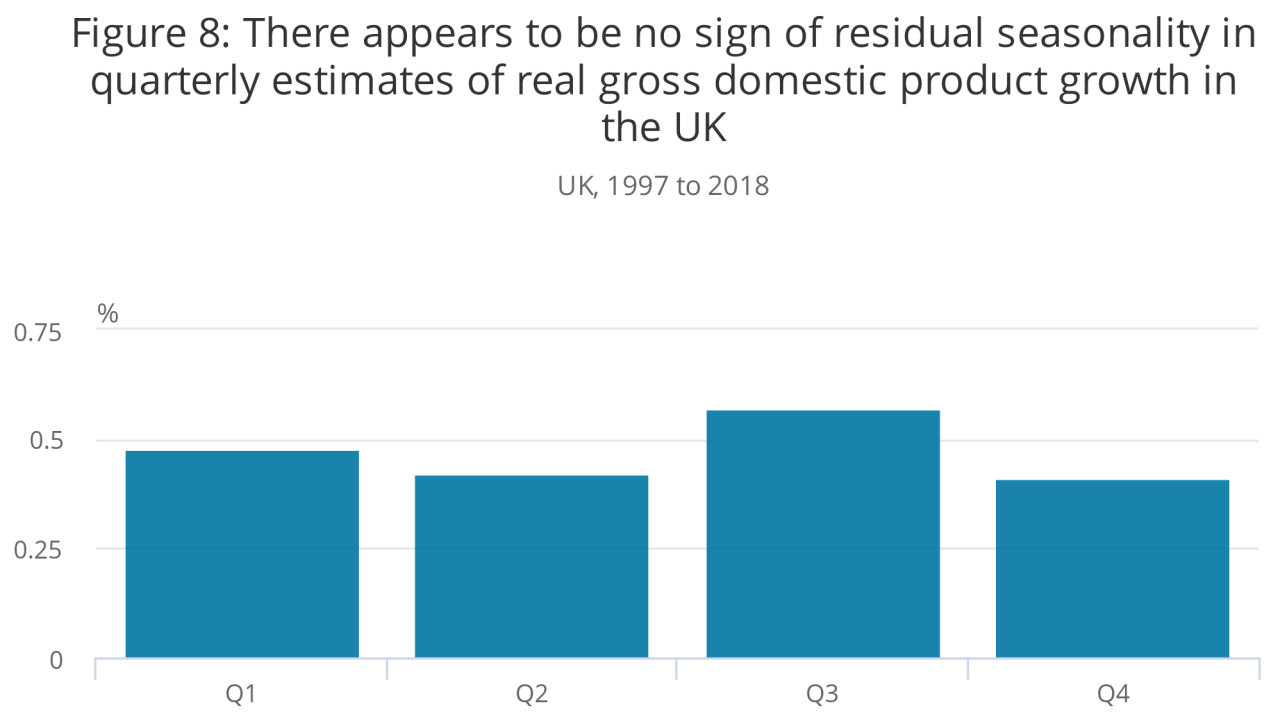
Residual seasonality

There has been much coverage in how real US GDP growth in the first quarter has been noticeably lower than that in other quarters, even after adjusting for seasonal components. This has led some commentators observing that the official estimate for Quarter 1 is artificially low, which may be reflecting residual seasonality – that is, there is still "the presence of lingering seasonal effects even after seasonal adjustment processes have been applied" (PDF, 424KB). As such, there is predictable pattern to the quarterly profile, even after these seasonal effects have apparently been removed. Given the recent profile of first estimates in the UK, it is possible that the UK is facing a similar challenge.

If there are signs of residual seasonality, then we would expect to see a predictable pattern of activity. Figure 8 shows seasonally adjusted real GDP growth in the UK, which has been shown by quarter. There appears to be little variation in the average quarterly growth rate over this period, implying there is little or no residual seasonality in quarterly GDP estimates.

Figure 8: There appears to be no sign of residual seasonality in quarterly estimates of real gross domestic product growth in the UK

UK, 1997 to 2018



Source: Office for National Statistics - UK National Accounts

Notes:

1. This refers to the period Quarter 1 1997 to Quarter 3 2018.

2. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).

In the UK, we apply seasonal adjustment in an “indirect” manner – that is, GDP components are seasonally adjusted where possible, which are then aggregated to produce a headline estimate of GDP that effectively has the seasonal components stripped out. In its 2018 Comprehensive Update, the US introduced improved seasonally adjusted measures to address residual seasonality, which it found to be present. There were two main reasons:

- there are instances where monthly figures do not exhibit seasonality, but then such movements appear when summed to a quarterly frequency; alternatively, there are instances where the monthly figures have been seasonally adjusted, yet still exhibit seasonality when aggregated to produce quarterly numbers

- restrictions on the period open for revisions leads to seasonal adjustment not being applied consistently over time

Following the US experience, we have tested for evidence of residual seasonality, including Easter effects in our headline GDP, in each of the three approaches to measuring GDP and in the quarterly output figures of the Index of Production (IoP), Index of Services (IoS) and Index of Construction (IoC), which are an aggregation of, and consistent with, monthly estimates.

We find that there is no evidence of residual seasonality in any of the tested series, including as a result of aggregating IoP, IoS and IoC to a quarterly frequency – see Annex C for more information on how this analysis has been carried out.

Annual benchmarking

Benchmarking is the process of constraining high frequency indicator estimates (for instance, monthly or quarterly survey responses) to a lower frequency one, such as responses to an annual survey. This process takes place in the December quarterly national accounts (QNA), where quarterly estimates of the previous calendar year are applied to the annual surveys.

These annual benchmarks are of a higher quality – the sample size is much larger so provides a more comprehensive picture of economic activity. This will inevitably lead to revisions but it might also be that this process impacts upon the quarterly profile, as we reassess the pre-existing quarterly path, the impact of seasonal adjustment and how alignment adjustments are applied.

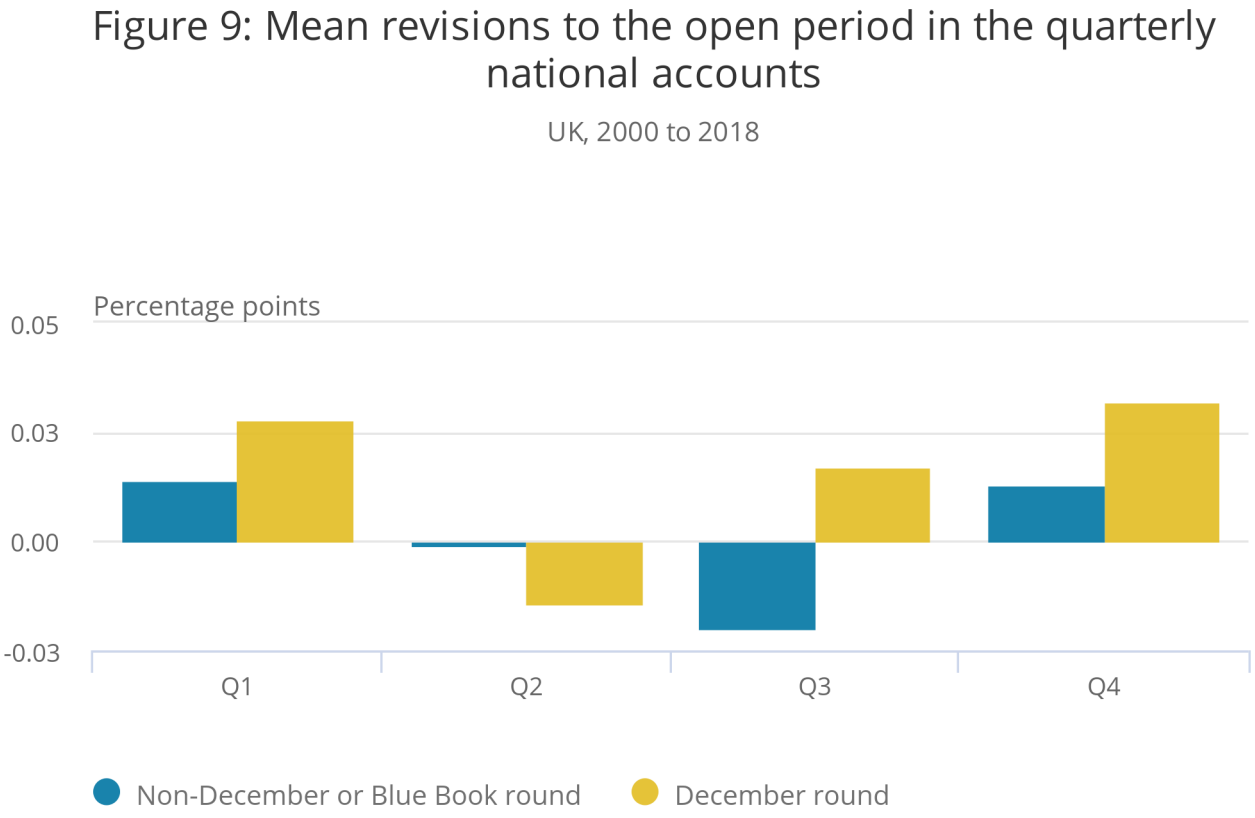
These updates will help to improve the quality of our estimates where we are able to incorporate more comprehensive annual survey data, but it might also reveal insights into the quality of the first quarterly estimates.

Figure 9 shows the MR in March, June, September and December QNA for each open quarter. The amount of quarters open varies depending on which round it is, while Blue Book rounds have been excluded from the analysis to allow for comparability, as all periods are then open and this captures additional methodological changes to how GDP is compiled.

This shows that the revisions tend to be larger when the annual benchmarks are incorporated in the December round, with revisions typically being in an upward direction. For example, the upward revision in the December round is larger than that in other comparable rounds in Quarter 1 (Jan to Mar) and Quarter 4 (Oct to Dec), and the direction of the MRs in Quarter 3 (July to Sept) are positive compared with negative for the other selected QNA rounds. The December round revisions are also larger in Quarter 2 (Apr to June), although it is of an opposite direction.

Figure 9: Mean revisions to the open period in the quarterly national accounts

UK, 2000 to 2018



Source: Office for National Statistics - UK National Accounts

Notes:

1. Revisions analysis refers to Quarter 1 2000 to Quarter 4 2018.
2. Blue Book rounds are excluded from all non-December rounds.
3. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).
4. June 2010 has been excluded from the calculations due to a non-standard timing of Blue Book in this year.

Further analysis is required to understand how the incorporation of annual benchmarks are impacting upon the relative profile of revisions, which may provide further insights into how GDP estimates are balanced in real time. This will include analysis of the profile of revisions at a lower level, specifically looking at those expenditure components that are subject to this benchmarking process to see how this might explain the patterns seen in Figure 11.

Register update

Up until recently, the data content for the first estimate of GDP has tended to be around 40%, with a range of forecasts and imputations applied in this initial estimate – and it is this that leads to increased uncertainty around these first estimates.

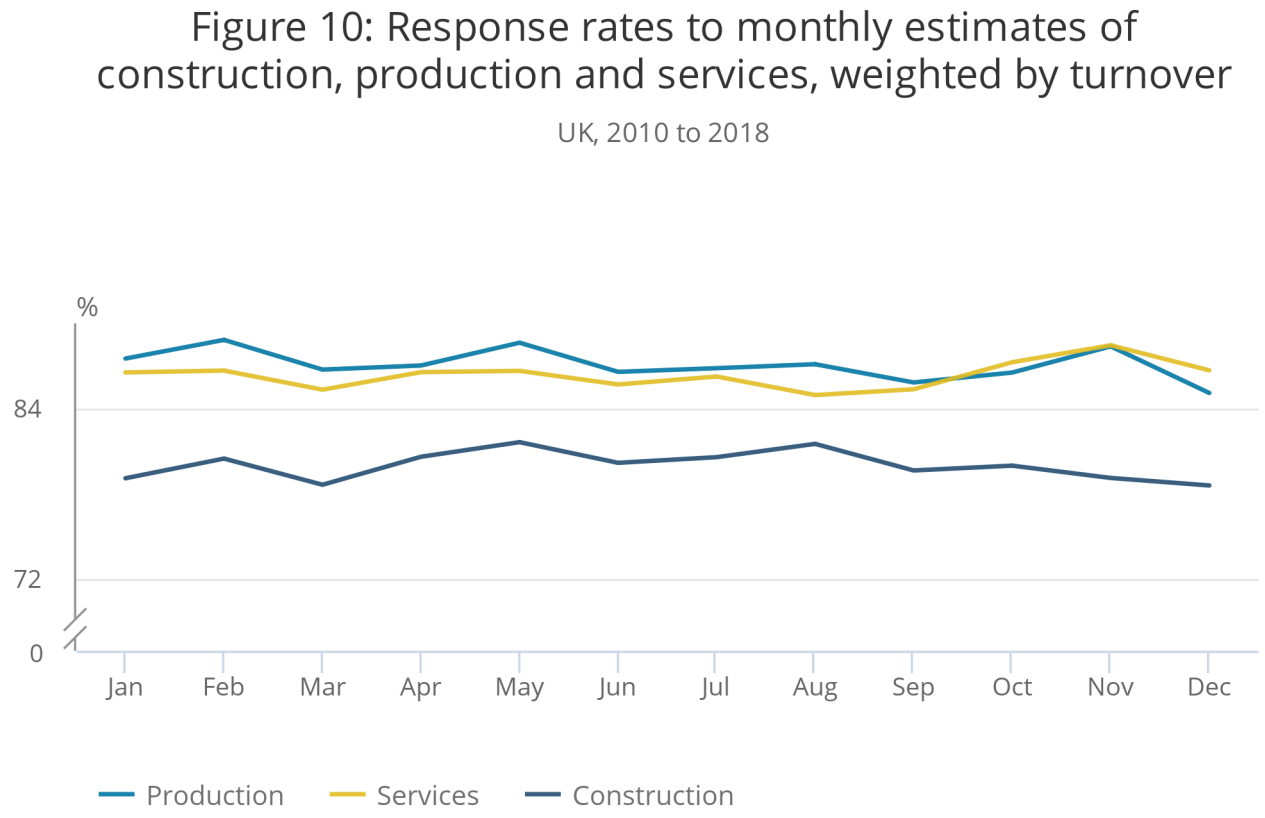
However, recent evidence finds that it is possible that this level of uncertainty may be slightly higher in the estimate for Quarter 1, as the business register that is used to sample businesses for their returns on turnover is updated every January. As there are new businesses that are surveyed, it may be that a higher proportion of responses have to be imputed as there may be relatively more newly-selected businesses who have not provided responses previously. These responses may then have to be imputed.

Recent analysis showed that this was leading to a bias in early estimates of construction, with a range of improvements incorporated into Blue Book 2018 to help tackle this feature. There had been no evidence that this had impacted upon early estimates of production and services.

Figure 10 shows the average response rate over the year in the first estimate of monthly output for construction, production and services, weighted by the size of turnover. It is true that the response rate is slightly lower for construction, but the focus of this analysis is whether there is a marked fall that would require a higher degree of imputation in Quarter 1 that may explain the pattern of revisions. There is no obvious fall in the response rate, which would point to why the first estimates of Quarter 1 may be more prone to revision.

Figure 10: Response rates to monthly estimates of construction, production and services, weighted by turnover

UK, 2010 to 2018



Source: Office for National Statistics - UK National Accounts

Notes:

1. Production averages are calculated using data from January 2010 onwards, services averages are calculated using 2011 onwards, and construction averages are calculated using data from January 2014 onwards.

Notes for: GDP production process

1. Revisions that take place in a Blue Book are not considered here explicitly, as these will typically reflect a range of methodological improvements in how we record economic activity in the UK National Accounts. Also, the scale of these revisions will vary from year to year, while its timing in the production cycle is not the same each year, which would make this a challenge to capture in this framework. Instead, the effects of these Blue Book revisions are captured implicitly.

6 . Conclusions

Revisions to gross domestic product (GDP) are inevitable, reflecting that more information becomes available over time. This provides a more comprehensive picture of economic activity, which we look to incorporate, so that we produce the most accurate estimates of GDP that are possible at any point in time.

Furthermore, we introduce methodological improvements each year, which provide a better estimate of GDP. Revisions in Blue Book 2018 had a relatively modest impact, with the impact on the level of nominal GDP smaller than those seen in the Blue Books published from 2004 to 2017. Similarly, the Blue Book 2018 revisions to real quarterly growth were relatively small.

We find that the initial revisions of the quarterly round and those revisions that tend to reflect the incorporation of annual benchmarks and balancing in a supply and use framework are not significant. However, this is not the case for those revisions in the “final” estimate, although these revisions tend to reflect more structural changes to how GDP is compiled in the national accounts, which cannot be anticipated at the time of the first estimate. As such, this is less a reflection of the quality of early estimates.

In recent years, users have noted that in real time there has been a tendency for estimates of GDP growth in the first quarter to be noticeably weaker than in other quarters. Following the US experience, we checked to see if there was any residual seasonality in GDP estimates and found no such evidence in the UK. We also looked at other aspects of how we produce GDP to see if this explained the recent quarterly profile, specifically looking at the process in which we incorporate annual benchmarks and how this impacts upon the quarterly profile and the role of imputations.

Future analysis will build on some of these initial findings, specifically looking at whether there are insights in how we produce balanced short-term estimates of GDP in real time and whether this improves the revisions performance of GDP and/or provides more insight into the quarterly profile.

7 . Authors

Andrew Walton, Charlotte Richards, Lee Mallett, Sumit Dey-Chowdhury, Katrina Yu and Fred Haynes, Office for National Statistics.

8 . Annex A: Major causes of revisions by Blue Book

Blue Book 2004

Rebalance of 2001 and balanced 2002 for the first time. Reclassified NHS trusts from public corporations sector to central government sector back to 1991. Referenced from 2000 to 2001 and introduced a new method for estimating the output of government health services back to 1996 in chained volume measures (CVMs).

Blue Book 2005

Rebalance of 2002 and balanced 2003, with the reference year moved from 2001 to 2002. Current price revisions back to 1991 for improving the recording of private pension contributions and receipts, and for CVM gross domestic product (GDP) there was a new methodology for the estimation of government education and social protection from 1996 onwards. Also improved the allocation of central government consumption to reflect machinery of government changes from 1996 onwards in CVMs.

Blue Book 2006

Full rebalance for 2003 and balanced 2004, with specific current price revisions to earlier years, mainly to apportion adjustments across industries which was not completed in BB 2005. Reference year moved from 2002 to 2003.

Blue Book 2007

Closed to all revisions except for revisions to estimates for private investment in own-account computer software back to the 1970s, which increased current price levels. No supply and use rebalance of 2004, and no balance of 2005. Reference year unchanged.

Blue Book 2008

Methodological improvements for the output of financial intermediation services indirectly measured (FISIM) made in line with international standards adopted by all European Union (EU) member states and with worldwide best practice.

Blue Book 2009

Rebalance of 2004 to 2006 and balanced 2007 for first time and moved from 2003 to 2005 as reference year.

Blue Book 2010

Rebalance of 2006 to 2007 and balanced 2008 for first time and moved from 2005 to 2006 as reference year.

Blue Book 2011

Introduction of Standard Industrial Classification: SIC 2007 and Classification of Product by Activity (CPA08), CORD systems and replacing Retail Prices Index (RPI) with Consumer Prices Index (CPI) to deflate the main expenditure and output components (back to 1997 only). Reference year moved from 2006 to 2008.

Blue Book 2012

Insurance revisions to clear gross national income (GNI) reservation taken back to 1987, deflator changed from RPI to CPI pre-1997 to start of GDP series. Reference year moved from 2008 to 2009.

Blue Book 2013

European System of Accounts 95 (ESA 95) GNI reservations for own account software, improved estimation of artistic originals and imputed rentals of owner occupiers were all addressed back to 1990.

The gross capital formation methodological development revised estimates of gross fixed capital formation (GFCF) and changes in inventories back to 1997 and improvements were made to the estimates of bonds data and overseas deposits of private non-financial corporations. Improvements were also made to the alignment of national accounts with the public sector finances. Reference year moved from 2009 to 2010.

Blue Book 2014

ESA 95 GNI reservations relating to the measurement of the non-profit institutions serving households sector (NPISH), household expenditure on new cars, the inclusion of illegal activities into the national accounts, and improvements made to the measurement of “own account construction”’.

ESA 2010 implementation including research and development, weapons, decommissioning costs, small tools and pensions.

Other changes included the review of public sector finances and further alignment of national accounts with public sector finances, improved methods for inventories and GFCF, Producer Price Index (PPI) and Services Producer Price Index (SPPI) re-basing from 2005 to 2010. Reference year moved from 2010 to 2011.

Blue Book 2015

ESA 95 GNI reservations for exhaustiveness adjustments for concealed income and under-coverage of unincorporated businesses, new estimates within the NPISH sector and a rebalance across all sectors, cross-border property income, improvements to the estimation of spending on repairs and maintenance of dwellings by householders, improvements to the estimation of the consumption of fixed capital on roads and a change to the recording of Vehicle Registration Tax as a fee paid on a vehicle when it is first registered.

Other improvements related to gross fixed capital formation, reclassifications, local government pensions, alcohol and tobacco in household final consumption expenditure, narcotics, Consumer Prices Index including owner occupiers’ housing costs (CPIH) alignment, insurance industry measurement. Reference year moved from 2011 to 2012.

Blue Book 2016

Methodological improvements include imputed rental, exhaustiveness adjustments for concealed income, estimates for Value Added Tax fraud, illegal activities, own account construction, Transport for London capital stock changes and natural gas imports from Norway.

Corrections made to gross fixed capital formation for improvements to dwellings and to agricultural data. Reference year moved from 2012 to 2013.

Blue Book 2017

Methodological improvements include actual and imputed rental, improvements to recording GFCF, separation of estimates for the households and NPISH sector.

Improving the data sources for dividend income of the self-employed, introducing the new securities dealers survey data and methods, improving the treatment of corporate bonds, shares and dividends methods and data sources.

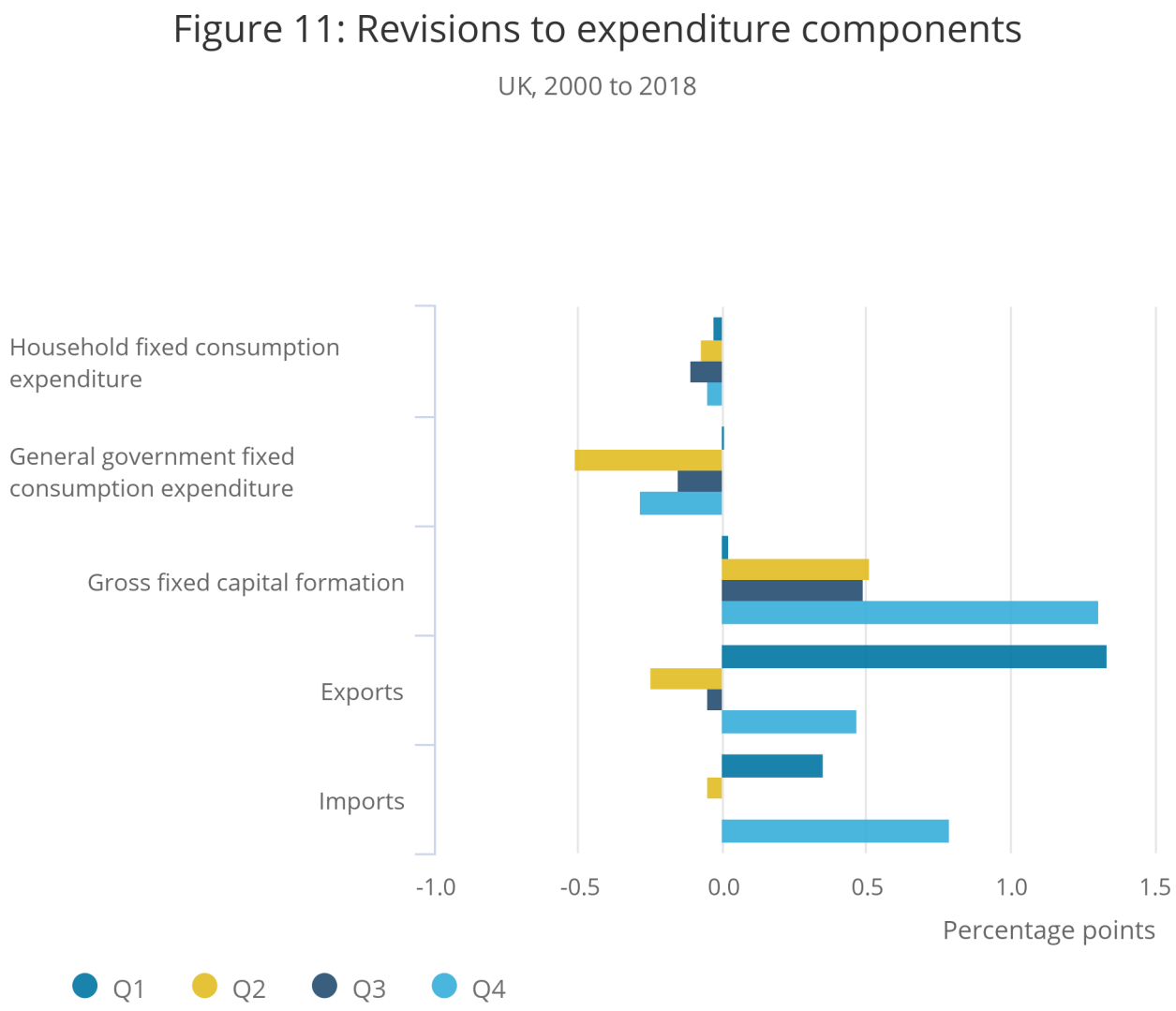
Other methodological improvements include unfunded public sector pensions methodology review, improvement to illegal activities, revised estimates of exhaustiveness and concealed income adjustment, revised estimates of Value Added Tax fraud, BBC data update, and public sector finances alignment. Reference year moved from 2013 to 2015.

9 . Annex B: Revisions to expenditure components

It can be useful to look at real-time analysis of expenditure components of gross domestic product (GDP), as this provides an initial insight as to which are most prone to revision (Figure 11). This can then be looked at in the context of which components are most affected by the incorporation of more comprehensive data. Further analysis will look into these real-time estimates to see if there is any further insight into how balanced estimates of GDP are produced.

Figure 11: Revisions to expenditure components

UK, 2000 to 2018



Source: Office for National Statistics - UK National Accounts

Notes:

1. Non-Profit Institutions Serving Households (NPISH), Changes in Inventories and Acquisitions Less Disposals of Valuables are excluded.

2. Mean revisions to GDP and imports work in opposite directions, as imports contribute negatively to GDP.

3. Revisions analysis refers to Quarter 1 2000 to Quarter 4 2015.

4. Q1 refers to Quarter 1 (Jan to Mar), Q2 refers to Quarter 2 (Apr to June), Q3 refers to Quarter 3 (July to Sept), and Q4 refers to Quarter 4 (Oct to Dec).

10 . Annex C: Residual seasonality

Tests for residual seasonality were completed on our headline quarterly estimates of gross domestic product (GDP) as well as the three approaches to measuring GDP – expenditure, income and output – between Quarter 1 (Jan to Mar) 1997 and Quarter 3 (July to Sept) 2018.

In addition, tests were completed on the quarterly aggregates of monthly data for the Index of Production (IoP), Index of Services (IoS) and the Index of Construction (IoC) from Quarter 1 1990 to Quarter 3 2018.

The combined test for seasonality in X-13ARIMA-SEATS was used. This allows us to test for evidence of seasonality based on a combination of tests, including an F-test for the presence of stable seasonality, an F-test for the presence of moving seasonality and a non-parametric Kruskal-Wallis test. These tests were performed on the full length of the series and also the last three years of the series. Tests on the last three years of data were done in case there was evidence of evolving seasonality that had not been appropriately dealt with in the seasonal adjustment process.

The QS statistic is another test for seasonality, which is based on the sample autocorrelation at first and second seasonal lags and assumed to approximately follow a chi-squared distribution with two degrees of freedom.

An AIC test was used to test for the presence of Easter effects, which was based on a comparison of automatically selected regARIMA models, with and without Easter regressors.