

# Regulative, structural and detailed improvements of national accounts data quality

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## Abstract:

This paper presents three initiatives on how data quality for national and regional accounts is being improved in recent years. The paper firstly shows how the quality reporting exercise brings benefit to the effectiveness of the national accounts' regulation; secondly, discusses how the coordination at European level for structural benchmark revision improves the quality of data; and thirdly, presents a method to define thresholds for reporting metadata on revisions in regional accounts as an example of quality improvement at the detailed level.

Regulation (EU) No 549/2013 establishes the European System of Accounts 2010 (ESA 2010) which is the internationally compatible EU accounting framework for a systematic and detailed description of an economy. It is the source for a multitude of key economic indicators, including gross domestic product (GDP), that are used for policy making and economic analysis. The quality of ESA 2010 data transmitted by the Member States is systematically monitored during the annual quality reporting exercise set out in Regulation 2016/2304. The paper outlines the role of the quality reporting exercise in enhancing the quality and reliability of national accounts data.

Benchmark revisions, carried out at least once every five years, are vital for incorporating new data sources and aligning with the latest international statistical methodologies. They improve the quality of data and ensure consistency within national accounts and across Member States. The paper outlines the coordinated efforts for the 2024 coordinated benchmark revision, the coordinated communication by the European Statistical System (ESS), the benchmark revision requirements and main expected changes.

A robust methodology is provided to effectively identify revisions that significantly deviate from typical values in regional accounts. A dynamic, percentile-based thresholding method is used, adjusting thresholds according to the standard error (SE) of historical revisions for three-unit measures (national currency, persons, hours worked) across all NUTS 2 or 3 regions within each country. This approach mitigates disparities emerging from the different region sizes and measurement scales. The thresholds are further tuned so that if the SE is high, indicating less reliability, the threshold lowers to flag more revisions; conversely a low SE raises the threshold, targeting most extreme revisions. This ensures that the thresholds are pertinent and applicable across diverse contexts.

**Keywords:** ESA 2010 quality framework, harmonised European revision policy, benchmark revision, validation thresholds, national and regional accounts

## 1. Introduction

The European system of national and regional accounts (ESA 2010) is the internationally compatible EU accounting framework for a systematic and detailed description of an economy. National accounts are produced from a large variety of data sources and are the source for a multitude of key economic indicators for policy making and economic analysis by

governments, international institutions, and academia, including gross domestic product (GDP). Eurostat has established several initiatives in recent years to ensure high quality, coherence, and comparability of data. These initiatives cover regulative, structural and detailed improvements of national accounts data quality.

On the regulative aspect, the European statistical system (ESS) sets the criteria to be applied to statistics to assess the quality of the transmitted data. The Commission (Eurostat) regularly assesses whether Member States' data quality is in accordance with ESA 2010 requirements. Consequently, the quality assessment of ESA 2010 data follows a common approach and standards adopted by the ESS. The quality of ESA 2010 data transmitted by the Member States is systematically monitored during the annual quality reporting exercise set out in Regulation 2016/2304.

The sources used to estimate the national accounts and the macroeconomic aggregates in general, are provided with varying degrees of timeliness. As users need national and international data as fast as possible, data are produced using the sources and related indicators that are most readily available. As more complete data are obtained from these sources over time, revisions are necessary to improve quality. Benchmark revisions are coordinated major revisions carried out at least once every five years to incorporate new data sources and any major changes in international statistical methodology. They aim to ensure a maximum degree of consistency within national accounts across Member States as well as between national accounts and balance of payments. The next coordinated benchmark revision of national accounts and balance of payments in the EU is due by Autumn 2024 and represents the structural aspect of quality improvements.

In view of the coordinated benchmark revision in 2024, several initiatives relevant for national accounts compilation have taken place recently to achieve quality improvement at the detailed level. One such example is the robust methodology that is used to effectively identify revisions that significantly deviate from typical values in regional accounts.

## **2. Regulative improvements of national accounts data quality**

Regulation (EU) No 549/2013 of the European Parliament and the Council establishes the European system of accounts 2010 (ESA 2010). Article 4 of this regulation prescribes that the quality of data transmitted under the ESA 2010 Transmission Programme shall be regularly assessed according to the quality criteria established by Art. 12(1) of Regulation (EC) No 223/2009. These criteria, namely relevance, accuracy and reliability, timeliness and

punctuality, accessibility and clarity as well as coherence and comparability, are applied to statistics produced by the European statistical system (ESS). Consequently, the quality assessment of ESA 2010 data follows the common approach and standards adopted by the ESS.

The modalities, structure, periodicity and indicators of this assessment process are defined in the Commission Implementing Regulation No 2016/2304. Every year, under Article 4(2) of Regulation (EU) No 549/2013, each Member State provides a report on the quality of data sent to Eurostat. Eurostat launches the national quality reporting based on the ESA 2010 data transmitted in the previous year. National quality reports of EU Member States, Iceland, Norway and Switzerland are prefilled with the values from five quantitative assessment indicators. The quality reports cover all ESA 2010 domains, namely the main aggregates, government finance statistics, non-financial sector accounts, annual financial accounts, regional accounts and supply, use and input-output tables, as well as the supplementary table on pension entitlements.

Countries are then invited to review and comment on the quantitative indicators in accordance with their compilation methodology and statistical production process. They are also requested to update the report with information on the qualitative indicators. The reporting is implemented in the ESS Metadata Handler - a web-based application for the production, exchange, and dissemination within the ESS of reference metadata and quality reports. The completed country quality reports are submitted to Eurostat. Based on these country reports, Eurostat prepares an overall assessment in accordance with Article 4(4) of the same regulation. In addition, in order to encourage countries to undertake actions to increase data quality, Eurostat draws up a list of country-specific recommendations for quality improvements that are eventually discussed with the countries and mutually agreed.

Each year Eurostat also prepares an overall assessment report based on the national quality reports. The assessment report is addressed to users and provides information to help understand the published data and, where applicable, the factors that enable or limit their quality. It is based on the information provided in the country quality reports, as well as on other available information on the ESA 2010 implementation at Eurostat. The Eurostat assessment report is consulted with the countries for final review and once finalised, the report is published on the Eurostat website by the end of each year.

Under Article 12 of the ESA 2010 regulation, every fifth year, the Commission (Eurostat) reports to the European Parliament and the Council about the quality of data on national and

regional accounts. This latest report was submitted to the European Parliament and the Council on 13.06.2023 using information from the 2022 quality reporting and assessment exercise (2021 data).

Member States have made significant efforts to improve data availability in accordance with ESA 2010 requirements. The Commission (Eurostat) supports these efforts through meetings, workshops, courses, guidance manuals and documents. Technical cooperation is conducted through the Working Groups on National Accounts and Excessive Deficit Procedure Statistics under the guidance of the Directors of Macroeconomic Statistics of the National Statistical Institutes. Financial support from the Commission to Member States is an important tool to further improve the completeness, comparability and consistency of ESA 2010 data. Grants are regularly offered to Member States to improve ESA 2010 data in specific areas.

### **3. Structural improvements of national accounts data quality**

#### **3.1 Benchmark revisions and the Harmonised European Revision Policy (HERP)**

Since benchmark revisions aim to improve the accuracy and comparability of key macroeconomic indicators for policy and business analysis in the EU, they need to be accompanied by enhanced communication to inform on expected changes and revisions. Given the particular importance of coherent and comparable data for EU policy uses, a Harmonised European revision policy (HERP) covering benchmark and routine revisions was developed by Eurostat and the ECB in close cooperation with national statistical institutes and national central banks. The aim is to ensure coordinated and consistent revisions between the statistical domains within each country and across the EU as user needs, legal requirements, methodological manuals and compilation methods change.

In 2019, the handbook on Practical guidelines for revising ESA 2010 data was published, providing good practices for routine and benchmark revisions as well as for non-scheduled revisions. The handbook brings together recommendations on data revisions that were developed through different fora at different times. It also translates these consolidated recommendations into concrete practices to ensure accurate, reliable, consistent and comparable data from both national accounts and balance of payments statistics.

Even though adherence to HERP is not legally binding, its voluntary implementation by the Member States has progressed, and Eurostat regularly monitors the adherence to HERP of EU Member States and EFTA countries in its annual quality reports of ESA 2010 data and quinquennial reports to the European Parliament.

A main recommendation of the Harmonised European Revision Policy (HERP) is to ensure consistency of data across different national account domains and with balance of payments. The handbook on Consistency of ESA 2010 based national accounts, published in 2020, aims to support compilers' efforts to improve the consistency of national accounts. It contains definitions, explanations, recommendations and examples of good practice under the ESA 2010 Regulation that aim to ensure that the output of national accounts compilation is numerically consistent.

In summary, a harmonised benchmark revision should ensure that a maximum degree of consistency (within national accounts, across Member States and between domains) is reached at least once every five years.

### **3.2 Coordinated efforts for the 2024 benchmark revision**

The 2024 benchmark revisions will combine a number of typical objectives with more specific ones. Typical objectives of benchmark revisions are to incorporate new data sources and major changes in international statistical methodology in a coordinated manner at least once every five years. Following an amendment of the ESA 2010 regulation after a mid-term review by Regulation (EU) 2023/734, countries should implement an updated classification for household expenditure breakdowns (COICOP 2018) and some transmission improvements, unless temporary derogations were agreed. Countries should also resolve outstanding compilation and technical errors and integrate improvements in the entire time series.

Benchmark revisions should improve adherence with ESA methodology by addressing open action points and reservations from the verification of gross national income used in the determination of EU own resources (GNI OR verification), implementing updates required for government finance statistics in accordance with the latest version of the Manual for Government Deficit and Debt (MGDD 2022) or other recommendations made during excessive deficit procedure (EDP) dialogue visits.

Specific improvements in sources and methods also include the implementation of globalisation-related improvements of the accounts as a follow up of the GNI work on multinational enterprises and the Early Warning System and integration of improved source data – like business statistics and social survey data after updates of the framework regulations (EBS/IESS) and the 2021 population census.

Eurostat also expects that analyses and recommendations of recent national accounts improvement projects are taken into account by NSIs when preparing the 2024 benchmark

revision. These concern notably recommendations of a Task Force for a further harmonization of estimates for fixed capital stocks and depreciation, in-depth analysis of national accounts volume estimates using (mainly) implicit deflators, and also draft recommendations expressed in the context of an ongoing analysis of employment estimates.

Finally, countries should consider recommendations on improving cross-domain consistency and ensure a maximum degree of coherence and consistency within and between national accounts datasets and with balance of payments statistics.

A fully co-ordinated implementation across the European Statistical System and the European System of Central Banks in line with the HERP principles is an explicit feature of the 2024 benchmark revision.

### **3.3 Coordinated communication by the European Statistical System (ESS)**

In line with legal transmission requirements, it is expected that most EU Member States will implement the 2024 benchmark revision shortly before or at the deadline for annual main aggregates and most other annual datasets at T+9 months. However, Member States will also follow their established national release schedules, so that Eurostat expects to receive some first transmissions in 2024Q2, even though most countries will transmit revised data from 2024Q3 onwards, in line with the legal transmission deadlines for different datasets.

As a key aspect of the benchmark revision is communication, Eurostat has setup a page on data revision on its ESA 2010 website to support the implementation of a coordinated ESS communication strategy on the 2024 benchmark revision. Following the publication of an overview note early in 2023, Eurostat foresees the publication of additional information on main data release dates, expected overall impact on GDP and explanations for possible shortcomings with respect to HERP compliance (e.g. shorter time series revisions, series breaks and/or inconsistencies between NA domains and/or BoP) and information linked to the monitoring of national releases, including links to nationally published metadata and information. As Eurostat is collecting more precise information on these aspects, users are invited to regularly visit this website to obtain further or updated information.

## **4. Detailed improvements of national accounts data quality**

The ESA 2010 mid-term review of the transmission programme set new requirements for countries. Alongside their data submissions, countries are now mandated to provide specific metadata detailing significant data revisions amongst others. To define which revisions should be reported in the specific metadata, the use of thresholds has been proposed in annual

financial accounts since 2022. The threshold approach was recently also applied in regional accounts. In the following section, the robust procedures for transmitting this information for the regional accounts' domain will be explored in detail, including the criteria that define them, and an explanation of the algorithm employed to flag them.

#### **4.1 Thresholds for significant data revisions in regional accounts**

To set robust revision thresholds, a dynamic percentile-based approach was adopted that adjusts thresholds based on the number of historical revisions a country has made. This approach allowed to: 1. identify revisions that significantly deviate from typical values, by setting thresholds based on percentiles and 2. determine country-specific thresholds based on the variability and reliability of the revisions of their data.

Vintage data spanning values reported between 2000 and 2022 were collected. This data was transmitted over the years 2020, 2021, 2022 and 2023. For each unit of measurement, two threshold types were established: one based on percentage change (to be considered in absolute values) and another on absolute differences, and an "OR" approach for the definition of a significant revision was proposed. A revision was said to be significant if it was greater than either the percentage change OR the absolute difference threshold.

The standard error (SE) was used to assess the reliability of the historical data. The SE offers an indication of the variability of the sample mean: as the sample size (in terms of number of revisions) increases, the SE decreases, indicating a more reliable mean. **Figure 1** shows the SE of the historical revisions (as absolute difference) reported by all regions by country, units of measurement and NUTS level.

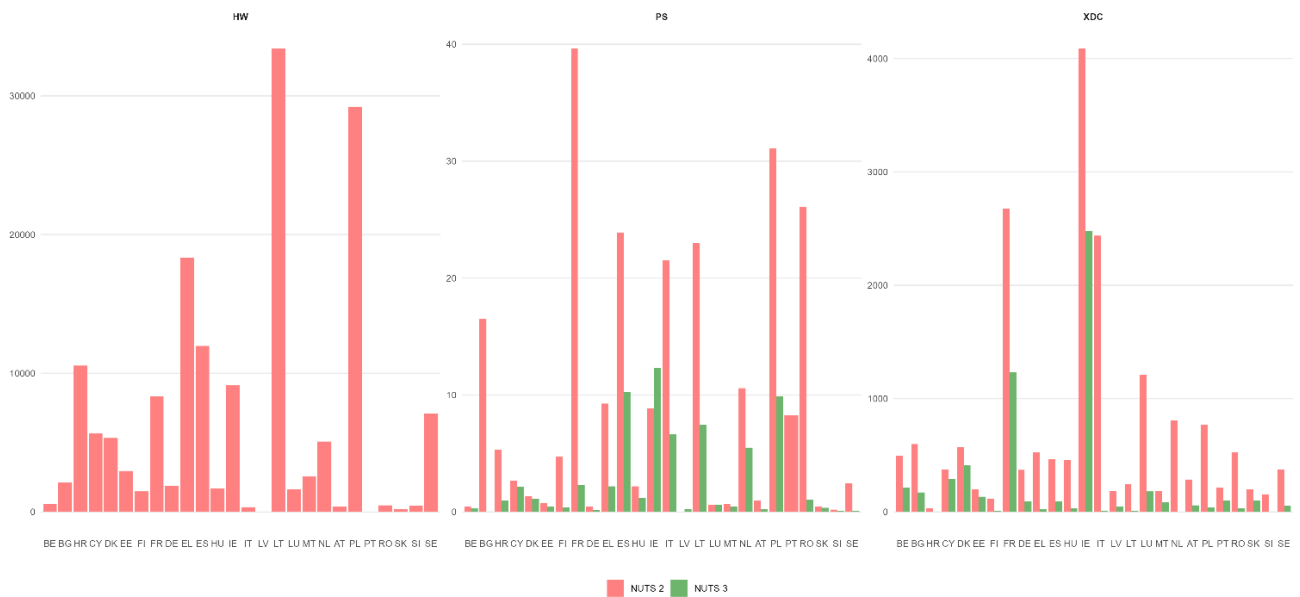


Figure 1: Standard Error (SE) of the revisions (as absolute difference) reported by all regions by countries, units of measurement and NUTS level.

First, the average across countries of the SE of the revisions reported by all regions (within each country) by NUTS level and units of measurement was computed (see **Figure 1**). For each unit of measurement and across all NUTS2 (or NUTS3) regions within each country, regardless of the year and NACE activity, thresholds were determined as follows: when the SE exceeded this computed average, the threshold was set at the 95th percentile of the distribution of revisions, whether measured in percentage change or absolute values. Conversely, when the SE was below or equal to this average, the threshold was set at the 98th percentile.

This approach ensured that as the SE rises (indicating decreased reliability), the threshold adjusts to a lower value, flagging more significant revisions. On the other hand, as the SE decreases, the threshold rises, flagging only the most extreme revisions.

Further refinements were made. Lower and upper bounds were introduced for each unit of measurement, for dealing with the cases where the 95th or 98th percentile of the distribution appears lower or smaller than what is deemed appropriate. Moreover, to ensure consistency and prevent disproportionately high thresholds for NUTS3 (compared to NUTS2), it was defined that the threshold for NUTS3 could not exceed that of NUTS2 for any given country, and if it does, the NUTS3 thresholds were set to be equal to those defined for NUTS2.



The provided algorithm will undergo annual updates to incorporate new data. After its initial run, refinements were made based on insights and experiences.

The main R functions used to derive the thresholds can be found here: [https://colab.research.google.com/drive/1JW-ZF64HPH\\_62u8a13oM8UkvkHlvn7sz?usp=sharing#scrollTo=o2v448HYvWK](https://colab.research.google.com/drive/1JW-ZF64HPH_62u8a13oM8UkvkHlvn7sz?usp=sharing#scrollTo=o2v448HYvWK). Users can experiment with the code using a sample dataset provided in the Colab notebook. Real data results by countries, NUTS level and unit of measurement are provided in Table 1 in the Appendix.

## **5. Conclusions**

This paper analyses the initiatives undertaken by Eurostat to improve the quality of national accounts data on three levels: the regulative, the structural, and detailed improvements.

The Commission Implementing Regulation No 2016/2304 sets out the modalities, structure, periodicity and indicators of the quality assessment of national and regional accounts data assessment process. The national quality reporting framework has resulted in the improved accuracy, quality and coherence of the ESA 2010 data.

Since 2014, during benchmark revisions and other major ad-hoc revisions, Member States have improved data sources and harmonised methods in a structured way. Eurostat has taken steps to prepare for and communicate effectively on the 2024 benchmark revision. To this end, good practices in line with the harmonised European revision policy (HERP) and agreed official communication are emphasised.

The dynamic percentile-based approach proposed for setting revision thresholds in regional accounts ensures precise and relevant data quality assessments. This robust framework, coupled with annual updates, facilitates continuous improvement in data monitoring and quality.

## Appendix

Table 1: Threshold for each country by NUTS2 and NUTS3 region in percentage change and absolute difference

Country	NUTS	Domestic currency (millions)		Persons (thousand)		Hours Worked	
		% change	abs diff	% change	abs diff	% change	abs diff
BE	2	16	600	11	5	3	5000
	3	22	100	25	5	NA	NA
BG	2	25	800	25	10	25	5600
	3	25	200	25	5	NA	NA
HR	2	25	800	25	10	25	10000
	3	21	800	25	9	NA	NA
CZ	2	3	2400	3	5	3	5000
	3	3	2400	3	5	NA	NA
DK	2	16	7000	15	8	13	6550
	3	22	2800	25	8	NA	NA
EE	2	25	400	7	5	6	10000
	3	25	300	14	5	NA	NA
FI	2	3	200	3	10	18	10000
	3	4	100	3	5	NA	NA
FR	2	25	1000	25	10	22	8200
	3	18	200	23	6	NA	NA
DE	2	25	1000	3	5	3	6300
	3	15	200	6	5	NA	NA
EL	2	25	300	18	10	18	10000
	3	16	100	18	5	NA	NA
ES	2	25	1000	9	10	13	10000
	3	12	200	25	10	NA	NA
HU	2	11	201200	13	7	4	5000
	3	8	38200	17	5	NA	NA
IE	2	25	1000	25	10	25	10000
	3	25	1000	25	10	NA	NA
IT	2	12	1000	3	10	3	5000
	3	3	100	4	10	NA	NA
LV	3	13	100	25	5	NA	NA
LT	2	3	100	20	10	25	10000
	3	3	100	25	5	NA	NA
MT	3	25	300	22	5	NA	NA
NL	2	25	700	10	10	5	10000
	3	3	100	22	8	NA	NA
AT	2	12	400	6	5	3	5000
	3	7	100	11	5	NA	NA
PL	2	24	3000	25	10	25	5000
	3	14	600	25	10	NA	NA
PT	2	4	500	6	10	3	5000

	3	3	200	3	5	NA	NA
RO	2	25	4000	3	5	5	5000
	3	18	1100	25	5	NA	NA
SK	2	13	300	3	5	3	5000
	3	16	200	3	5	NA	NA
SI	2	25	200	3	5	3	5000
	3	3	100	3	5	NA	NA
SE	2	6	5200	3	10	25	10000
	3	15	1900	3	5	NA	NA
NO	2	25	11500	8	5	3	5000
	3	6	2200	19	5	NA	NA
CH	2	3	1000	3	5	3	5000
	3	3	100	3	5	NA	NA

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This paper aims to present the work that is taking place in Eurostat in the recent years to ensure high quality, coherent, and comparable national and regional accounts data. We wish to thank the country national statistical authorities that contribute to the national quality reporting exercise throughout the year. We acknowledge the high degree of collaboration and coordination between the NSIs and the National Central Banks to provide coherent national macroeconomic statistics in the framework of the revision works. We would also like to acknowledge the support of the different units within Eurostat to the common goal for quality statistical data. Finally, we would like to thank John Verrinder for reviewing the draft paper.

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