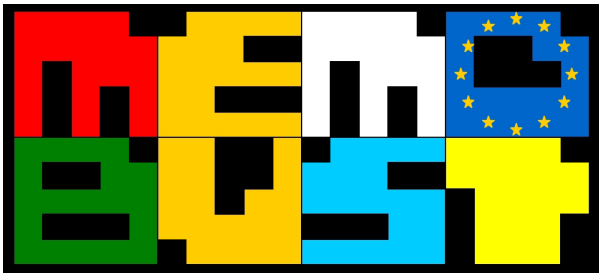

This module is part of the

Memobust Handbook

on Methodology of Modern Business Statistics

26 March 2014

Theme: Revisions of Economic Official Statistics

Contents

General section

1. Summary

Macroeconomic indicators are very often revised and the size of revisions, computed comparing subsequent estimates with previous ones, allows to assess their reliability. Along with accuracy, reliability represents a dimension of the statistics quality and is considered in the twelfth of the fifteen principles of the European statistics code of practice (Eurostat, 2011; see also IMF, 2012). Stating that "European Statistics accurately and reliably portray reality", the code of practice recognises the revision analysis as a tool "… to improve statistical processes". As stressed in De Vries (2002), accuracy refers to the closeness between the estimated value and the true unknown value and is assessed (when possible) evaluating the error associated with the estimate. On the other hand, reliability refers to the closeness of the initial estimated value to the subsequent up to the final estimated value and is partially assessed comparing estimates over time, i.e., analysing the revisions. In fact reliability is only one indicator of statistical quality and is not completely captured by revision analysis. Other aspects of quality in statistics are established in the Eurostat framework and include timeliness and robustness. Especially for short-term statistics is well known the existing trade-off between timeliness and reliability. For many of these indicators for which seasonally adjusted data are produced it is also important to distinguish between revisions in raw data and revisions in the seasonally adjusted data due to the seasonal adjustment method used.

The importance of the reliability, as one of the dimensions of quality, is confirmed by the growing interest in revisions on official statistics from international organisations (Eurostat, OECD, IMF) and National Statistics Institutes (NSIs). With the aim to produce as much as possible transparent statistics NSIs put efforts describing the revision policy, providing information about past revisions, scheduling future revisions, creating real-time data bases and analysing revisions. Most of these efforts are users-oriented because users see with a certain criticism the fact of revising economic statistics. However, in some cases, revision analysis could be helpful as well for data producer detecting possible "weakness" in the estimation procedures and to suggest suitable measures to counteract them.

Several recommendations have been set by international organisations (OECD, IMF and Eurostat[1]) and NSIs (in particular ONS). In particular:

1. revisions should follow a regular and transparent schedule (publicly available);
2. preliminary and/or revised data should be clearly identified;
3. non schedulable revisions due to errors should be communicated as soon as possible by data producers to the general public;
4. real-time databases should be built for performing revisions analysis and made public at least for the main economic indicators;
5. studies and analyses of revisions should be carried out routinely, used internally to inform statistical processes and made public (particularly for short-term statistics).

[1] Recently, Eurostat (2013) has released the guidelines on revision policy for PEEIs (Principal European Economic Indicators) stating eight principles for a common revision policy for European Statistics.

2. General description

The remainder of the module is aimed at presenting the revisions, their sources and causes and the tools to analyse them. It is organised in three subsections. Section 2.1 defines the revisions and presents their classification; section 2.2 describes the real-time datasets and section 2.3 deals with revision analysis and some statistical measures on revisions.

2.1 Definition and classification of revisions

Macroeconomic statistics are typically revised and the size of revisions reflects the trade-off between accuracy/reliability and timeliness. In particular accuracy refers to the closeness between the estimated value and the true value measured by the statistic (usually unknown); reliability refers to closeness of the initial estimate to subsequent (revised) estimates. The latter is measurable and the size of revisions, computed comparing subsequent estimates with previous ones, allows to assess the reliability, though non revised estimates are not to be considered automatically as reliable estimates (see Di Fonzo, 2005). Users often see with a certain criticism the revision of economic statistics. To improve the communication about the revision process many NSIs have made efforts towards transparency, providing information about past revisions, scheduling future revisions both methodological and definitional, classifying revisions, creating real-time datasets where all the vintages are gathered, analysing size, bias and efficiency of revisions.

Hereinafter in this section definitions and classifications of revisions are provided to better understand concepts and practices presented in section 2.2.

Definition of revisions

Although several formal definitions of revisions have been proposed in the literature (for short term economic indicators see Mazzi and Ruggeri Cannata, 2008), here we are interested in providing an analytical definition. In particular, given an indicator and two subsequent estimates referred to a generic period t (month or quarter), a preliminary (or earlier) estimate P_t and a later (more recent) estimate L_t, revision can be defined as

$R_t = L_t - P_t$ [2]

or, in relative terms,

$R_t = (L_t - P_t) / L_t$.

The first definition is exploited to analyse revisions to growth rates (period-on-period or year-on-year growth rates), while the second definition is exploited to analyse revisions to values in level. Since many short term economic indicators are released as index numbers, both users and producers of

[2] When revision R_t refers to the comparison of growth rates, it may depend on all the estimates exploited to compute the growth rates L_t and P_t, that is the estimates referred to different time points (t and t-12, for year-on-year growth rates, and t and t-1, for period-on-period growth rates). Using the triangles described in section 3, it is possible to isolate the revisions affecting only one time period, say only t or only t-1 (t-12). Although it could sound like the correct way to analyse revisions on growth rates, this practice is not followed by NSIs and other international organisations because it does not consider the revisions in the growth rates actually released to users.

official statistics are interested in revisions on growth rates and, consequently, on the first definition of revision.

Classification of revisions

Classifying revisions to official statistics is helpful for both users and producer. Although several bases and criteria have been proposed by NSIs and international organisations, revisions are often classified either by reason or by scheduling (as proposed in Mazzi and Ruggeri Cannata, 2008): the former focuses on the sources or the causes of revisions, while the latter refers to the frequency of revisions.

a) Revisions by reason

- Incorporation of additional data
    - incorporation of late responses (increasing the response rates to surveys)
    - replacement of previous model-based estimates/forecasts with available data (for example in the calculation of national account aggregates early estimates are produced on the basis of models and forecasting techniques and revisions should be expected when more information becomes available)
    - incorporation of data more closely matching concepts and definitions (e.g., more accurate annual data, alignment to annual structural surveys and so on). For example in guidelines for the calculation of index of production it is suggested to use an input method based on hours worked that foresees the calculation of productivity coefficients (calculated as value added per hour worked drawn from national accounts) and their forecast for the current year. Annual changes in these coefficient may lead to revisions in following releases.
- Updating of routine adjustment/treatment or compilation
    - Updating of seasonal factors or time series models exploiting to produce seasonally adjusted data (see the ESS guidelines on seasonal adjustment (Eurostat, 2009) for more details about revision policy of seasonally adjusted data)
    - Change of the base year involving the update of the basket of products, the rotation of business in the sample, the revision of the weighting system
- Introduction of new methods and concepts
    - improvement of estimation methods
    - changes in classifications
    - introduction of new definitions
- Correction of data/estimation errors either caused by the incorrect internal treatment of source data or resulting from wrong information previously provided by respondents and replaced later on (very often after direct contacts with the respondents).

b) Revisions by scheduling (more suitable for short-term indicators)

- Routine revisions generally affecting only the most recent periods
- Annual revisions made when annual (external to surveys) information becomes available and affecting a larger time span (even several years)
- Major revisions recurring at longer intervals (more than three/four years) due to changes of classifications, base period for fixed-based indices, benchmarking and so on. They may require a re-calculation of the whole time series of short term indicators
- Unexpected revisions usually caused by errors or by extraordinary acquisition of new data

Since the main aim of revisions should be the improvement of the estimates previously released, they need to be freely available along with the new statistics and they should be accompanied by supporting and explanatory information aimed at explaining their causes. In order to inform users about this, NSIs should publish general statements describing their practice and policy on revisions accompanying revised statistics, explaining revision sources and describing the effects of revisions.

2.2 Building a real-time dataset

As stated above, the analysis of revision is a tool to assess the quality of the first estimate in relation to later and final estimates. In the recent years, OECD, Eurostat and ONS have stressed that real time datasets (also referred to as *revision triangles*) can represent a useful tool for producers of official statistics to undertake revision analysis and to present revisions and their statistical properties to users. These datasets show how estimates change over time and provide further information about the dissemination policy, timing of revisions, the explanation of revision sources, the status of the published data.

For short-term statistics, a complete history of revisions can be derived collecting the historical vintages of the same indicator in these datasets. According to the definition given by Mckenzie and Gamba (2008), a vintage is a "set of data (sequence of values) that represented the latest estimate for each reference point in the time series at a particular moment in time".

The real time dataset is a table whose rows represent the vintages (identified through their date of release) and whose columns represent the reference periods (months or quarters) of the time series.

As far as the updating of real time datasets is concerned, it is worth stressing two issues: firstly, in order to avoid the loss of information on the revision process, they should be updated whenever a new estimates is available; secondly, when a release is skipped for extraordinary reasons, this missing release should not be replaced by the previous release, because this means to introduce a null revision in the revision process altering its statistical properties.

According to the aim of the analysis to be performed, a revision triangle can be read "horizontally", "vertically" or "diagonally" (Figure 1). When triangles are read horizontally, they provide time series released at the available dates (such information is useful to analysts interested in assessing their forecasting models). On the contrary when triangles are read vertically, they give the revision history referred to a given period, from the preliminary estimates to the latest (such information measures the

reliability of the earlier estimates). Finally, when triangles are read along the main diagonal (the first sub-diagonal, the second sub-diagonal, …), they give the time series of the first (second, third, …) releases.

Release date	Reference Month											
	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
Preliminary estimates P	82.5	85.8	90.6	83.6	86.1	87.3	97.6	46.6	93.2	96.2	93.0	77.0
Revised estimate R	81.6	85.4	90.6	83.4	85.9	87.6	97.9	46.4	93.5	96.3	93.1	77.0
Estimate S	81.1	85.4	90.2	83.1	85.8	87.4	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Estimate Y1	79.9	84.1	88.8	81.8	84.6	86.2	96.8	46.0	92.5	94.6	91.7	76.1
Estimate Y2	79.4	83.7	88.4	81.3	84.1	85.8	96.3	45.8	92.0	94.1	91.2	75.7
Last estimate L	79.6	83.8	88.4	81.4	84.2	85.9	96.4	45.8	92.1	94.2	91.3	75.8
Mar-09	82.5											
Apr-09	81.6	85.8										
May-09	81.6	85.4	90.6									
Jun-09	81.6	85.4	90.6	83.6								
Jul-09	81.6	85.4	90.6	83.4	86.1							
Aug-09	81.6	85.4	90.6	83.4	85.9	87.3						
Sep-09	81.6	85.4	90.6	83.4	85.9	87.6	97.6					
Oct-09	81.1	85.4	90.2	83.1	85.8	87.4	97.9	46.6				
Nov-09	81.1	85.4	90.2	83.1	85.8	87.4	97.9	46.4	93.2			
Dec-09	81.1	85.4	90.2	83.1	85.8	87.4	97.9	46.4	93.5	96.2		
Jan-10	81.1	85.4	90.2	83.1	85.8	87.4	97.9	46.4	93.5	96.3	93.0	

Figure 1: Example of real time dataset[3]

Based on the more widespread practice among NSIs and international organisations, the diagonal reading of the triangles is generally used to build time series of revisions on which descriptive analysis is carried out. The idea is that comparing the first estimate with later estimates (for example the second estimate), a time series of homogeneous revisions is derived, that is a time series of revisions having the same features (e.g., routine revisions between the second and the first estimate, in the example the time series of one-step revisions). Since other causes of revisions than routine revisions may occur at lower frequency producing important changes in the estimates, attention should be taken to exclude them from the analysis.

Usually, the real time dataset contains seasonally adjusted data and growth rates on them (Figure 2). However, when users are interested in unadjusted data, triangle should be provided for both unadjusted and adjusted data and revision analysis undertaken on year-on-year growth rates (for unadjusted data) and on period-on-period growth rates (for adjusted data). In fact the seasonal adjustment, causing revisions spanning several years, may mask interesting evidences on the revision process of unadjusted data.

[3] For a generic index the preliminary estimate (P), the revised estimate after a month (R), the estimate after a year (Y1), after two years (Y2) and the last estimate (L) are reported. Figure 1 reports a further estimate (S), which is peculiar of the indicator considered in the example, released in October 2009 and revising the period January-June 2009.

	Growth rate on the same month of the previous year						Revision of Growth rate on the same month of the previous year					
Reference month	Preliminary estimate P	Revised estimate R	Estimate S	Estimate Y1	Stima Y2	Last estimate L	R - P (h = 1)	S - P	Y1 - P	Y1 - R	Y2 - Y1	L - P
jan-09	-21.9	-22.8	-23.3	-24.2	-24.7	-24.5	-0.9	-1.4	-2.3	-1.4	-0.5	-2.6
feb-09	-23.7	-24.1	-24.1	-25.0	-25.3	-25.2	-0.4	-0.4	-1.3	-0.9	-0.3	-1.5
mar-09	-18.2	-18.2	-18.6	-19.6	-19.9	-19.9	0.0	-0.4	-1.4	-1.4	-0.3	-1.7
apr-09	-25.4	-25.5	-25.8	-26.7	-27.2	-27.1	-0.1	-0.4	-1.3	-1.2	-0.5	-1.7
may-09	-22.6	-22.8	-22.8	-23.7	-24.2	-24.1	-0.2	-0.2	-1.1	-0.9	-0.5	-1.5
jun-09	-19.7	-19.4	-19.6	-20.4	-20.8	-20.8	0.3	0.1	-0.7	-1.0	-0.4	-1.1
jul-09	-17.5	-17.2	N.S.	-18.2	-18.6	-18.5	0.3		-0.7	-1.0	-0.4	-1.0
aug-09	-14.5	-14.9	N.S.	-15.4	-15.8	-15.8	-0.4		-0.9	-0.5	-0.4	-1.3
sep-09	-15.3	-15.0	N.S.	-15.6	-16.1	-16.0	0.3		-0.3	-0.6	-0.5	-0.7
oct-09	-14.0	-13.9	N.S.	-15.1	-15.5	-15.4	0.1		-1.1	-1.2	-0.4	-1.4
nov-09	-5.2	-5.1	N.S.	-6.0	-6.6	-6.5	0.1		-0.8	-0.9	-0.6	-1.3
dec-09	-2.3	-2.3	N.S.	-2.9	-3.6	-3.4	0.0		-0.6	-0.6	-0.7	-1.1

Figure 2: Revision of growth rate on the same month of the previous year

2.3 Analysis of revisions

Descriptive analysis of revision

It can be also useful for producers of official statistics to better understand the characteristic of the statistical compilation process to identify eventually possible drawbacks and to make improvements studying the information in succeeding revisions. It is an important tool for economic forecasts. Moreover it gives the user the opportunity to analyse different types of revision intervals depending on the purpose of the study: revision between first and final estimates or the incremental effect of revisions between subsequent releases.

Using all vintages for an economic indicator it is possible to identify where any biases might exist, to study the pattern in the revisions that can be used to improve the forecasting processes and finally to provide measures of data quality.

To measure the average size of the revisions without providing an indication of directional bias, mean absolute revision (MAR) is calculated. The range that 90% of revisions lie within gives a normal range expected for the revision without being influenced by outliers.

To reveal whether revisions are systematic or not and to have an idea if the average level of revision is close to zero is useful to calculate the arithmetic average or means of revisions. When the mean is positive it indicates that on average earlier releases have been underestimated. Because revisions of opposite signs cancel out this measure is of limited use but calculating the percentages of positive, negative and zero revisions can be useful supplementary information. Besides, a modified t-statistics test (to take into account the serial correlation because revisions are not independent of each other) is used to see whether there is statistical evidence that the bias (mean revision) is significantly different from zero. In the case of not significance it is implied that the pattern of revisions may have occurred by chance.

The relative mean of absolute revisions (RMAR) can be calculated along the previous statistics when making comparisons in the size of revision across different indicators.

It is useful to have a measure of the variability of the revisions calculating the standard deviation of revision to give an indicator of the volatility of revisions for a given revision interval together with the minimum and maximum revision.

The mean squared revisions (MSR) and its decomposition (UM, UR and UD) displays possible systematic components in the revision process.

News or noise

Other approaches are available in order to analyse revisions. Among them an interesting tool, usually applied to analyse revisions to GDP, is the news or noise approach (Mankiw and Shapiro, 1986; Fixler, 2007), which provides an evidence about the way in which the available information is used.[4] In fact revisions may add new available information (they contain news) or may arise because of measurement errors and inefficiencies in the preliminary estimates (they contain noise). In order to assess if revisions are news or noise, the correlation between $R_t = L_t - P_t$ and the estimates L_t and P_t are considered. If revisions R_t are significantly correlated with P_t (and uncorrelated with L_t), they contain noise and the preliminary estimates do not fully utilise the information available. On the contrary, if revisions R_t is significantly correlated with L_t (and uncorrelated with P_t), they contain news enabling the subsequent estimates to embody new information correctly.

Another technique, based on regressions, could be used to assess whether revisions embody news or noise (see Mankiw and Shapiro, 1986). As stressed in Fixler (2007), although it can be shown that the two techniques are related, there is a difference between them: in the computation of the correlation coefficient revisions and estimates are considered symmetrically, while in the regression equation the (preliminary or revised) estimate of an economic indicator represents the independent variable and the revision represents the dependent variable.

Analysis of revisions to detect the sources of large/biased revisions

Since revisions can be widely reported and criticised in the media threatening to undermine confidence in official statistics and in NSIs, most of their efforts to improve revision policy, to build real-time database and to analyse revisions are users-oriented. This contributes to explain why revision analysis is mainly restricted to key economic indicators (often in seasonally adjusted form). Revision analysis could be utilised as well as in different contexts and specifically can help detecting problems in the statistical estimation/compilation process. In fact, as the Statistics Commission stated in its report (Statistics Commission, 2004, p. 4) some revisions are not the consequence of additional information, but are potentially "avoidable", as they are "due to errors or to weakness in the estimation procedures, or to tractable weakness in the underlying data systems". In particular the report highlights four categories of avoidable circumstances that affect the revision process (p. 24):

- substantial mistakes in early processing;
- the models used to compute early estimates are not "best practice";
- timetables could be more rapid than they actually are;
- the methods used are "best practice", but they are implemented without sufficient resources.

[4] Revisions due to changes in definitions, estimation methods, nomenclature, ... should not be considered in this analysis.

Revision analysis could be a useful tool both to detect such circumstances and to suggest suitable measures to counteract them. Two examples are provided in Hoven (2008) and in Ciammola et al. (2008): the former refers to the Dutch estimates of GDP volume growth, the latter to the Italian index of industrial production. Both propose a top-down approach (i.e., analysing first the highest level and then proceeding to the more detailed levels) to identify the specific area(s)/domain(s) "responsible" for large or biased revisions. Based on this approach, the following steps can be implemented[5]:

1) analysis of revisions on the highest level of aggregation (total aggregate);
2) if revisions are large or biased, computation of their contribution to the revision of the total aggregate;
3) if *one* or *few* areas/domains show a large contribution, analysis of revisions on these selected areas;
4) replication of steps 2 and 3 up to the most disaggregated components;
5) detection of the causes of large/biased revisions on early estimates (through a decomposition of revisions if the latter are generated by several sources).

It is worth noting that analysing revisions requires the analysis of a time series of homogeneous revisions.

3. Design issues

4. Available software tools

5. Decision tree of methods

6. Glossary

For definitions of terms used in this module, please refer to the separate "Glossary" provided as part of the handbook.

7. References

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[5] The procedure here presented fits well the domain of short-term economic business indicators (industrial production, turnover, retail trade, … derived through the aggregation of many components), while for GDP, due to its complex estimation process, many other factors have to be considered.

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Interconnections with other modules

8. Related themes described in other modules

1.

9. Methods explicitly referred to in this module

1.

10. Mathematical techniques explicitly referred to in this module

1.

11. GSBPM phases explicitly referred to in this module

1.

12. Tools explicitly referred to in this module

1.

13. Process steps explicitly referred to in this module

1.

Administrative section

14. Module code

Quality Aspects-T-Revisions of Economic Official Statistics

15. Version history

Version	Date	Description of changes	Author	Institute
0.1	18-03-2013	first version	Anna Ciammola Roberto Iannaccone	Istat
0.2	10-06-2013	numeric example, glossary	Anna Ciammola Roberto Iannaccone	Istat
0.3	26-08-2013	several changes to embody comments and remarks by SE	Anna Ciammola Roberto Iannaccone	Istat
0.4	11-09-2013	changes to embody comments by SE	Anna Ciammola Roberto Iannaccone	Istat
0.4.1	30-09-2013	preliminary release		
1.0	26-03-2014	final version within the Memobust project		

16. Template version and print date

Template version used	1.0 p 4 d.d. 22-11-2012
Print date	26-3-2014 13:27