

Revisions analysis on regional gross value added for NUTS1 level regions

An analysis covering the revisions to R-GVA statistics.

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Release date:
30 October 2017

Next release:
To be announced

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1 . Introduction

Regional gross value added (R-GVA) statistics are legally required by the European Union's (EU) statistical office, Eurostat. Estimates are compiled in compliance with the [European System of Accounts 2010](#): ESA 2010 and are consistent with the standards set out in the United Nations [System of National Accounts 1993](#): SNA 1993. This is to ensure that the estimates are directly comparable with the R-GVA of other EU countries through adopting standard methods and classifications.

The R-GVA statistics have developed significantly since the [UK Statistics Authority](#) first confirmed the [National Statistics](#) designation of the statistics calculated using the income approach (R-GVA(I)) in 2012. There have been improvements to the source data, to the regionalisation methods and by taking on changes introduced to the UK National Accounts. Additionally, the R-GVA statistics team has introduced annual real-term estimates with the effect of inflation removed. These real GVA estimates are compiled using the production approach (R-GVA(P)) and are currently published as [Experimental Statistics](#).

The UK Statistics Authority's [Office for Statistics Regulation](#) (OSR) recently completed the first phase of its [Assessment of compliance with the Code of Practice for Official Statistics](#) for R-GVA. Within this assessment, the OSR published a table of their findings, including the requirement that we should:

- publish revisions triangles for R-GVA(P), by 31 October 2017
- better convey whether revisions have provided more news than noise and which estimates display significant volatility, by 31 October 2017

The revisions analysis contained within this article aims to address the second of these points. The analysis undertaken uses statistical practices to better understand the significance of any volatility within the revisions made to R-GVA(I) in annual publications from December 2006 to the latest [Regional gross value added \(income approach\)](#) bulletin published on 15 December 2016. It also covers revisions to the experimental R-GVA(P) statistics between their first publication in December 2013 and the latest [Regional gross value added \(production approach\)](#) bulletin published on 16 December 2016.

2 . Student's T-Test

The Office for Statistics Regulation (OSR) assessment suggests that we should better convey which estimates display significant volatility within the revisions made to those estimates. In other ONS releases, such as quarterly gross domestic product (GDP), a statistical test known as Student's T-Test is carried out on the revisions made to the given statistic for a given revisions period. The T-Test can be used to determine if two sets of data are significantly different from each other. It takes into account the mean revisions over a given period, any variance and any standard differentiation in the revisions, and gives an inverse result. This result is then compared with a calculated critical level of revision. This level is the point at which the mean revisions become statistically significant.

When applying the T-Test to each Nomenclature of Units for Territorial Statistics (NUTS) region at level 1 for R-GVA(I), only one region shows that the T-Test result is significant. The test was applied to revisions made to the annual growth of total R-GVA(I) in the years 1998 to 2014 after one year and to the years 1998 to 2012 after three years, published within the revisions triangles in the [Regional gross value added \(income approach\)](#) bulletin, published on 15 December 2016.

The T-Test applied to the region of London (NUTS1 Region code UKI) indicated that the revisions made one year after the figures were first published were statistically significant. It did not, however, indicate that the revisions made three years after the figures were first published were statistically significant. These findings point to significant volatility to the estimate for London when revised after one year, but that the volatility reduces when the estimates are revised in subsequent years.

Table 1 shows the T-Test results for all 12 NUTS level 1 regions and the extra-regio area that covers activity that cannot be assigned to a mainland region of the UK. T is the inverse value of the T-Test and T-crit is the value at which the mean revision becomes statistically significant.

Table 1: Student's T-Test results for revisions one and three years after publication, regional gross value added income approach, UK NUTS1 region, 1998 to 2014

Region	After 1 year		After 3 year	
	T	T-crit	T	T-crit
UKC North East	-0.95	2.11	-0.93	2.16
UKD North West	-0.10	2.11	-0.77	2.13
UKE Yorkshire and The Humber	-0.92	2.11	-0.71	2.13
UKF East Midlands	-0.08	2.11	-0.26	2.26
UKG West Midlands	0.10	2.20	-0.04	2.36
UKH East of England	1.25	2.11	0.50	2.13
UKI London	3.33	2.11	1.91	2.20
UKJ South East	1.21	2.11	1.07	2.13
UKK South West	0.27	2.11	0.15	2.13
UKL Wales	-0.47	2.13	-0.45	2.13
UKM Scotland	1.21	2.13	-0.12	2.14
UKN Northern Ireland	-1.37	2.11	-1.15	2.13
UKZ Extra-Regio	-1.55	2.11	-0.31	2.13

Source: Office for National Statistics

The T-Test result for London after one year (3.33) which is larger than the T-crit value. Comparing other regions, we can see that all regions are well below their T-crit result for revisions made one year after they were first published. All regions are below the T-crit value for revisions made three years after first publication, with London again the only notable region. The T-Test for London in this instance is only slightly below the point at which the mean revisions become statistically significant.

The same T-Test has also been applied to the revisions triangles for regional gross value added (R-GVA(P)), the production approach measure of regional GVA. As with the regional gross value added income approach (R-GVA(I)), the test has been applied to data one year after first published and three years after first published for NUTS1 level regions. However, for R-GVA(P) we have looked at revisions to the annual growth in real GVA instead of nominal GVA. None of these regions failed the T-Test for either one year or three years after first publication. The range of data used in these tests was 1999 to 2013 as this is the range of data available in R-GVA(P). Table 2 shows the results, with T and T-crit for each region shown.

Table 2: Student's T-Test results for revisions one and three years after publication, regional gross value added production approach, UK NUTS1 region, 1999 to 2013

Region	After 1 year		After 3 year	
	T	T-crit	T	T-crit
UKC North East	0.87	2.23	-0.64	2.16
UKD North West	-0.14	2.13	0.53	2.16
UKE Yorkshire and The Humber	-0.24	2.13	-0.26	2.16
UKF East Midlands	0.66	2.13	0.78	2.16
UKG West Midlands	0.65	2.13	0.88	2.16
UKH East of England	-0.52	2.13	0.21	2.16
UKI London	0.56	2.13	-1.45	2.16
UKJ South East	-0.99	2.13	0.13	2.16
UKK South West	0.80	2.13	0.12	2.16
UKL Wales	0.45	2.13	0.46	2.16
UKM Scotland	0.62	2.13	-0.01	2.16
UKN Northern Ireland	0.60	2.13	-1.14	2.16
UKZ Extra-Regio	-0.55	2.13	-0.70	2.16

Source: Office for National Statistics

3 . The impact of change

The Office for Statistics Regulation (OSR) assessment suggests we should better convey whether revisions to estimates contain more news than noise. Revisions in both the regional gross value added income approach (R-GVA(I)) and the regional gross value added production approach (R-GVA(P)) figures come from two general causes:

- changes in the national gross domestic product income approach (GDP(I)) and gross domestic product output approach (GDP(O)) estimates – whether methodological, from a change in data source or new data becoming available
- changes to the regional dataset

In the latest release, published December 2016, the period open for revisions was 1997 to 2014. Table 3 shows where revisions to R-GVA(I) came from in the [Regional gross value added \(income approach\)](#) for the year 2014, for which figures were published in the previous bulletin as provisional estimates.

Table 3: UK percentage revisions to total gross value added income approach in 2014 by UK NUTS1 region

2014	Total revision (%)	Revision due to National Estimates (%)	Revision due to other regional dataset changes (%)
UK	0.7	0.7	0.0
North East	1.1	1.2	-0.1
North West	1.0	1.0	0.0
Yorkshire and The Humber	0.1	1.1	-1.0
East Midlands	1.0	1.1	-0.1
West Midlands	2.1	1.3	0.8
East of England	2.2	1.3	0.8
London	0.6	0.0	0.6
South East	0.7	1.4	-0.7
South West	1.1	1.1	0.0
Wales	-0.3	1.0	-1.3
Scotland	0.7	0.8	-0.1
Northern Ireland	-1.9	0.7	-2.6
Extra-Regio	-9.0	-10.3	1.4

Source: Office for National Statistics

National estimate changes comprise the larger proportion of the revision for the majority of regions, with the exceptions being London, Northern Ireland and Wales during 2014.

To show further how much national measure changes affect regional revisions, this next section focuses on one region in particular, London. This region has been picked to focus on as the revisions for this region one year after first publication are statistically significant, as shown in the Student's T-Test discussed earlier in this report.

Table 4: UK percentage revisions to total gross value added income approach) in NUTS1 region UKI – London, 1997 to 2014

	Total revision (%)	Revision due to National Estimates (%)	Revision due to other regional dataset changes (%)
1997	6.4	6.2	0.1
1998	5.9	5.7	0.2
1999	5.9	5.8	0.1
2000	5.3	5.5	-0.2
2001	5.3	5.6	-0.2
2002	4.9	4.9	0.0
2003	4.1	4.3	-0.1
2004	3.7	3.7	0.0
2005	2.9	3.8	-0.8
2006	2.8	3.0	-0.2
2007	3.2	2.8	0.4
2008	2.9	3.0	-0.1
2009	2.5	2.4	0.2
2010	1.4	1.2	0.2
2011	0.6	0.5	0.0
2012	0.9	0.6	0.3
2013	-0.2	0.0	-0.2
2014	0.6	0.0	0.6

Source: Office for National Statistics

Notes:

1. The table shows the percentage change in the level of GVA(I) for region UKI – London between the 2015 and 2016 R-GVA(I) publications

As you can see from Table 4, a large proportion of total revisions in R-GVA(I) for London come from revisions due to changes in the national estimates. These changes are from the [UK National Accounts, The Blue Book 2016](#) published 29 July 2016 and are not isolated to this one particular region, but rather affect all regions. The Blue Book is an important annual publication of national accounts statistics. It is also the point in time when the national accounts are updated with methodological changes, such as European System of Accounts: ESA 2010 changes to comply with Eurostat guidelines.

The largest contribution to revisions in The Blue Book 2016 came from changes in [how ONS measures owner-occupied imputed rental](#). This component of the income approach to GDP is an estimate of the housing services consumed by households who are not actually renting their residence. It can be thought of as the amount that non-renters pay themselves for the housing services that they produce and consume. The change from survey data as a source to an administrative data source resulted in a level change in the income approach to GDP from 1997 to 2010. This impact flowed through into R-GVA(I), which is evident in the large revisions to London estimates for 1997 to 2010 shown in Table 4 and can be seen in all other regions within the [revisions triangles](#). Therefore, the revisions to R-GVA(I) between the publications in 2015 and 2016 show the effects of large national changes that flow through into the regional data.

Similarly, the effects of a regional dataset change can be seen in the years after 2010. These years have been impacted by the inclusion of Crossrail business rates supplement. This is a tax on production, which has been levied from April 2010 and affects only the London region. In the years 2013 and 2014 in particular, the revisions to the London region were affected solely by regional datasets and the introduction of this change in the 2016 publication would suggest that these revisions originate from Crossrail.

Further to owner-occupied imputed rentals and Crossrail business rates supplement, a number of changes have been introduced in the regional accounts over the past few years. These include but are not limited to the following.

2011 changes:

- a change in the industrial classification of activities, moving from the Standard Industrial Classification: SIC 2003 to the SIC 2007

2013 changes:

- ceasing of smoothing of regional gross value added (R-GVA) after the 2012 ONS Methodology Directorate review of smoothing and commuter adjustments in the UK Regional Accounts
- use of Annual Business Survey (ABS) gross operating surplus as a regional indicator
- allocation of residence-based income of embassy personnel, armed forces based overseas and individuals working on the continental shelf (for example, North Sea oil and gas extraction) from Nomenclature of Units for Territorial Statistics: NUTS1 extra-regio to NUTS regions; this came from a European Commission taskforce to make the 27 EU member states more consistent
- introduction of manufacturing sub-sections of production consistent with SIC 2007 to R-GVA at NUTS1 and NUTS2 levels in response to user demand
- inclusion of improved estimates of investment in artistic originals (for example, composition of music) and own-account software

2014 changes:

- introduction of illegal activities relating to drugs and prostitution into R-GVA; due to inconsistencies in the quality of the regional data sources, the total UK value added of these illegal activities have been allocated to each region by population size
- change in the treatment of research and development (R&D) from intermediate consumption to gross capital formation
- changes to the treatment of government expenditure on weapon systems; similarly to R&D, this has been moved from intermediate consumption to gross capital formation; within the regional accounts, this type of investment appears as non-market capital consumption
- changes to the treatment of non-profit institutions serving households (NPISH)
- introduction of a new Oil and Gas Model, developed by Scottish Government statisticians, to improve the measurement of onshore oil and gas extraction in R-GVA

2015 changes:

- changes to the treatment of household rental income, including a change in the average house prices used to calculate the regional allocation of imputed rental and a change in the treatment of second homes owned in the UK by foreign nationals and those owned by UK residents in other countries
- removal of a bias adjustment in the Scotland R-GVA estimates; following a review and user consultation it was agreed that the data and methods used are now of sufficient quality and that the adjustment was no longer needed

2016 changes:

- changes to show subsidies on production separately from mixed income and profits
- improvements to the consistency and accuracy of measurement of the manufacturing of coke and refined petroleum industry

In Table 3, the revisions due to national estimates and other changes have been quantified for each region. Due to the timing of the annual Blue Book publication, which is published in either July or October in (approximately) alternating years, the regional team does not always have the necessary processing time to analyse the revisions and allocate them to either national estimates or other regional changes. In Table 4 the changes to London are quantified because the December 2016 regional publication followed a July national publication and therefore the revisions made back to 1997 to the national estimates were quantifiable.

The last part of this analysis will focus on the average revisions to R-GVA due to national estimates or other regional changes where that split is available. By creating an average for the years where these data are available it can be demonstrated that the national estimate revisions have a greater effect on the regional accounts revisions than changes to the regional data and methods.

The split of revisions between national estimates and other regional changes was available in the 2012, 2013, and 2016 publications. Additionally, the revisions presented in the 2012 publication covered two years, so there are four years in total where this split has been calculated. Table 5 shows the average revisions caused by changes to national estimates and other changes, by region, over those four years where data were available.

Table 5: Average percentage revisions to total gross value added income approach by NUTS1 region, UK

	Total revision (%)	Revision due to National Estimates (%)	Revision due to other regional dataset changes (%)
UK	0.9	0.9	0.0
North East	-0.2	0.3	-0.5
North West	1.3	1.2	0.1
Yorkshire and The Humber	0.3	1.2	-0.9
East Midlands	-1.0	-0.0	-1.0
West Midlands	1.2	0.8	0.4
East of England	1.1	0.7	0.4
London	2.1	1.7	0.5
South East	0.8	0.9	-0.1
South West	0.3	0.3	0.0
Wales	0.2	0.3	-0.1
Scotland	-0.2	0.1	-0.3
Northern Ireland	0.7	0.5	0.1
Extra-Regio	5.5	4.8	0.3

Source: Office for National Statistics

Notes:

1. The table shows the average percentage change in the level of GVA (I) for all regions between the 2011 and 2016 R-GVA (I) publications

Apart from in four regions where revisions are quite small (North East, East Midlands, Wales and Scotland), the largest proportion of the average revisions across the four publications where the split was available comes from changes to the national estimates. This shows that, although revisions due to other regional dataset changes can cause small changes in the estimates for each region, the majority of these regions are more impacted by revisions to the national estimates.

4 . Author

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