How to Communicate and Visualise the Quality of Short-term Business Statistics Indicators to Users?

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Abstract

Economic policy implementation relies heavily on the timely availability of economic indicators. Short-term business statistics (STS) indicators are published as monthly, quarterly, and annual indices. The deadline to publish the data is short, therefore, revisions constitute an integral part of the production and publication process of STS indicators. Different types of revisions can be distinguished. Apart from routine revisions due to late incoming data and regular benchmarking, revisions can be caused by methodological changes and the correction of errors. In view of STS, revisions are necessary to provide good quality data and are not always a sign of insufficient quality, unless they are systematically very large. At the same time, the revision indicators provide guidance to users on the expected level of revisions and allow for an assessment of the reliability of the STS indicators. The aim of the paper is to promote the existing ESS standards for quality reporting and present different ways of communicating the results of the revision analysis to the users. In doing so, it presents new ways to visualise revision tracks to show possible future developments in the field of quality reporting of STS indicators.

Keywords: short-term business statistics, quality indicators, revision indicators, visualisation of revisions

1. Introduction

Economic policy implementation relies heavily on the timely availability of economic indicators. Short-term business statistics (STS) are the earliest statistics released by Eurostat to show emerging trends in the European economy. They are part of the European business statistics and provide data for industry, construction, trade, and services. STS describe economic developments by means of indices for production, turnover, producer and import prices as well as for some other indicators (construction costs, labour input).

STS indicators are published as monthly, quarterly, and annual indices. The deadline to publish the first monthly or quarterly data is short. Therefore, revisions constitute an integral part of the production and publication process of STS indicators. Different types of revisions can be distinguished. Apart from routine revisions due to late incoming data and regular benchmarking, revisions can be caused by methodological changes and the correction of errors (European Commission, Eurostat, 2013). In view of STS, revisions are necessary to provide good quality data and are not always a sign of insufficient quality, unless they are systematically very large. At the same time, the revision indicators provide guidance to users

on the expected level of revisions for the data and allow for an assessment of the reliability of the STS indicators.

The aim of the paper is to promote the existing ESS standards for quality reports (European Communities, 2009) and present different ways of communicating the results of the revision analysis to the users. In doing so, it presents new ways to visualise revision tracks to show possible future developments in the field of quality reporting of STS indicators. The paper is structured as follows: In section 2, we introduce quality aspects of STS indicators. Section 3 provides an overview of the release and revision policy of STS. Section 4 explains different reasons for revisions and illustrates the reasons for revisions with examples of revision tracks of STS European aggregates for the Principal European economic indicators (PEEIs) subject to STS News Releases. In section 5, we perform a user-oriented revision analysis of the industrial production index using different quality indicators. The focus is on the differences between the first and the second releases as well as the first and the last releases. Section 6 concludes.

2. Quality Aspects of STS Indicators

The quality of STS indicators is measured twice per year in a compliance assessment, which focusses on aspects such as completeness, punctuality, and length of time series. Eurostat also regularly investigates with the reporting countries significant revisions, seasonal adjustment, and possible outliers, especially at the higher aggregated level. In addition to the general compliance assessment, the present paper focusses on two other aspects of quality:

- The size of revisions
- The biases of revisions.

3. Release and Revision Policy of STS

In February 2012, the European Statistical System Committee (ESSC) approved guidelines on how to deal with the various types of revisions for the PEEIs (European Commission, Eurostat, 2013). The revision policy of STS follows the general guidelines on revision policy approved by the ESSC (Eurostat, 2024c):

- European aggregates are generally released and revised once per month. The policy is applied for all STS PEEIs but also for other STS indicators.
- European aggregates of STS labour indicators and construction prices or costs are revised when new information becomes available.
- National data are revised whenever new information becomes available.

Detected errors in national data or in European aggregates are corrected immediately. Users are informed about forthcoming major revisions in news releases and on Eurostat's website (Eurostat, 2024b).

4. Reasons for Revising STS Data

STS data are very often subject to revisions. Revisions can be caused by several reasons (European Commission, Eurostat, 2013):

- Routine revisions of STS data are necessary because of late incoming data, seasonal adjustment, or regular benchmarking.
- Methodological changes and changes of the reference and base year introduce main revisions that may be large in size but take place less frequently and regularly than routine revisions.
- Corrections of errors may take place at any moment.

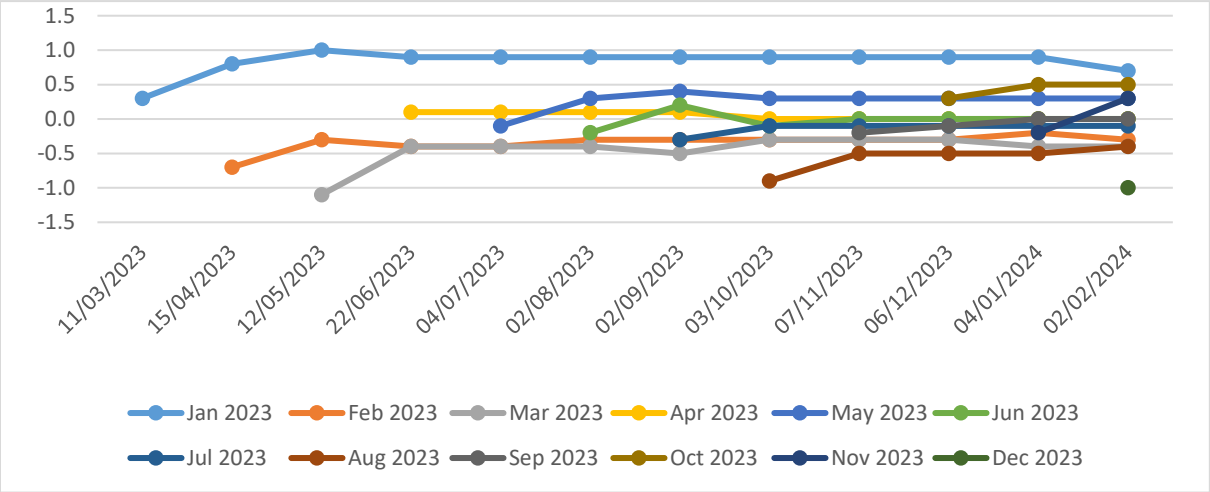
In the past, the largest revisions with the second data release among the selected PEEIs were expected for euro area/EU production in construction[1], followed by volume of sales in retail trade and industrial production. Industrial producer prices are very stable and if revised at all, the revisions are relatively small (Eurostat, 2024c).

The figures below show the revisions of the EU month-on-month growth rates of volume of sales in retail trade (Figure 1), industrial producer prices (Figure 2), production in construction (Figure 3) and industrial production (Figure 4). The data basis is the STS vintage dataset managed by Unit G-3: Business cycle; Short-term statistics. The y-axis shows the month-on-month growth rates. The release dates are depicted on the x-axis. The first data release is 1-2 months after the end of the reference period. Figures 1, 2 and 3 show that the largest revisions occur mainly with the second release. From the third release onwards, the revision tracks are relatively flat.

The month-on-month-growth rates of volume in sales in retail trade show some variation between the first and second data release (Figure 1). The first releases of the month-on-month growth rate are always revised upwards with the second data release, indicating a systematic bias. From the second release onwards, the revisions are moderate.

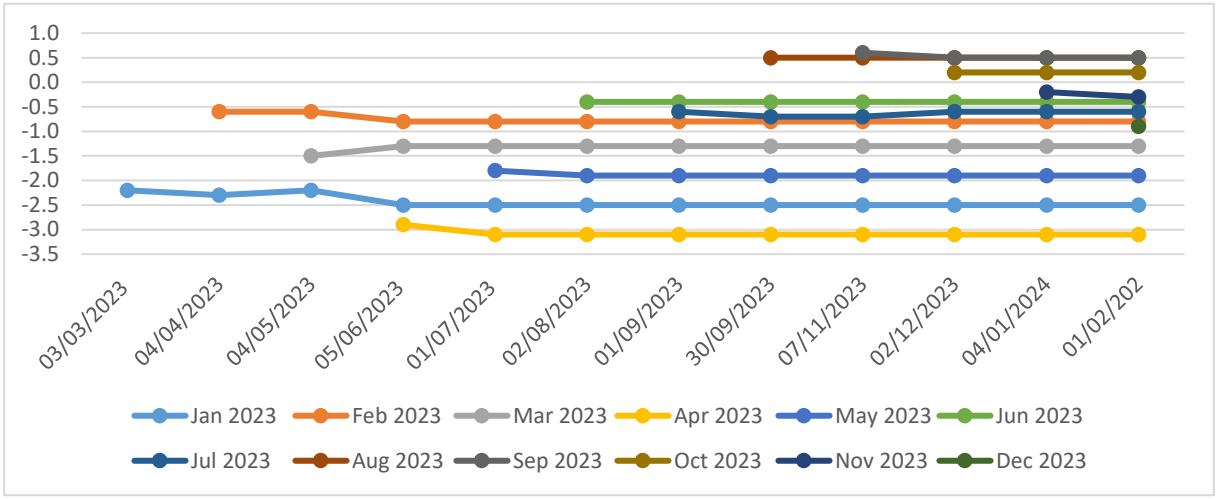
[1] One reason for this was that several middle-sized countries transmitted their first monthly results after the release of the European aggregates. For the European aggregates, these countries data were estimated and later replaced by real data which caused revisions of the European aggregates.

Figure 1: Evolution of the volume of sales in retail trade month-on-month growth rate by publication date, EU, January 2023 (reference month) to December 2023 (reference month)



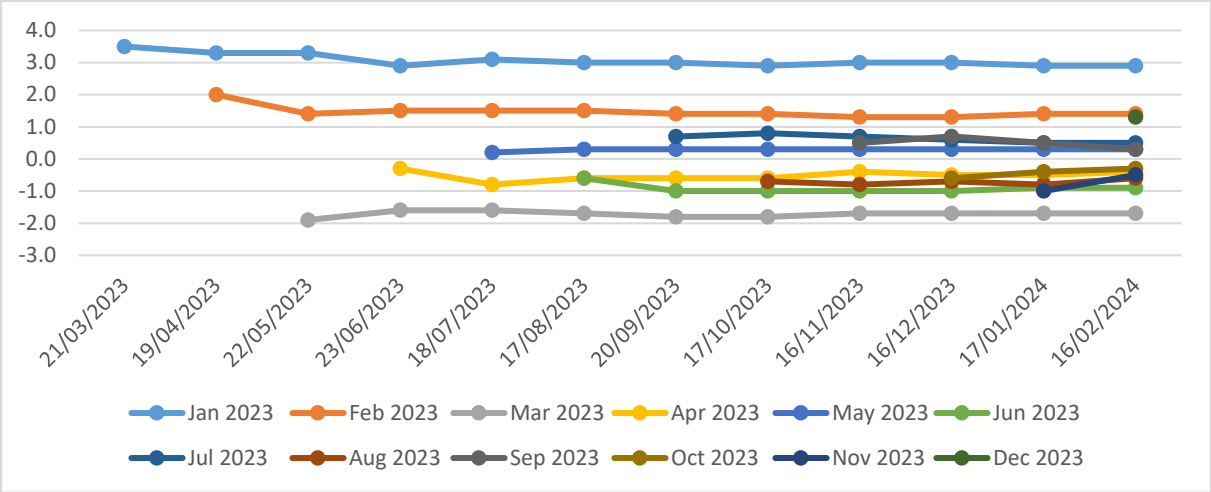
Industrial producer prices of the domestic market have very smooth revision tracks (Figure 2). Most growth rates are not revised at all. If a revision takes place, it is very small in size.

Figure 2: Evolution of the domestic industrial producer prices month-on-month growth rate by publication date, EU, January 2023 (reference month) to December 2023 (reference month)



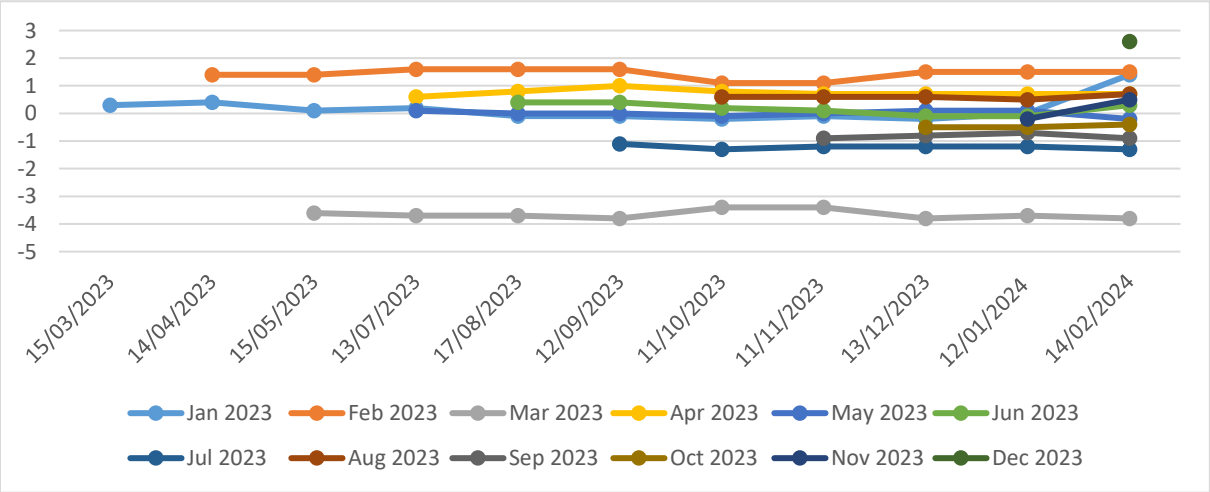
In the past, the $MAR(1)$ was the highest for production in construction among the selected PEEIs (Eurostat, 2024c). This finding is supported by Figure 3. For example, the month-on-month growth rate of February 2023 is revised from 2.0% to 1.4% with the second release.

Figure 3: Evolution of the production in construction month-on-month growth rate by publication date, EU, January 2023 (reference month) to December 2023 (reference month)



While the revision tracks of the month-on-month growth rates presented above remain quite stable after the first revision, the growth rate of industrial production is revised more frequently. Figure 4 shows that for the EU industrial production index small revisions occur throughout the year 2023. An exception seems to be January 2023 (reference month), where the month-on-month growth rate for January 2023 is revised from 0.5% (published on 12 January 2024) to 2.2% (published on 14 February 2024). This revision can be largely attributed to one country that has revised its data.

Figure 4: Evolution of the industrial production month-on-month growth rate by publication date, EU, January 2023 (reference month) to December 2023 (reference month)



5. Revision Analysis

This section presents a detailed revision analysis of the industrial production index. Revisions are a normal part of the statistical production process. In particular in STS, where first results

are published early after the reference period, revisions are naturally to be expected. Correcting the first results – that had to be based on partially incomplete surveys or sources, such as administrative records, which are not perfect for statistical purposes – can even be seen as an indicator of quality and not as a simple correction of avoidable errors. Nevertheless, it is of course desirable that the first releases are relatively close to final data and that the first data do not give a misleading impression of the real development. In order to balance these diverging aspects of revisions, the following is proposed:

- Focus on annual average revisions so that occasional high revisions do not indicate a general lack of quality.
- Focus on relative absolute revisions, so that revisions of different countries with different rates of change are, to the extent possible, comparable.
- Set a threshold for the critical size of a revision.
- Pay particular attention to possible biases of revisions, i.e., whether the first data release is systematically too high or too low.

In the following analysis, the focus is on revisions for the industrial production indicators, as this is the indicator that receives the most attention from users. The industrial production vintages are also available for users in Eurostat's database Eurobase (Eurostat, 2024a). The mean revision (MR), mean absolute revision (MAR) and relative mean absolute revision ($RMAR$) serve as quality indicators. The quality indicators are defined as follows (Fonzo, 2005; Eurostat, 2024c):

$$MAR(L) = \frac{1}{n}\sum_{t=1}^{n}\left|X_{L_t} - X_{0_t}\right|$$

$$RMAR(L) = \frac{\sum_{t=1}^{n}\left|X_{L_t} - X_{0_t}\right|}{\sum_{t=1}^{n}\left|X_{L_t}\right|}$$

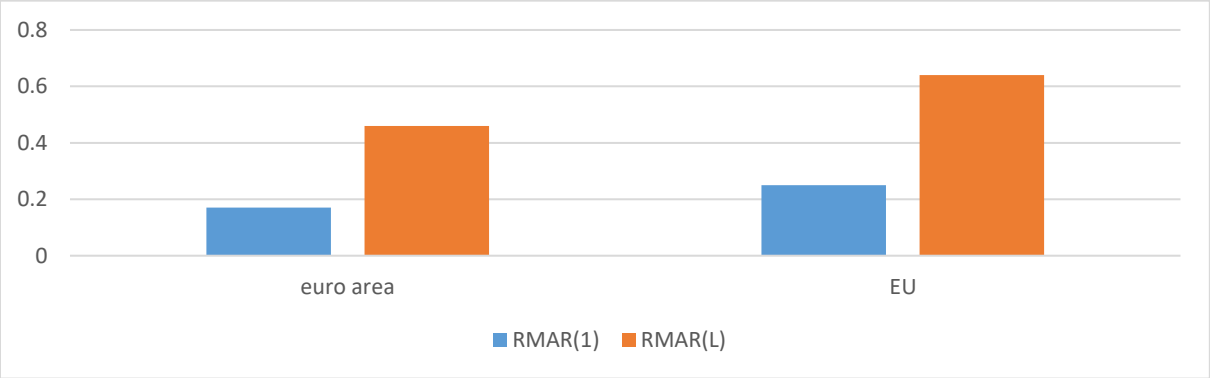
$$MR(L) = \frac{1}{n}\sum_{t=1}^{n}\left(X_{L_t} - X_{0_t}\right)$$

with $t = 1, \dots, n$ denoting the number of reference periods, X_{L_t} the latest available data release of the growth rate for reference period t and X_{0_t} the first data release for reference period t. It is recommended to use 36 reference periods for monthly data. It should be noted that revisions occur mainly between the first and second release. In this case, X_{L_t} is the second data release. The quality indicators are calculated based on seasonally adjusted month-on-month growth rates. $MAR(L)$ gives the mean of the absolute revision between the initially published and revised growth rate. $RMAR(L)$ puts the absolute revision in relation with the value of the revised

growth rate. Thus, it makes the MAR comparable across indicators and countries. $MR(L)$ is the mean of the revisions between the initially published and the revised growth rate. It should be zero or close to zero as upwards and downwards revision should cancel each other out to a certain degree.

Figure 5 shows the $RMAR(1)$ and $RMAR(L)$ of the industrial production indicator for the euro area and the EU. For the EU, the quality criteria are calculated based on data from January 2021 (reference month) to December 2023 (reference month). For the euro area (EA20[2]), data is only available from October 2022 (reference month). The $RMAR(1)$ for the euro area is 0.17% and the $RMAR(L)$ is 0.46%, while the $RMAR(1)$ for the EU is 0.25% and the $RMAR(L)$ is 0.64%. It is evident that most countries revise their initial estimates not only with the second data release, but also with the subsequent data releases.

Figure 5: $RMAR(1)$ and $RMAR(L)$ of industrial production for the euro area and the EU



In order to determine critical revisions two different threshold values are introduced: First, the double size of the arithmetical average of the available country revisions and second, the "1.5 interquartile range (IQR) rule". These threshold values are used to identify countries with revisions, which are outside the typical range for the respective indicator. Table 1 shows the quality indicators for industrial production for the euro area and the EU. Both the euro area and the EU month-on-month growth rates are revised upwards on average with the second data releases. Using the first proposed threshold, two Member States are identified as countries with critical revisions of the industrial production indicator based on the $RMAR(1)$ and two Member States based on the $RMAR(L)$.

[2] The euro area (EA20) includes Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia, and Finland.

Table 1: Quality indicators for industrial production

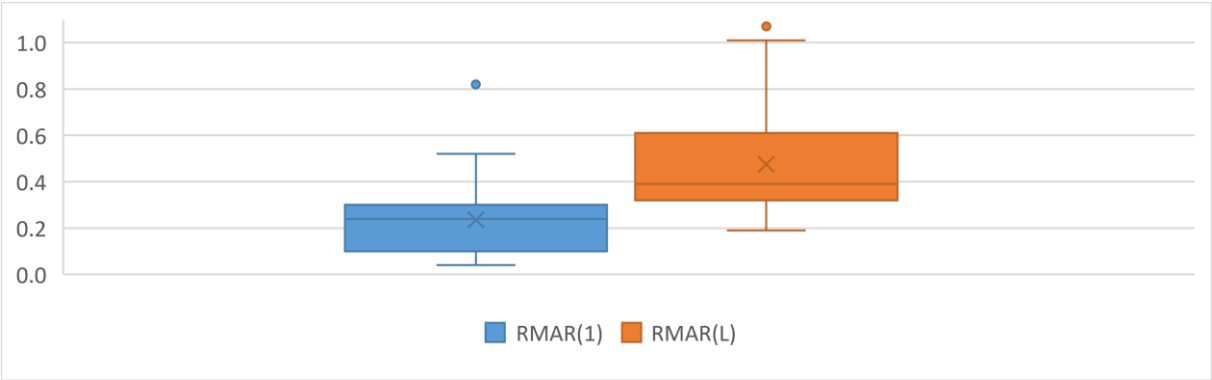
	***MAR* (percentage point)**		***RMAR* (%)**		***MR* (percentage point)**	
	$MAR(1)$	$MAR(L)$	$RMAR(1)$	$RMAR(L)$	$MR(1)$	$MR(L)$
Euro area	0.20	0.63	0.17	0.46	0.09	-0.11
European Union	0.24	0.73	0.25	0.64	0.03	0.02

Figure 6 shows the results based on the "1.5 interquartile range (IQR) rule". For graphical representation of the revisions, boxplots are used. The box represents the middle 50% of the distribution, which is the range between the 25th percentile (or first quartile q_1.) and the 75th percentile (or third quartile q_3). The line inside the box is the median (50th percentile, second quartile). The whiskers extend the box to both sides. Please note, that the whiskers show the range of the 1.5 IQR. The 1.5 IQR is applied to determine outliers:

$$q_1 - 1.5IQR < RMAR < q_3 + 1.5IQR$$

with $IQR = q_3 - q_1$. Thus, the whiskers show the lowest and highest value, which is within this distance. The outliers are marked as dots (Aggarwal, 2017, pp. 45-46). According to the second proposed threshold, one Member State is identified as country with critical revisions of the industrial production indicator based on the $RMAR(1)$ and one Member State based on the $RMAR(L)$. Therefore, the first proposed threshold based the double size of the arithmetical average of the available country revisions in the subsequent data releases is more stringent than the second proposed threshold based on the "1.5 IQR rule". However, the revisions of most Member States are considered as non-critical according to both proposed thresholds.

Figure 6: Boxplots for $RMAR(1)$ and $RMAR(L)$ for industrial production



Moreover, the size and direction of biases in the revisions are analysed. To determine if revisions between the first and second publication were biased or oscillated around the value zero, the available data were tested with a student t distribution for a two-sided error and a 5% significance level. Most of the Member States do not display a bias in their revision history. Only one Member State exhibits a potential bias in the first data release.

6. Conclusion

The magnitude and direction of revisions provide crucial indications to users regarding the reliability of initial estimates. Therefore, revision analyses are very important and should be carried out on a regular basis. Our analysis shows that routine revisions of the STS data are moderate for most countries. The first data release can therefore be considered reliable.

The revision analysis and visualisation provide guidance on the assessment of the data quality of first estimates. The introduction of threshold may help users in their assessment. However, when evaluating the results of the revision analysis, it should be noted that revisions are a normal part of the statistical production process.

Two different approaches for determining the threshold values were presented: the double size of the arithmetical average of the available country revisions and the “1.5 IQR rule”. As an alternative to the proposed thresholds, simpler thresholds could be introduced, for example, requiring the bottom three countries in the $RMAR$ ranking to improve the quality of their first estimates.

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