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Improving the measurement of employment in national accounts – Recommendations and good practices

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Abbreviations

AS	Administrative Sources
BS	Business Survey
EFTA	European Free Trade Association
ESA	European System of National and Regional Accounts
EU	European Union
FTE	Full-time equivalents
GDP	Gross domestic product
GNI	Gross national income
GNIC	Gross national income committee
GVA	Gross value added
IESS	Integrated European Social Statistics
ILO	International labour organization
LCS	Labour cost survey
LFS	Labour force survey
LKAU	Local kind of activity unit
NA	National accounts
NACE	Statistical classification of economic activities (Nomenclature statistique des activités économiques dans la Communauté européenne)
NOE	Non-observed economy
NSI	National statistical institute
OECD	Organisation for Economic Cooperation and Development
OS	Other sources
SBS	Structural business survey
SR	Statistical register
STS	Short-term statistics

Executive summary

National accounts provide the main framework for describing an economy as a whole. The estimation of employment, consistent with the concepts and definitions used for the main economic aggregates (e.g. output, intermediate consumption, value added) included in the framework, allows the construction of basic indicators for the analysis of a country's economy.

The legal basis for national accounts statistics is Regulation (EU) No 549/2013([1]) on national and regional accounts in the European Union (the ESA 2010 Regulation). Chapter 11 refers explicitly to population and labour input and specifies the concepts and limits of three main employment measures: persons employed, jobs, and hours worked. Adherence to these concepts is essential to provide national accounts with auxiliary variables for the calculation of labour productivity indicators such as value added, output or labour costs per person employed and per hour worked.

This paper is the result of a project, supported by Eurostat, to collect information on sources and methods for measuring employment to exchange experiences and perspectives between countries. A main question was if significant differences in the level of average hours worked per person between the EU and EFTA countries reflect economic and social differences or may be due to different approaches to calculating the estimates and adjustments made to align with national accounts concepts.

Results were presented to national compilers at a workshop, where they were able to share their countries' experiences with different compilation practices and discuss possibilities for further improvements for the accuracy and comparability of employment estimates.

The structure of this paper is as follows:

The first chapter provides an introduction to the topic; the second chapter describes possible sources of information and estimation methods used by countries for employment measures. Chapter three analyses the adjustments needed for conceptual clarity and comprehensiveness. Chapter four suggests some validation checks that countries could perform to improve the quality of employment estimates. Chapter five presents the main conclusions.

At the end of each chapter, a set of recommendations based on the analysis of the survey results is presented. These are intended to provide guidance on the use of data sources and estimation

([1]) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R0549; recently amended by Regulation (EU) 2023/734

methods, on the necessary adjustments and on specific issues based on the analysis of data by industries (according to the Statistical Classification of Economic Activities of the European Community NACE Rev. 2).

The aim of this paper is to document good practices in the compilation of employment estimates, as well as recommendations on adjustments, data analysis and checks that can be useful to obtain employment data of good and sufficient quality. The target audience is e.g. new staff in national institutes or Eurostat as well as users interested in information on employment estimates.

Acknowledgements: We would like to particularly thank colleagues from the statistical offices of Czechia, Spain, the Netherlands and Finland for providing practical examples.

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1 Introduction

Estimates of employment play a central role in national accounts, providing information for policy decisions. In particular, employment levels are key indicators in an economy and help to understand how many people are employed in different sectors in order to assess economic performance, potential growth and productivity levels. The importance of estimating employment in national accounts stems from the need to provide auxiliary variables that allow the construction of indicators of economic performance on the basis of labour input. Employment measures are defined in accordance with ESA2010, using coherent concepts, the same boundaries and classifications. As for the other national accounts aggregates, the estimation of employment should result from the integration of information from different sources.

To measure the amount of labour underlying GDP and income, ESA2010 provides three measures of employment: persons employed, jobs and hours worked. Employed persons refer to all persons engaged in a productive activity that falls within the production boundary of the national accounts. ESA2010 distinguishes between two concepts depending on the geographical coverage: resident persons in employment (i.e. the national scope of employment) and employment in resident production units irrespective of the place of residence of the employed person (i.e. the domestic scope, see §§ 11.17-11.18 and 11.24).

The number of jobs is the sum of all jobs in the economy, both main and secondary, held by persons employed, excluding persons temporarily not at work but who have a formal attachment to their job (see §§ 11.22 and 11.23). The amount of hours worked is the sum of hours actually worked in all jobs. A detailed description of what to include and what to exclude in the estimation of hours worked is given in ESA2010 (see § 11.27-11.31).

In general, the number of hours worked is the preferred measure as it better captures industry-specific features such as part-time employment and secondary activities. This measure represents the actual contribution of labour to the production of goods and services.

All these measures should refer to the production boundaries of national accounts being exhaustive, i.e. including work performed in the non-observed economy. The non-observed economy refers to illegal activities, informal activities and legal activities deliberately concealed

from public authorities ('underground economy') (SNA93, § 6.30-6.36). It also includes activities that are not covered because of inefficiencies in the statistical system (for example, failure to update statistical registers of employment), or because of non-response to surveys([2]).

Employment estimates should be comparable, reliable and exhaustive. These three aspects form the core of the recommendations on good practice for the accurate compilation of employment data. Comparability should be ensured by complying with the relevant EU regulations, including ESA2010 and those on the use of data sources.

Reliability should be verified through plausibility and consistency checks, which indicate that employment estimates reflect economic reality and are consistent with other variables such as output and compensation of employees (i.e. wages, salaries and social contributions).

Exhaustiveness requires the best combination of sources and methods for making adjustments (where relevant and applicable) to cover the non-observed part of the economy. Regardless of the origin of the exhaustiveness adjustments, it is necessary to achieve and verify the consistency of the adjusted data across all relevant aggregates.

When national accounts provide such estimates of the input of labour, indicators can be calculated and used for international comparisons and economic analyses. At the international level, economic aggregates can be compared if the employment figures provided by countries correspond to the same definitions and are consistent with the definitions of the related economic aggregates. In addition, estimates of the input of labour are important variables for economic analysis. The input of labour is the variable used in the construction of performance indicators (productivity of labour in terms of value added or production); it allows the construction of indicators of labour or the intensity of capital.

Given the importance of these estimates, the measurement of employment in the context of national accounts has been widely studied in recent years.

In 2018, Eurostat and the OECD conducted a survey on the methodologies([3]) adopted by countries for the estimation of labour input, which the OECD further analysed([4]). In December 2021, Eurostat disseminated a set of productivity indicators allowing the analysis of employment measures provided by countries in the context of the national accounts transmission programme([5]). Further work on the employment method is being carried out in the GNI context. The group presented its final report to the GNI expert group in November 2023([6]). The objective was to identify good practices and to develop practical guidance on some open issues concerning the application of the employment method (based on the integration between LFS and business statistics).

This paper is the result of Eurostat's latest initiative to examine labour input estimates. To this end, Eurostat launched a questionnaire. The aim of this project was to analyse the estimation methods used by countries to calculate employment data for national accounts and the comparability of these estimates and related measures.

([2]) For a comprehensive description of the concepts and methods used to measure the non-observed economy, see OECD (2002).
([3]) https://ec.europa.eu/eurostat/documents/24987/9131938/CY+Questionnaire.pdf/f08df276-05d8-47ab-a9f0-c0e1aba029e2.
([4]) https://one.oecd.org/document/SDD/DOC(2018)12/En/pdf.
([5]) https://ec.europa.eu/eurostat/web/national-accounts/methodology/european-accounts/productivity-indicators.
([6]) Eurostat (2024). The application of the employment method for the exhaustiveness of GDP estimates. Practical guidelines for enhanced comparability between countries'. (Paper in preparation)

BOX 1: EUROSTAT QUESTIONNAIRE ON LABOUR INPUT

In 2022 Eurostat started the project 'Supporting improvements in the compilation of employment data'. One of the first tasks was to analyse and compare countries' data and metadata on employment in national accounts, taking into account data expressed in number of persons and hours worked; available information on national compilation practices; adjustments to obtain national accounts estimates from the respective data sources.

To this end, the Eurostat 2023 questionnaire on the methodology underlying labour input data in national accounts (hereafter referred to as the '2023 Eurostat questionnaire on labour input') was launched in January 2023 with the aim of collecting the missing information needed to better understand the underlying methodology, including the sources used and any adjustments made by countries. In addition, the questionnaire was designed to cover recent challenges faced by national compilers, e.g. the impact of changes in LFS data collection, adjustments related to COVID-19 and the impact of the population census on employment estimates.

The questionnaire was divided into four parts:

- The first part primarily addressed the opportunity to obtain an assessment of the different data sources as an accurate tool for measuring employment, based on the experiences of the countries. This included a description of the advantages and disadvantages of each data source.
- The second part was an extension of the first part, asking for additional details on how national accounts estimates of employment in persons and hours worked are derived from the source data.
- The third part aimed at collecting information on the estimation method and on recent/planned changes.
- The last part covered information on recent challenges and clarifications on data collection and compilation procedures.

The questionnaire was completed by almost all EU Member States (except Bulgaria), as well as Norway and Switzerland.

The survey results indicate variations in the approaches adopted by countries, largely depending on the sources available. Areas for improvement have been identified and are presented in the document. Broadening the range of sources used for estimation is identified as a primary objective to be considered by some countries. In addition, improving adjustments from primary statistics to national accounts concepts is crucial. The paper also addresses the scope for presenting best practices and recommendations for refining both the methods and the quality of the estimates produced.

2

Data sources and estimation methods

Employment is a phenomenon for which a variety of sources of information are available, ranging from statistical surveys and registers to administrative archives. While these sources are valuable for the collection of employment data, they are not specifically designed to produce national accounts estimates of employment.

Statistical sources are generally standardised at European level with regulations defining concepts and coverage; other sources are country-specific and need to be assessed to determine their optimal use for national accounts estimation purposes. Countries may implement different estimation approaches using one or more sources, adjusting, and combining them to produce a measure of employment consistent with national accounts concepts. National accounts require a specific set of criteria and definitions that may not be consistent with those used in other sources of employment data. This requires national accounts compilers to have a thorough and deep understanding of the characteristics of each available source of information to examine and assess its usefulness for national accounts estimates of employment and to determine its usage.

2.1 Data sources

Definitions of employment in household and business surveys as well as in administrative sources rarely correspond exactly to ESA2010 requirements. There are differences in the coverage of both reference populations and economic activities. Household surveys and administrative sources cover persons resident in the country, which represents national employment. These sources are not fully suitable for measuring domestic employment, which is needed in national accounts to align with the main economic aggregates. Two main examples of adjustments that apply in particular to Labour Force Survey are the following:

a) residents working for non-resident producer units (included in these sources but not included in domestic employment as defined in the ESA);

b) non-residents working with resident producer units (not included in these sources but included in domestic employment as defined in the ESA).

National accounts integrate information from many sources. All available sources should be explored and assessed in terms of their strengths and weaknesses. Based on this evaluation, decisions can be made regarding their use and the optimal method of integration. Each source may shed light on a particular part of the economy/employment, therefore, information from multiple sources can be combined to provide the most complete and consistent estimate. As a consequence of this approach, each individual basic source may yield results that differ from the integrated national accounts estimates.

The questionnaire aimed to collect information on whether all available data sources were explored for possible use in compiling employment estimates. Upon screening the provided answers, it appears that countries have explored and assessed one or more sources before using them. In some cases, sources were explored and assessed but not used in the compilation process. Table 1 provides an overview of the different sources used and/or assessed.

Table 1

Data sources (employment in persons)

	LFS	Business surveys	Statistical registers	Administrative source	Other
BE	Used			Used	
BG					
CZ	Used	Used	Explored	Used	
DK	Used		Used	Used	
DE	Used		Used	Used	Used
EE	Used	Assessed		Used	
IE	Used			Assessed	
EL	Used	Used	Used	Used	
ES	Used	Used	Used	Used	Used
FR	Used	Used	Used	Used	Used
HR	Used				Used
IT	Used	Used	Used	Used	Used
CY	Used	Used		Used	Used
LV	Used	Used			Explored
LT	Used	Assessed	Assessed	Used	Assessed
LU	Assessed			Used	
HU	Used	Used	Used	Used	Used
MT	Used	Used	Used	Used	
NL	Used	Explored	Used	Used	
AT	Used	Used	Used	Used	Used
PL	Used	Used		Explored	
PT	Used	Used		Used	
RO	Used			Used	

	LFS	Business surveys	Statistical registers	Administrative source	Other
SI	Assessed	Explored	Used	Used	Assessed
SK	Used	Used	Used	Used	
FI	Used		Used	Used	Used
SE	Used	Used		Used	

A brief overview of the main sources and their advantages and disadvantages in the use of employment estimates in national accounts is provided in the following sections.

2.1.1 Labour Force Surveys

The Labour Force Survey (LFS) aims to measure the main aggregates of labour supply, including employed and unemployed persons. The survey is addressed to households and asks them to report on their occupational status and, if they are in employment, on their main and secondary jobs. It collects information on various aspects including position, economic sector, hours worked and absence from work. The survey is harmonised at European level and consistent with international standards defined by the ILO. Regulation (EU) 2019/1700([7]) of the European Parliament and of the Council, which has been in force since 1 January 2021, establishes a common framework for European statistics relating to persons and households.

The reference population consists of all individuals aged 15 years and older, living in de facto households, defined as a group of people who usually live together, whether or not they are related to other members of the private household, and who share household income or expenses with other household members.

Other forms of collective housing are excluded from the survey: members who permanently live together, including hospices, children's homes, religious institutes, barracks, etc., are excluded from the reference population.

The data on persons employed collected in the LFS are the most widely used for the estimation of national accounts on employment. They are the basis for the estimation of persons employed according to the national concept. Adjustments described in ESA2010 §11.17-11.18 are necessary to derive the measure of persons employed according to the domestic concept, which is the underlying measure for the main economic aggregates estimated by national accounts.

The LFS is specifically designed to cover employment and is therefore a good source for the estimation of national accounts employment. Some problems may be related to its sample nature and the survey techniques. Household members responding to the questionnaire may omit information on employment, whether intentionally or not, and this may affect the result. Similarly, data on hours worked may be affected by memory failures, e.g. respondents may report contractual hours or habitual hours worked instead of those actually worked during the reference week. Another weakness of the survey relates to the classification by NACE, which can be difficult to reconcile with the concept of the local kind-of-activity unit (LKAU) used in national

([7]) https://op.europa.eu/en/publication-detail/-/publication/9c53922a-eed8-11e9-a32c-01aa75ed71a1#:~:text=EU%20law-Regulation%20(EU)%202019%2F1700%20of%20the%20European%20Parliament%20and,(EC)%20No%201338%2F2008, amending Regulations (EC) No 808/2004, (EC) No 452/2008 and (EC) No 1338/2008 of the European Parliament and of the Council, and repealing Regulation (EC) No 1177/2003 of the European Parliament and of the Council and Council Regulation (EC) No 577/98 (Text with EEA relevance).

accounts. The LFS has received the second-best evaluation score by countries as an accurate tool for measuring both persons and hours worked.

2.1.2 Business surveys

European Regulation (EU) 2152/2019([8]) constitutes the legal basis for the collection of structural business statistics (SBS) data. In general, EU countries fulfil the requirements of the Regulation through surveys on enterprises.

The SBS covers the economic activities of market producers within the business economy (NACE Rev.2 Sections B to N, P to R and Divisions S95 and S96).

Jobs and hours worked in the enterprise are among the variables collected in the SBS surveys. The survey is therefore a source for the estimation of employment in national accounts. The advantage of using such a source lies in the accuracy of the NACE classification allowing to estimate the total amount of jobs engaged in each NACE category. Nevertheless, the survey does not provide any information allowing to distinguish between primary and secondary jobs. An example on how secondary jobs can be estimated from SBS, implies the use of other sources to be compared with: in particular secondary jobs can be indirectly measured comparing, by NACE, the total amount of jobs from SBS with data on persons employed from LFS, obtaining the estimate as the difference between the two sources. .

On the other hand, some critical aspects may relate to data on hours worked, as employers may be inclined to report hours paid instead of hours actually worked. In order to avoid this, specific attention has to be paid to this issue and methodologies can be developed in order to correct the data. For example, in Spain, since 2016, the SBS has used a new method for estimating hours by applying auxiliary information from the Quarterly Labour Cost Survey to each Legal Unit in the SBS sample.

In general, such data from survey reports refer to employment that is regularly registered on the payroll. However, this source is inadequate for measuring undeclared employment, which requires adjustments for the non-observed economy (hereafter NOE) for the purpose of national accounts estimates.

For employment in hours worked, business surveys received the best evaluation scores from the countries. For employment in persons, it received a relatively lower evaluation score because it covers jobs and not persons.

2.1.3 Statistical registers

At European level, registers are increasingly being developed by the NSIs. They rely on the use of administrative archives, which result from statistical processes aimed at

- harmonisation with concepts and definitions set by statistics;
- integration of different sources of information (both administrative and statistical).

The EBS regulation (Regulation (EU) 2019/2152), repealing the 2008 Business Register

([8]) https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32019R2152

Regulation (Regulation (EU) 177/2008([9])), refers to the inclusion of data on employees and the self-employed. The register should be updated annually, as recommended and provides very detailed and exhaustive data on registered employment according to harmonized rules at European level. No information is provided on informal, underground and illegal jobs. Although households as employers are not excluded from the scope of business registers, units/persons classified in NACE Division 97 are generally outside the scope of business surveys.

Further work is ongoing in the NSIs to implement population registers, including data on employment.

The statistical registers provide a reliable NACE breakdown, good and exhaustive coverage and accurate data on jobs and persons. However, data on hours worked are either less reliable or not available. In addition, statistical registers may sometimes contain only partial and not up-to-date information.

For employment in persons, statistical registers are considered to be ‘quite accurate’, while for employment in hours worked they are rated by countries as ‘moderately accurate’ sources for this measure.

2.1.4 Administrative sources

Administrative sources appear to be a good source for many countries. Such sources may cover all employment or specific segments. In both cases they can provide useful information. However, conceptual adjustments need to be made and/or difficulties with classification correspondences need to be overcome.

The administrative set of archives available for statistical use varies among countries, depending on social security and fiscal rules. The NSIs are developing procedures for the progressive use of these kinds of sources, which generally feed statistical registers. Notwithstanding this, some administrative archives may still not be integrated into registers and may then be available for statistical use for the estimation of employment.

The advantages of using administrative sources lie in their complete coverage of the employment segment in question, which allows them to capture marginal jobs and to produce data at a very detailed level. The disadvantage of using this type of source is the lack of timeliness, as administrative sources are often available at t+2 years.

It is worth noting that administrative sources only cover employment declared to the national authorities therefore do not cover informal, underground and illegal jobs.

The use of administrative sources requires statistical treatment that corresponds to the concepts, definitions and classifications used in statistics. For example, administrative sources could provide data on hours paid instead of hours worked.

Their availability is strictly linked to national legislation on the matter and privacy requirements should be taken into account.

For employment in persons, administrative sources have been given the best evaluation scores by countries. For employment in hours worked, these sources are considered by countries as

([9]) No longer in force, expiry date: 31/12/2020; repealed by 32019R2152, the new legal acts on European business statistics (Regulation (EU) 2019/2152 and Commission Implementing Regulation (EU) 2020/1197).

'moderately accurate' sources for this measure.

2.1.5 Other sources

Countries may have access to additional employment sources, both statistical and administrative. Their evaluation and use should be assessed in order to provide estimates that are as accurate as possible.

These other sources are considered by countries to be 'moderately accurate' sources for measuring both persons and hours worked. The following sources were mentioned by respondents:

- Business Reports,
- Social Balance Sheets,
- Demographic and social statistics,
- Population Census,
- Employment and Job Vacancy Survey,
- Agricultural Census,
- Registers of Public Servants,
- etc.

BOX 2: CHALLENGES DUE TO CHANGES IN DATA SOURCES

National accounts compilers often face challenges in data compilation, such as changes in the underlying data sources or events that have an impact on the final figures and may cause breaks in the series. These disruptions in time series should be prevented and addressed by national accountants during the compilation process.

In recent years, the main events faced by all EU NSIs have been changes in the LFS for the implementation of the new IESS regulation and COVID-19, which have affected data collection and the recording of absences and hours worked. While COVID-19 and the evolution of the pandemic created uncertainty and put pressure on statisticians to produce timely and disaggregated statistics, Regulation 2019/1700 (IESS Framework Regulation) on establishing a common framework for European statistics relating to persons and households, based on data at individual level collected from samples, entered into force at the beginning of 2021.

In general, any change in the data, which may relate to data collection, target population, changes in definitions, estimation method etc., should be assessed and neutralized together with its impact on the final output in order not to introduce breaks in the series. In national accounts, the continuity of time series should be maintained and any kind of methodological changes should preferably be introduced only in the benchmark revision.

The information collected through the questionnaire helped to understand how data compilers have addressed these issues, the sources used and any adjustments made by countries to cover these recent challenges, as well as the impact of the population census on employment estimates.

The impact of changes in LFS data collection

The IESS Framework Regulation introduced a list of new variables to be transmitted to Eurostat. This information has been assessed, in particular by those countries using the LFS as their main data source. The main changes relate to stricter rules on target population, temporal references and data collection mode, as well as the introduction of more objective criteria for data collection.

All countries using the LFS as the main source have assessed the impact of the changes introduced by the IESS Regulation. Few issues affecting national accounts employment estimates were signalled, in particular issues related to the definition of the target population. Overall, most of the countries that reported some impact on employment consider the impact to be insignificant and no significant difference in estimates was found.

The impact of the Population Census on employment estimates

Regarding the Population Census, countries were asked to indicate to what extent they expected the population census to affect employment data and why. Very few countries expected the population census to affect employment data. In fact, many countries have not yet assessed the possible impact of the population census on employment estimates. For those countries using the LFS, it is advisable to assess the possible impact of the population census on employment estimates. Consistency checks between national accounts estimates and census employment estimates should also be considered.

2.1.6 Assessment of sources

The results of the questionnaire provided evidence for the assessment of the sources highlighted in the following section.

The LFS is considered reliable for both measures (persons, hours worked), which means that countries consider this source to be ‘quite accurate’ in both cases. The use of LFS data in combination with the other ‘quite accurate’ sources (as main or secondary sources) can maximise the accuracy of the method used. For persons, this applies to administrative sources and/or statistical registers, while for hours worked it applies to business surveys.

The LFS provides reliable estimates for the total economy along with disaggregated detailed data. It suffers mainly from reduced accuracy at the detailed NACE level, sample size issues and non-response.

Based on the findings of the questionnaire, countries state that the business surveys do not supply a complete coverage of employment as defined by national accounts but provide a reliable NACE breakdown and compliance with the domestic concept. In cases where data on hours worked is available, it is usually reliable for use.

The statistical registers provide an accurate NACE breakdown, good and exhaustive coverage and reliable data on persons and jobs. However, data on hours worked are either less reliable or not available. In addition, the SR may sometimes contain only partial and not up-to-date information.

Administrative sources appear to be a good source for many countries, mainly due to their good coverage and NACE breakdown. However, data on hours worked are either less reliable or not

available. In addition, there is apparently a need to make conceptual adjustments and/or overcome difficulties with classification correspondences.

It can be concluded that the combined use of sources (either as main or secondary sources) can exploit the strengths of each source in such a way that the accuracy of the overall method is maximised to the extent possible given the specific circumstances in each country.

Identifying the advantages and disadvantages of the different data sources for employment estimates is crucial when deciding whether and how to use a particular source. Whatever the decision for each country, the approach taken should aim at maximising the benefits that can be obtained from each individual data source, especially in cases where these sources are used in a combined way.

The table below shows the main advantages and disadvantages of the use of the sources described above by country, as derived from the questionnaire.

Table 2

Data sources: advantages and disadvantages

Data sources	Advantages	Disadvantages
Labour Force Surveys (LFS)	Reliable for the total economy Data richness and level of detail (main & secondary activities, hours worked, self-employed) Data timeliness & frequency, rich temporal reference. Good conceptual alignment with requirements	Not sufficiently accurate at detailed NACE level Sampling errors, sample size limitations, non-response Not aligned with domestic concept Conceptual adjustments needed
Business Surveys (BS)	Reliable NACE breakdown Use of domestic concept Hours worked: available & reliable for use	Non-exhaustive coverage Hours worked: not available or not usable
Statistical Registers (SR)	Good NACE breakdown Good coverage & exhaustive Reliable for persons	Hours worked: not reliable or not available Partial & not up-to-date information
Administrative Sources (AS)	Good coverage & exhaustive for specific domains Good alternative as a secondary source Good NACE breakdown Use of domestic concept	Hours worked: not reliable or not available Conceptual adjustments needed Overcoming difficulties in classification correspondence: time consuming
Other Sources (OS)	Additional data on specific domains Good mainly for comparison or as a supplementary source	Data source is too specific; cannot serve a broader use

2.2 Estimation methods

ESA2010 defines the concepts and classifications to be adopted when compiling data on employment. EU countries have the freedom to develop and select methodologies and approaches for estimating national accounts aggregates, including employment. These choices primarily depend on the availability and reliability of information sources, aiming to produce more accurate estimates.

The survey conducted in the framework of this project allowed an examination of the sources available and the approaches used by countries to estimate employment. The survey focused on the general approach and on some specific aspects of the estimation process which appeared relevant in order to evaluate the comparability of the estimates across countries, their correct classification by NACE categories and their completeness and exhaustiveness. In particular, questions were asked on issues such as the estimation of secondary jobs, the classification by LKAUs, adjustments for coverage and the Non-observed economy (NOE). General aspects were also examined, such as the relationship between methodologies for the calculation of current and benchmark estimates, provisional and definitive estimates, annual and quarterly estimates. Questions were also asked about planned or recent changes in the methodology used.

The survey revealed that:

- Nearly all countries employ the same estimation method for both benchmark and current years.
- In most instances, the estimation methodology remains unchanged from provisional to definitive estimates. When differences do arise, provisional estimates are typically derived from less detailed sources or computed using indicators of levels or growth rates.
- Over half of the countries generate annual data to serve as a benchmark for quarterly estimates, while the remainder derive annual figures from quarterly data. Countries that compute annual estimates from quarterly data more often use the same estimation method for both provisional and definitive estimates. Conversely, the opposite is true in countries where annual data serve as the benchmark.

Methods are frequently updated and revised, primarily upon the availability of new data sources or information, especially administrative data. However, efforts are also made to improve exhaustiveness. Generally, revisions of methods are performed during benchmark revisions to preserve the continuity of time series.

An evaluation of the strengths and weaknesses of the applied methods was conducted, focusing on specific aspects of the methodologies. The assessment revealed some critical issues related to the completeness, classification, and exhaustiveness of the estimates. The responses to the questionnaire indicated some possible areas for improvement in some countries where the assessment of sources seems inadequately performed. Not all countries estimate secondary jobs, which may mean that hours worked in secondary jobs are not estimated or, if estimated, could be wrongly attributed to the NACE in which persons are providing their main jobs, thus impacting the estimation of the amount of hours worked by industry. In some countries, not all the adjustments required to comply with ESA requirements are performed, e.g., with respect to coverage, to the measurement of NOE, and to the adoption of the domestic concept of employment (in a few cases, for example, the national accounts employment equals that of LFS).

Efforts should be made to enhance the quality of the estimates concerning these aspects. A set of indicators could be compiled to verify the consistency of the employment estimates with other national accounts aggregates. The consistency checks that countries may conduct are discussed in detail in Chapter 4.

2.2.1 Main and secondary sources

Many sources provide information on employment, each adopting specific definitions and covering different segments of the reference population. The estimate of labour input should be derived from the comparison and integration of all this information, considering that each source can serve as a reliable basis for estimating different measures of employment or specific segments thereof. For example, the LFS is the most frequently used source for estimating the number of persons employed, but adjustments should be made to adopt the domestic concept, account for the non-observed economy, and properly classify employment by NACE of the LKAU.

The analysis of the questionnaires confirmed that countries extensively utilize different sources for estimating employment, as illustrated in the tables below.

Table 3

Main and secondary sources by NACE groups (employment in persons)

			LFS	Business survey	Statistical registers	Administrative sources	Other
Employees	NACE A	main	HR, CZ, EE, HU, IE, IT, LT, PL, PT, RO, ES, SE, CH	PT, SK,	DK, DE, IT, NO, SI, EL	AT, BE, CY, DK, FR, DE, LU, NL, PT, ES	CY, FI
		secondary	CY, SK, EL	CZ, HU, LT, PL, SE, SI	CH	EE, HU, IT, LT, RO, SK, CH	AT, BE, HR, HU, IT, PT
	NACE B-S	main	HR, CZ, EE, HU, IE, IT, LT, PL, PT, RO, SE	AT, CY, PT, ES, SK, CH, EL	DK, FI, DE, IT, NO, SI, EL	AT, BE, CY, DK, FI, FR, DE, LU, NL, PT	CY
		secondary	CY, SK, EL	CZ, HU, IT, LT, PL, SI, SE	LT	EE, HU, LT, RO, SK, ES, EL	AT, HR, HU, IT, LT, SI
	NACE T	main	CZ, HR, EE, HU, IE, PL, PT, ES, SE, CH, EL	CY	DK, FI, DE, SI,	AT, BE, DK, FR, IT, LU, NL, ES	CY, FI, IT, SK
		secondary	CY, IT	CZ, HU, PL	NO, CH	CY, EE, HU, PT, CH	BE, HR, HU, SI,
Self employed	NACE A	main	AT, CZ, HR, EE, PL, DE, IE, IT, LT, PT, RO, SK, SI, ES, SE, CH	PT	DK, HU, IT, NO, SK, CH, EL	AT, CY, DK, FR, IT, LU, NL, ES	BE, CY, FI
		secondary	CY, HU, EL	CZ, CY	SK, SI, CH	EE, LT, PT, SK, SI, SE, CH	HR, HU, IT, PT
	NACE B-S	main	AT, CZ, HR, EE, FI, DE, IE, IT, LT, PL, PT, RO, SE, SK	CY, PT, ES, CH, EL	DK, FI, HU, IT, NO, EL	AT, CY, DK, FR, LU, NL, SI, BE	CY
		secondary	CY, HU, EL	AT, CZ, IT	SK	DE, LT, PT, SK, SE, EL	HR, HU, IT, SI
	NACE T	main	HR, CZ, EE, DE, IE, LT, PL, PT, ES, SE, CH, EL	CY	DK, HU	AT, DK, FR, LU, NL, ES	CY
		secondary	CY, HU	CZ,	No, CH	CY, EE, SE, CH	HR, HU

Table 4

Main and secondary sources by NACE groups (employment in hours)

			LFS*	Business survey	Statistical registers	Administrative sources	Other
Employees	NACE A	Main	AT, HR, EE, IE, FI, IT, LT, MT, PL, PT, RO, ES, SE, CH	PT, SK FR, CZ, HU,	IT, NO	BE, CY, EE, FR NL, MT	CY, FI, SI, AT
		secondary	CY, NL, FR, CZ, HU	CY, PL,	CH	EE	PT, NL FR, HR
	NACE B-S	main	AT, HR, EE, IE, IT, LT, MT, PL, PT, RO, SE	CY, CZ, PT,ES, FR, HU, MT, SK CH	FI, IT, NO	CY, NL, FR, BE MT FI	CY, SI, AT
		secondary	CY, NL, FR, CZ, HU, FI, SK	IT, PL, SE	PT, MT	EE, IT, SK	HR, FR, HR
	NACE T	main	AT, HR, EE, IE, IT, LT, PL, PT, ES, SE, CH,	CY, CZ, HU, SK	FI,	NL, FR, BE	CY, SI, IT, AT
		secondary	CY, NL, CZ, HU, FI	PL	CH	CY, EE, CH	HR, NL, FR,
Self employed	NACE A	main	IT, EE, PT, NL, PL, RO, HR, CZ, WE, HU, SK, CH, MT, IE, LT, AT	ES	IT, NO	CY, IT, MT	CY, SI, AT, FI
		secondary	CY, ES, FR, SI,	CZ, CY	CH	EE, FR, CH	HR, HU, IT, PT
	NACE B-S	main	IT, EE, PT, NL, PL, RO, HR, CZ, SE, HU, SK, MT, IE, LT, AT	CY, CH, ES, MT	IT, NO, MT, FI	CY, MT	CY, SI, AT
		secondary	CY, ES, FR, SI, FI,	CZ		EE, FR	HR, IT
	NACE T	main	IT, EE, PT, NL, PL, HR, CZ, SE, HU, CH, IE, LT	CY, ES		CY, EE, FR, CH	CY, SI, AT
		secondary	CY, ES, FR, SI	PT	CH	CY, EE, SE, CH	HR

*Greece indicated that they used the source but did not spec-ify whether it was used as the main or secondary source

2.2.2 Multiple and combined data sources

Utilizing a combination of several data sources can be the optimal approach to maximise the benefits obtained from each. Two distinct strategies can be employed to leverage the variety of information available. Firstly, the strategy might involve identifying the main source and using other sources as auxiliary, complementing specific segments or adjustments. According to the questionnaire results, while the main sources generally cover all NACE Sections, some countries opt for different sources depending on the specific NACE sections they aim to cover. For example, in more than one instance, the LFS is used for estimating persons employed only in NACE Sections A and T, whereas the estimate for NACE B-S relies on business surveys. Secondly, when more than one source is deemed reliable, they can be jointly used, developing statistical procedures for their integration.

Countries adopt both methodologies, although for estimating hours worked, several still rely on a single source of information.

2.2.3 Estimation approach for Hours worked

In the survey, countries' responses indicated that the methodologies used to estimate hours worked can mainly be categorized into three distinct approaches. Only two countries specified that they employ an 'other' type of approach, distinct from the three types identified.

In many of the countries, the predominant approach is based on grossing up an average value and, in particular, the average hours worked per person or per job, multiplied by the respective number of persons or jobs. The table below clearly shows that the most used approach is based on average hours worked per person employed.

Table 5

Approach used to estimate hours worked

Jobs x average hours worked per job	Persons x average hours worked per person	Total amount of hours worked	Other (specify)
AT	BE	EE	CZ
DK	HR	FI	FR
IE	CY	NO	
IT	DE	RO	
NL	HU	SK	
PT	LV	SE	
ES	LT	CH	
MT	LU		
	EL		
	PL		
	SI		
8	**11**	**7**	**2**

All the identified approaches can have advantages and disadvantages that are mainly associated with the sources used. All sources available should be explored and assessed in terms of their strengths and weaknesses concerning consistency with definition and coverage, at total economy level and by industry as well (see Chapter 2).

Some general considerations can be made by looking at the three approaches. When using the approach based on persons, it must be considered that the accuracy of estimating hours worked at the industry level could be hampered by the fact that persons employed should be classified where they perform their main activity, while hours worked must be registered according to the activity where they are actually employed in the production process. This means that employees engaged in more than one job are considered only in the main job and economic activity.

On the other hand, jobs include secondary jobs (or even more) where the same person can be engaged (ESA 2010 § 11.23). When primary and secondary jobs are estimated, a more accurate distribution of hours worked by industries can be achieved, improving the quality of labour productivity indicators based on hours worked, in particular at industry level.

In some countries, hours worked are estimated using direct information on the total amount of hours as reported in surveys or administrative data. When estimating directly from the sources the total amount of hours worked, attention should be paid to the coverage of the sources, considering the production boundary as it is defined in national account main economic aggregates.

BOX 3: PRACTICAL GUIDANCE: FINLAND

Estimation of full-time equivalents and hours worked by employees

This example will briefly outline how the data used in Finland to compile annual national accounts' hours worked by employees (E22) figures are formed. National accounts use the data from the Business Register([10]) to compile hours worked in annual accounts. Hours worked of an enterprise are obtained in the Business Register either from the Labour cost index([11]) or via an estimation method. The Labour Cost Index is a sample-based query, and data from it are prioritized. The estimation of hours worked is based on full-time equivalents (FTE) that are estimated through wages and salaries paid.

Wages and salaries paid are obtained from the Incomes Register([12]). The Incomes Register is a Tax Administration's electronic database, in which income payers report data separately for each individual and payment transaction. The data is reported using several different income types([13]), which indicate what kind of an income is in question. Income types that are counted as wage are defined based on ESA manual (**ESA income**). For the FTE estimation, the income types that are considered time-bound are specified (*101 Total wages, 201 Time-rate pay, 220 Commission and 227 Contract pay*) and in the estimation it is called **time-bound income**. The time-bound income is the primary income used in FTE estimation, but if it is not available then the ESA income is used.

The first step in FTE-estimation is determining the wage that an individual would receive if the employment relationship was full-time – **full-time income**. Full-time income is determined in

([10]) https://www.stat.fi/tup/yritysrekisteri/index_en.html
([11]) https://stat.fi/en/statistics/tvki
([12]) https://www.vero.fi/en/incomes-register/about-us/
([13]) https://www.vero.fi/en/incomes-register/companies-and-organisations/employers/earnings-payment-data/wage-income-types/

four steps:

1. For a full-time employee, full-time income is obtained directly from the Incomes Register.
   - Details related to employment relationship are voluntary in the Incomes Register.
2. *Full-time income* is based on Structure of earnings[14] statistics, if possible.
3. *Full-time income* is based on information from previous employment relationships.
4. Estimating *full-time income* based on employee information
   - Classification of Occupations, sector, age-group, etc.

After determining the full-time income, the FTE is calculated:

Full-time equivalent FTE = Income earned / Full-time income.

For a single employment relationship, the maximum FTE is set as 1. If the calculated FTE is between 0,9 and 1, it is rounded to 1. FTE is increased with income types that refer to working overtime *(212 Extra work premium, 235 Overtime Compensation*). For those individuals that have multiple employment relationships, the maximum FTE is set at 1,5. FTE is adjusted for all employment relationships, so there is no classification into primary and secondary jobs. (For multi-establishment enterprises, there is a yearly inquiry on FTE, and the data from this inquiry is prioritized.

After compiling the FTE, the hours worked are generated:

Hours worked = (Days of the month / 7) * Average weekly working hours * FTE

Average weekly working hours are compiled from the Labour Force Survey([15]) at the sector-industry level (three sectors and A*20 industrial level).

The data on FTE and hours worked is estimated with monthly level data and is then derived to annual level. If the information from the inquiry for a ulti-establishment enterprise is missing, the estimated data will be derived to the establishment (local kind of activity unit LKAU) level.

2.3 Recommendations on the use of data sources and estimation methods

Recommendation 1: All available data sources for compiling employment estimates in national accounts should be explored and assessed in terms of their strengths and weaknesses before they are used in national accounts. A **combination of several data sources** can be the best approach to maximise the benefits obtained from each individual data source.

Recommendation 2: Jobs are the link between the enterprise (institutional unit) and employed persons. Employment measured in jobs is a voluntary variable in the ESA Transmission

([14]) https://www.stat.fi/en/statistics/pra
([15]) https://www.stat.fi/en/statistics/tyti

Programme and countries are not obliged to produce estimates on secondary and total jobs. Nevertheless, when jobs are estimated, more accurate distribution of employment by industries can be produced thus improving the quality of indicators of output and value added per job by industries. Furthermore, improvements can also be obtained in the estimation of hours worked: when all the underlying jobs are measured, exhaustive estimates of hours worked can be assured and more accurate allocation of hours by industries can be obtained, thus impacting on productivity indicators. Countries are invited to develop methodologies for the estimation of secondary jobs and to improve the estimation of hours worked, in particular by industry.

Recommendation 3: Direct information on work performed in the context of illegal activities and the non-observed economy is generally not available. With respect to hours worked by unobserved and illegal workers, countries widely assume that the same amount of hours worked by registered workers can be imputed. It is recommended to investigate methods and sources to also indirectly derive information on the amount of hours worked in employment involved in illegal activities and the non-observed economy in order to produce a more plausible estimate of this amount.

Recommendation 4: The amount of hours worked in secondary jobs is less compared to those in primary jobs. Approaches to account for this may differ. Countries are recommended to ensure a plausible estimate of hours worked in secondary jobs.

3

The need for adjustments

When compiling employment data, the aim is to achieve the most accurate estimates, ensuring comparability, reliability, and exhaustiveness. As presented in the previous chapter, no single data source by itself can fully guarantee these three aspects unless certain adjustments are applied where this is relevant and necessary.

Countries have implemented a variety of different methods to include estimates of the non-observed economy in national accounts. Since no single source is specifically aimed at surveying the non-observed economy, comparison and combination of different sources of information is the basis of many countries' methods. Differences between surveys can be attributed to labour that is not directly observed. For example, household surveys may include some employment that is under-reported by enterprises in business surveys and registers. Enterprises may intentionally refrain from declaring employees who are not registered on the payroll, while employees participating in the LFS may be more inclined to report such work. Understanding respondents' behaviour across various surveys can enhance comprehension of the disparities between data sources.

3.1 Why there is a need for adjustments

National accounts integrate information from many data sources. All the available data sources in a country should be explored and assessed in terms of their strengths and weaknesses with respect to their coverage, their adaptation to the national accounts' concepts and definitions and their exhaustiveness. Depending on the data source(s) selected, it may be necessary for a country to perform certain adjustments (where relevant and applicable) in order to fit better the estimations to national accounts purposes. These adjustments could include those for improving the coverage, aligning with provisions of ESA2010, increasing exhaustiveness and generally rectifying any deficiencies that the relevant data source(s) may have.

The need for this kind of adjustments is very relevant for the data sources used by the countries in the compilation of employment data. As these data sources can differ significantly, the

adjustments needed could also differ. The adjustments could be relevant and applicable for either persons or hours worked or both measurement concepts. For persons, these could relate to (a) the correction for the coverage of economic territory and (b) the classification of employment by NACE according to the national accounts' concept of LKAU. For hours worked, the adjustments could relate to the adaptation to the national accounts' definitions and exhaustiveness of reported hours (underreporting or over-reporting of hours worked). For both persons and hours worked, all the exhaustiveness adjustments that are made in national accounts following the typology specified in the tabular approach to exhaustiveness (GNIC/050([16])) could indeed be relevant and applicable.

3.2 Persons: correcting for the coverage of economic territory

Countries should make all necessary corrective adjustments to the source data in order to achieve the coverage of the economic territory as specified by the provisions of ESA2010 (ESA §11.17-11.19). In this context, adjustments are needed (where relevant and applicable for each country) to deal with the conceptual differences arising from the geographical scope, the coverage and the recording thresholds of data sources. These corrective adjustments are mainly considered in relation to the most used source, LFS.

BOX 4: ADJUSTMENTS FOR THE COVERAGE OF THE ECONOMIC TERRITORY

Military/conscripts

LFS does not cover these forces. In countries where this issue is relevant and significant, administrative data could be explored to develop such an adjustment.

Resident workers below the age threshold

LFS results exclude persons below 15 years old from the definition of employment. Under the old LFS collections, in some countries, the exclusion boundaries were below 16 years old and/or above 75 years old. Under the new LFS collections, the age limits to be eligible for an interview are now the same for all countries (15-89 years old). National accounts do not exclude individuals from employment because of age (ESA2010 §11.19e). Although the difference is probably very small in developed economies, it should be investigated whether such an adjustment is worth making.

Other collective households not included in the data sources

LFS does not cover these households. Administrative Sources or Business Surveys could be utilised in order to make the appropriate adjustments.

Territories not covered by the data sources

The geographical coverage of data sources used for compiling employment statistics should be consistent with the economic territory of the country. Otherwise, adjustments may be needed. This difference is only relevant for countries that have overseas departments and territories. The national accounts include these overseas areas that belong to the economic

([16]) https://circabc.europa.eu/ui/group/7eb29b7b-33b0-4c9f-851b-e370277bb9e5/library/388028ed-d4dc-4a5f-8909-09128a55ca05/details

territory of the national economy, whereas the LFS does not.

Residents working outside the economic territory

LFS covers resident households. Hence, LFS provides information on the major part of the national concept. This means that LFS data should be adjusted, mainly for cross-border workers, to align with the domestic concept normally used in national accounts. For this purpose, administrative or survey data could be utilised in order to arrive at appropriate estimates and adjustments.

Non-residents working inside the economic territory

LFS does not cover non-resident households. Hence adjustments are needed. These adjustments could be estimated on the basis of relevant information that could be extracted from administrative or survey data.

Other adjustments

In addition to the adjustments specifically examined by the 2023 Eurostat survey, a few countries indicated that they apply other adjustments. These additional adjustments are mainly related to certain limitations of the data sources used in each case.

In the context of this survey countries' replies showed that the corrective adjustments to deal with the conceptual differences are mainly made for the residents employed in non-resident enterprises and the non-residents working in resident enterprises inside the economic territory. On the opposite side, the adjustments that have not been made (because these are not needed) are mainly those concerning the resident workers below the age threshold, the territories not covered by the main data source, the military/conscripts and the other collective households not covered by the country's main data source. The analysis did not reveal any significant correlation between the conceptual adjustments made and the approach used in relation to the data sources. This can be largely explained by the fact that the overwhelming majority of countries follow the approach of 'combined sources' (two or more sources are used as the main ones) or 'multiple sources' (one source is the main and the others are complementary). This confirms that the correct decision on whether to make a conceptual adjustment or not depends on the previous assessment of the coverage achieved in practice by each data source used in the country's approach. Therefore, this careful examination will clearly indicate all those cases where the adjustments are indeed relevant and applicable.

3.3 Persons: classifying employment by NACE according to the national accounts concept of LKAU

According to the questionnaire replies, the majority of the countries do not apply any adjustment in order to classify employment by NACE according to the national accounts concept of LKAU. The minority of the countries that do apply such adjustments, use different approaches in order to arrive at the desired outcome.

The predominant approach appears to be the use of fixed keys, adjustment factors and special ratios in order to establish the link between the enterprise and the establishment, either at a micro level or at a more aggregated level. The other approach used is the adoption of the NACE

structure of LKAU taken from business surveys.

The issue of classifying by NACE deserves more attention, especially when using the LFS as a data source. As the NACE code of the LFS corresponds to the establishment and not to the enterprise (or LKAU), one way to adjust for the different criteria is by linking the micro LFS data with administrative data where both NACE codes (establishment, enterprise) are available.

As this issue can contribute at a certain degree to the incomparability across countries when examining employment estimates across NACE industries, countries could work towards verifying the existence of LKAU and consequently classifying accordingly by NACE, assuring consistency with main economic aggregates (notably output, intermediate consumption and value added).

3.4 Hours worked: adapting to national accounts definitions and exhaustiveness.

Countries should make all necessary corrective adjustments to the source data in order to adapt to the national accounts' definitions as specified by the provisions of ESA2010 (ESA §11.27-11.31). In addition, exhaustiveness and measurement issues should also be addressed where relevant and applicable.

More specifically, hours worked are defined as follows:

1. hours actually worked occur in all types of jobs under varying work and compensation arrangements, paid or unpaid, and can be performed at all types of locations;
2. hours actually worked are not linked to administrative or legal concepts and therefore apply to all working persons and may occur within normal or contractual hours or as overtime;
3. statistics for hours actually worked shall include:
    a. hours actually worked during normal periods of work and directly contributing to production;
    b. paid time spent on training;
    c. time worked in addition to hours worked during normal periods of work, known as overtime. Note that overtime hours worked shall be included even if they are unpaid;
    d. time spent working on tasks such as the preparation of the workplace, repairs and maintenance, preparation and cleaning of tools, and the preparation of receipts, time sheets and reports;
    e. time spent waiting or standing-by during short-term disruptions during the workday, due to factors such as lack of work supply, breakdown of machinery, or accidents, or periods at the workplace where no work is performed but payment is guaranteed under employment contracts;
    f. time corresponding to short periods of rest during the workday, including tea and coffee breaks;
    g. on-call work arrangements. Where this occurs away from the work-place, for example at home, the time is included in hours actually worked according to the degree to which the person's non-work activities and movements are restricted;

h. hours worked by defence force personnel, including conscripts, shall be included even if they are outside the scope of a country's labour force survey;

4. statistics for hours actually worked shall exclude:
   a. hours paid for but not worked, such as paid annual leave, paid public holidays, paid sick leave, parental leave, strikes, 'short leave' for medical visits, etc., bad weather shutdowns;
   b. meal breaks;
   c. time spent on travel between home and work, although any work undertaken while commuting shall be included;
   d. education other than training.

Considering the above definition as well as the measurement concept of hours worked as it is captured by the available data sources in a country, it may be necessary for the countries to proceed to a number of adjustments.

BOX 5: ADAPTATION TO NATIONAL ACCOUNTS DEFINITIONS AND EXHAUSTIVENESS

Holidays and annual leave

Hours actually worked should not include hours paid for but not worked, such as paid annual leave and paid public holidays [ESA §11.28(4)(a)]. Appropriate adjustments should be made where necessary depending on the data sources used.

From the 2023 Eurostat survey and the questionnaire replies, a significant group of countries (but still less than half) are applying this kind of adjustment on the basis of survey (LCS, SBS, STS) and other relevant information, whereas a slight majority of the countries do not consider such adjustments as necessary because the data sources used are conceptually aligned with the ESA definition.

Sickness leave

Hours actually worked should not include hours paid for but not worked, such as paid sick leave [ESA §11.28(4)(a)]. Once again, appropriate adjustments should be made where necessary.

According to the countries' replies, a significant minority of countries are applying this kind of adjustment on the basis of surveys (LFS, LCS, SBS, STS) and other relevant information. On the contrary, the majority of the countries do not adjust due to the conceptual alignment of the data source used.

Strikes and temporary layoffs

Hours paid for but not worked such as strikes and temporary layoffs should not be included in hours actually worked [ESA §11.28(4) (a)], leading to the need for appropriate adjustments where needed.

Based on the questionnaire replies, the minority of countries are applying this kind of adjustment on the basis of survey (LCS, SBS, STS) and other relevant information, while the majority of countries consider these as unnecessary.

Unreported overtime

Hours actually worked should include the time worked in addition to hours worked during normal periods of work, known as overtime [ESA §11.28(3)(c)], regardless of whether this is reported or not.

Only few countries do such an adjustment, with the majority of the countries are considering it as unnecessary mainly due to the assumed conceptual alignment of the data sources and/or the insignificance of the possible impact.

Unpaid overtime

Hours actually worked should include the time worked in addition to hours worked during normal periods of work, known as overtime [ESA §11.28(3)(c)], even if the overtime hours worked are unpaid.

This adjustment is made through various sources and methods by the minority of countries. The majority of the countries do not do this adjustment mainly due to the assumed conceptual alignment of the data sources and/or the insignificance of the possible impact.

Under-reporting

Depending on the data sources used, specific adjustment may be needed to account for under-reporting that can be due to either measurement or exhaustiveness issues.

Only a few countries do such adjustments, whereas the overwhelming majority of the countries do not, mainly because they assume that this is unnecessary or that the impact should not be expected as significant.

Over-reporting

Depending on the data sources used, specific adjustment may also be needed to account for over-reporting that can be due to measurement issues.

The countries' replies are consistent with those given for the under-reporting issue.

Other adjustments

Very few countries indicated that they applied other adjustments.

For all the above-mentioned adjustments, there is a need for the countries to re-check carefully the measurement concept used to capture hours worked in practice by the data sources, especially in those cases where an assumption is made about the perceived conceptual alignment or the expected insignificance of the possible impact. In addition, a very small number of countries indicated that there is a possible need to make adjustments in few cases such as the sickness leave, the unreported overtime, the unpaid overtime, the under-reporting and the over-reporting.

Therefore, the careful re-check of the measurement concept of hours worked would allow the identification of any necessary adjustments for the adaptation to the national accounts' definitions.

BOX 6: PRACTICAL GUIDANCE: THE NETHERLANDS

The estimation of hours worked by Dutch employees

Introduction

For the Dutch labour accounts, hours worked are estimated by Statistics Netherlands (SN) in several different situations. Both quarterly and yearly estimates are made, via different methods, for both employees and self-employed workers, also via different methods. Only the method for yearly estimates for employees will be discussed in the following text. The quarterly estimates are extrapolations of the levels that are calculated during the yearly estimates. Furthermore, the yearly method for calculating hours worked by self-employed workers differs significantly from the yearly method for employees and relies heavily on information from the Labour Force Survey (LFS).

Main source

The main source for the yearly estimation of the amount of hours worked by Dutch employees is register data from the Dutch Agency for Employment Insurances (Dutch: UWV). This register data, which in Dutch is called the 'Polisadministratie', consists of integral administrative data of UWV and contains, on a monthly level, all jobs from employees and several characteristics of these jobs. One of these job characteristics is the amount of 'hours paid', which provides a good starting point for calculating the amount of 'hours worked'.

Additional sources and calculations

Several data sources are combined with the data on hours paid (which are the hours actually paid) from the 'Polisadministratie', to deduct the 'hours worked' by employees. In Table 1, an overview is given.

The deduction of 'hours worked' from 'hours paid' for Dutch employees for reference year 2021 (Rev.2015), excl. NACE U

TYPE OF HOURS	SIGN	HOURS (x 1mln)	SOURCE	SOURCE TYPE
paid hours		13 191.3	'Polisadministratie'	Register data
paid overtime hours	(-)	145.1	'Polisadministratie'; Estimation	Register data, estimated from overtime wages
base hours		13 046.2	-	-
base hours after correction		13 079.6	-	-
paid overtime hours	(+)	145.1	'Polisadministratie'; Estimation	Register data, estimated from overtime wages
unpaid overtime hours	(+)	84.3	LFS	Survey data on persons
vacation leave	(-)	1 282.0	Collective agreements; Legislation; Survey on holidays	Combined, meso, macro and survey data
national holidays leave	(-)	246.7	Legislation; Calendar data	Estimation
short absence leave	(-)	66.2	-	Estimation
parental leave	(-)	87.4	Reports by UWV; Population register	Combined, macro and integral register data
short time leave	(-)	119.1	Reports by UWV; LFS for COVID-years	Meso numbers, estimation
strikes	(-)	0.5	Survey on strikes	Survey data on businesses
life cycle saving schemes	(-)	6.0	Data from Dutch Central Bank	Macro numbers, estimation
weather events leave	(-)	6.8	Production survey	Survey data on businesses
sickness leave	(-)	512.8	Survey on sickness leave	Survey data on businesses
balancing correction	(+/-)	30.5 (+)	National accounts	Estimations (based on the balancing procedure for remuneration with SUT's)
hours worked		11 010.9		

The starting point ‘paid hours’ is available on a job level, monthly, for all Dutch (legal) jobs. However, many of the additional data that need to be combined with this starting point to derive the ‘hours worked’, are not available on this integral micro level. Most additional sources regard either survey data or macro/meso totals, all with their own specific characteristics. This makes micro linkage to the ‘Polisadministratie’ not an option and therefore for every additional data source a separate solution is implemented. In the remainder of this text, (only) the most significant of these additional data sources and their solutions will be discussed in depth.

Paid overtime hours

The ‘Polisadministratie’ does not contain ‘paid overtime hours’, it contains only the total amount of ‘paid hours’. However, the ‘Polisadministratie’does contain ‘paid overtime wages’. This variable is used, in combination with a calculated hourly wage per person and some additional assumptions, to estimate the amount of ‘paid overtime hours’ per person per month.

Base hours correction

A correction is made for a limited group of employers that report a monthly averaged number of paid hours (e.g. every month the number of hours is the same) instead of the actual monthly paid hours (where number of hours fluctuate with the calendar days). This correction is made after the deduction of paid overtime hours, which are subsequently added back after the correction.

Vacation leave

Information from collective agreements and general legislation is linked to the ‘Polisadministratie’. With some additional assumptions, this information is used to estimate the number of vacation hours per person per year. Macro level information from the Survey on holiday leave is subsequently used to distribute these vacation hours per person correctly over the year.

National holidays leave

Here too information from collective agreements and general legislation is linked to the ‘Polisadministratie’. With some additional assumptions, this information is used to estimate the number of national holiday hours per person per year. Calendar information on national holidays is subsequently used to distribute these holiday hours correctly over the year.

Short time leave

The Dutch amount of reduced hours worked based on short-time work (STW) schemes can be estimated on a sectoral level with a yearly social benefits report by UWV, but is usually neglectable.

However, during the COVID-19 pandemic, the usual STW scheme was temporarily replaced by the so-called NOW scheme, which entailed a labour costs subsidy for employers with revenue losses due to COVID-19. For the years 2020 and 2021, the STW variable contains an estimation of the amount of hours temporarily worked less due to COVID-19 and compensated through the NOW scheme. To estimate these figures, information from the LFS on hours worked on a meso level was combined with the ‘Polisadministratie’ and several assumptions were made.

3.5 Persons and hours worked: exhaustiveness for the coverage of national accounts

Exhaustiveness adjustments made in national accounts follow the typology specified in the tabular approach to exhaustiveness (GNIC/050).

N1 - Producer should have registered (underground producer)

N2 - Illegal producer that fails to register

N3 - Producer is not obliged to register

N4 - Registered legal person is not included in statistics

N5 - Registered entrepreneur is not included in statistics

N6 - Misreporting by the producer

N7 - Statistical deficiencies in the data

Each one of the non-exhaustiveness types (N1 to N7) is distinguished and described in table 5.

Table 6

Non-exhaustiveness types

N1	Producer should have registered (underground producer)	• Producer fails to register to avoid tax & social security obligations. These are often small producers with turnovers which exceed the thresholds above which they should register their income. • Producers that fail to register because they are involved in illegal activities fall under N2, rather than N1. • Type N1 does not include all underground activities, some are associated with type N6.
N2	Illegal producer that fails to register	• N2 covers activities of producers that avoid registration entirely. • N2 excludes illegal activities by registered legal entities or entrepreneurs that report (or misreport) their activities under legal activity codes.
N3	Producer is not obliged to register	• Producer is not required to register because it has no market output. Typically, these are non-market household producers involved in: (a) production of goods for own consumption or for own fixed capital formation, and (b) construction of and repairs to dwellings. • Producer has some market output but it is below the level at which the producer is expected to register as an entrepreneur.
N4	Registered legal person is not	• The legal person may not be included in the statistics for various reasons. For example, the business register is out of date or

	included in statistics	updating procedures are inadequate; the classification data (activity, size or geographic codes) are incorrect; the legal person is excluded from the survey frame because its size is below a certain threshold, etc.
N5	Registered entrepreneur is not included in statistics	• A registered entrepreneur may not be included in the statistics for many reasons. For instance, the administrative source with lists of registered entrepreneurs may not always pass on complete or up-to-date lists to the statistical office. • Even if there is a regular flow of accurate and comprehensive information from the administrative source to the statistical office, the registered entrepreneur may not be included in the business register for several reasons (see those given under N4).
N6	Misreporting by the producer	• Misreporting invariably means that gross output is under-reported and intermediate consumption is over-reported to evade (or reduce) income tax, value-added tax, or social security contributions. • Misreporting often involves: the maintenance of two sets of books; payments of envelope salaries which are recorded as intermediate consumption; payments in cash without receipts; and VAT fraud.
N7	Statistical deficiencies in the data	• The type N7 is subdivided between **N7a** - data that is incomplete, not collected, or not directly collectable, and **N7b** - data that is incorrectly handled, processed, or compiled by statisticians. This distinction is useful because it helps one to better understand the huge variety of possible statistical deficiencies. However, in practice, N7a and N7b cannot always be easily separated. • Statistical deficiencies: the following list is not comprehensive but these topics should be investigated for non-exhaustiveness: • Handling of non-response; • Production for own final use by market producers; • Tips; • Wages & salaries in kind; • Secondary activities. • Clearly, not all statistical deficiencies result in the underestimation of GDP. The focus has been to illustrate those areas that are likely to contribute to non-exhaustiveness in the national accounts.

By the use of specific data sources and methods, countries make exhaustiveness adjustments in national accounts either explicitly or implicitly. It is sometimes observed that the approaches used by the countries can lead to adjustments covering more than one non-exhaustiveness type,

without being practically possible to provide exact estimates on the separate impact of such adjustments to national accounts variables. Countries are encouraged to provide the best possible estimates in order to show the impact of each one of these non-exhaustiveness types (N1-N7).

While variables such as the output, intermediate consumption and gross value added can be well adjusted in this context, it should be always checked and verified that all corresponding adjustments needed are indeed made to the employment estimates. Actually, adjustments for non-observed economy should always be made as no source measures it directly and completely (only the LFS may partly account for it).

In the context of the 2023 Eurostat survey, it was indicated by almost half of the countries that no consistency checks are performed between the exhaustiveness adjustments made in output, intermediate consumption and value added with any corresponding adjustments made in employment (persons and hours worked).

Concerning the exhaustiveness adjustments in **persons**, these are mainly done for the non-exhaustiveness types N2 (illegal producer that fails to register), N1 (producer should have registered - underground producer) and N6 (misreporting by the producer). In fact, these three types appear to be those for which greater attention is needed since they can escape to a relatively greater extent from the coverage of the data sources used. Persons who are involved in illegal activities or do not declare their employment activity in order to avoid tax & social security obligations are expected to escape coverage, partly or entirely, regardless of the data sources used (household, business or administrative).

Table 7

Exhaustiveness adjustments for employment in persons (number of countries)

Adjustments	done	not done but NEEDED	not done but NOT NEEDED
N1 (producer should have registered - underground producer)	10	1	8
N2 (illegal producer that fails to register)	14	2	4
N3 (producer not obliged to register)	7	1	11
N4 (registered legal person not included in statistics)	3	0	16
N5 (registered entrepreneur not included in statistics)	5	0	14
N6 (misreporting by the producer)	8	0	12
N7 (statistical deficiencies in data)	7	2	10

The non-exhaustiveness types that are predominantly not addressed (because they are not needed) are the types N4 (registered legal person not included in statistics), N5 (registered entrepreneur not included in statistics), N7 (statistical deficiencies in data), N3 (producer not obliged to register) and N6 (misreporting by the producer). These types are reported to be irrelevant in many countries due to the perceived or assumed exhaustiveness of the data source used (LFS being the most frequently mentioned) and the negligible impact of such adjustments. Nevertheless, the exhaustiveness of the data source for each non-exhaustiveness type should be carefully checked to ensure that the assumption is indeed supported.

Regarding exhaustiveness adjustments made or not made by countries for employment in **hours worked**, the responses were largely similar to those given for employment in persons.

Table 8

Exhaustiveness adjustments for employment in hours worked (number of countries)

Adjustments	done	not done but NEEDED	NOT DONE but NOT NEEDED
N1 (producer should have registered - underground producer)	10	1	6
N2 (illegal producer that fails to register)	11	2	3
N3 (producer not obliged to register)	6	0	10
N4 (registered legal person not included in statistics)	2	0	14
N5 (registered entrepreneur not included in statistics)	4	0	13
N6 (misreporting by the producer)	8	1	7
N7 (statistical deficiencies in data)	5	1	9

In the case of very few countries, no exhaustiveness adjustments are done (persons, hours worked) but it is recognised by the countries that these adjustments are needed. This is indicated by the very small number of countries presented in Tables 7 and 8 above.

The close cooperation within the NSIs to ensure the coordinated application of the exhaustiveness adjustments in both the national accounts aggregates and the employment estimates is essential.

BOX 7: PRACTICAL GUIDANCE: SPAIN

Data employment

According to Chapter 11 of the ESA-2010, employment in national accounts covers all persons engaged in productive activity that falls within the production boundary of the national accounts. In Spanish Annual Accounts, total employment is measured using two main variables: jobs and hours worked, and from the previous ones we can derive employed persons and full-time equivalent employment (FTE). These four aggregates are estimated by industries, sectors, and type of worker (employees or self-employed persons):

A. When estimating market industries, total employment is obtained by adding the employment of both the observed economy and the non-observed economy. The non-observed economy refers to both those jobs/companies that are not registered in the official framework of the economy, and those that, even though they are registered, misreport their economic activity.

- Observed Economy

  The available sources for estimating employment variables in the observed economy are the Labour Force Survey (LFS), administrative registry from Social Security (SS) and the Structural Business Survey (SBS). After analyzing each available source, the SBS was selected as the main source for jobs and hours because it is the one that is best aligned with the NACE activity codes of the Business Register and therefore with

the estimates of output or added value by industry (productivity ratios). However, in industries not covered by this survey (NACE codes A, S94 and T), LFS and SS (or a mix of them) are still used at the moment.

Some exceptions to the general rule are made for financial industries, where information about employment is provided by the Central Bank and the Insurance and Pension Funds Directorate.

Key adjustments are made to ensure compliance with ESA2010 when using LFS and SS:

- In order to meet the definition of self-employed persons, a fraction of self-employed persons is transferred to employees through a coefficient computed for each industry.
- A NACE adjustment is performed to align the statistical unit used in LFS (establishment's self-defined NACE code) and SS (NACE of the social contribution account) with the legal unit used in national accounts.

Once jobs and hours are obtained, employed persons are estimated by means of a ratio using LFS microdata that captures the persons-job relationship by industry. The estimates of FTE are based on the average annual number of hours worked in full-time jobs obtained from LFS and Annual Labour Cost Survey, although from BR 2024 this data will also be obtained from SBS itself.

- Non-observed Economy

The method used to estimate the non-observed economy is the Employment Method. This requires a workforce survey like LFS stratified by industry and business size, contrasted with employment data from sources such as structural business surveys. From the confrontation between both sources for validation purposes, we can capture the signal of those industries where it is probable that there is a degree of non-observed economy *(i.e. where employment measured in worked hours by LFS exceeds that obtained SBS).* This detection of non-observed economy by industries can be complemented with fiscal information from labor inspections or with a data mining of people working in the LFS who are not in the Social Security database.

B. For non-market industries, such as General government, the main source is Social Security from an extract of information completely aligned with the units that form the framework of sector S.13 each year (complemented with information from mutual societies of civil servants in Defence, Justice and General Government). In the case of sector S.15 it is similar, since each year the framework of units that meet the condition of being considered as NPISH (% of costs covered with sales) is updated with an algorithm and employment is obtained directly from the Business Register.

Note: The methodology applied above has been further developed in Benchmark Revision 2024 by adding reconciliation at the microdata level between the LFS and Social Security records to improve the accuracy of category N1.

3.6 Implications from not applying adjustments

Not applying necessary adjustments can have significant implications. The absence of these adjustments may distort the comparability, reliability, and exhaustiveness of employment estimates across countries.

First, employment estimates will lack consistency with national accounts concepts and definitions, rendering them unreliable for users.

Second, the inconsistencies between the national accounts' main economic aggregates and employment estimates will make them incomparable. This will distort any relevant indicators based on them, such as productivity.

Thirdly, the absence of exhaustiveness adjustments will result in an incomplete picture of the labour market that fails to reflect economic reality.

Finally, varying levels of adherence to these three aspects (comparability, reliability and exhaustiveness) across countries will further hinder comparability between employment estimates.

Given that important economic policy decisions rely on employment data and derived productivity indicators, ensuring the reliability and comparability of employment measures across countries is crucial.

3.6.1 Best practices for alignment in exhaustiveness

The need to align the exhaustiveness adjustments made on employment with those made on national accounts' main economic aggregates (output, gross value added, and compensation of employees) is paramount. The exhaustiveness adjustments made by the countries can have a significant impact on national accounts aggregates. If the corresponding exhaustiveness adjustments are not made consistently on employment, this can be one of the major sources of distortion of the productivity measures negatively affecting the comparability among countries.

The exhaustiveness adjustments in national accounts are made by the countries by using specific sources and methods (Eurostat/C1/GNIC/050 EN - Eurostat's tabular approach to exhaustiveness Guidelines). These adjustments can be either explicit or implicit depending on the countries' approaches.

In order to achieve the alignment of the exhaustiveness adjustments made on employment with those made on national accounts main economic aggregates, the cooperation within the NSI is essential. Compilers involved in the exhaustiveness adjustments on output, gross value added and compensation of employees should communicate frequently with the compilers of employment estimates. Compilers from each side should explain the coverage of the sources used and the methods applied in order to achieve exhaustiveness.

Consequently, this will lead to an understanding of whether the adjustments are done directly, indirectly, partly or entirely. A prerequisite of this communication is that the people involved should be in a position to provide these explanations adequately, meaning that they should possess the necessary knowledge and experience of using the specific sources and applying the particular methods to achieve exhaustiveness. As a result of this checking procedure that should be followed on a frequent basis, any inconsistencies in the application of the exhaustiveness

adjustments should be identified. The consistency checking procedure can become even more effective if it is fully integrated in national accounts' compilation and monitored by responsible personnel who have a good overview of all related variables.

The consistency checking procedure could be supplemented by the application of certain validation and detection checks. These checks could be applied in order to check the validity of the explanatory information and identify the existence of possible inconsistencies. Additional verification and plausibility checks can be applied in order to verify that measures have been implemented to achieve the alignment and the consequent results are plausible. The final consistency checks between the exhaustiveness adjustments made on output, intermediate consumption and value added with any corresponding adjustments made on employment should therefore be successful.

3.6.2 Examples

The following examples are indicative of a few cases where the need arises for checking and ensuring the alignment.

Scenario 1

The country uses business statistics as its main source for employment and the compilation of employment statistics is over-reliant on this data source.

National accounts compilers make exhaustiveness adjustments of types N3, N4 and N5 to output, gross value added and compensation of employees. This is considered necessary as the business statistics which is again the major source in the country for collecting the relevant data is not fully exhaustive.

As the main source used for the employment statistics (business statistics) suffers from the same non-exhaustiveness issue, it should be investigated whether exhaustiveness adjustments are needed to be applied also on employment and to what extent.

An estimate of the additional employment relating to the exhaustiveness adjustments of types N3, N4 and N5 should be available or easy to produce by the national accounts' compilers. This additional employment figure from national accounts could be compared with the difference between the initial employment figure given from the business statistics and the final employment figure after the compilation of employment statistics. The comparison will provide a good indication of the extent to which exhaustiveness adjustments need to be applied on the employment as well.

Scenario 2

The country uses LFS as its main source for employment and the compilation of employment statistics is over-reliant on this data source.

National accounts compilers make exhaustiveness adjustments of type N2 to output, gross value added and compensation of employees. This is considered necessary as the data sources and methods used in national accounts do not capture illegal activities.

While the LFS may partly account for some exhaustiveness types, it may be the case that the respondents in LFS survey who are involved in illegal activities will not provide correct answers or will not reply at all.

Consequently, it should be investigated whether exhaustiveness adjustments are needed to be applied also on employment and to what extent. The already collected information relating to the types of illegal activities, the forms through which these activities are conducted, and the profession of people involved in these activities should be checked with the aim of identifying the extent to which LFS fails to capture this employment.

Scenario 3

The country uses two main sources for employment (LFS, business statistics) which are used combined in the compilation of employment statistics.

National accounts compilers make exhaustiveness adjustments of type N1 and N6 to output, gross value added and compensation of employees. This is considered necessary as the business statistics which is again the major source in the country for collecting the relevant data do not capture the underground producers and the misreporting by the producers.

For employment statistics compilation, the business statistics apparently suffer from the same non-exhaustiveness issue. The LFS source may partly account for some exhaustiveness types. In these cases, the respondents in the LFS may have an incentive to hide part of their employment in their replies. In this way, they minimise the risk of being discovered and asked to respect their tax and social security obligations.

An estimate of the additional employment relating to the exhaustiveness adjustments of types N1 and N6 should be available or easy to produce by the national accounts' compilers. This additional employment figure from national accounts could be compared with the difference between the initial employment figure given from the business statistics and the final employment figure after the compilation of employment statistics (based on LFS as well). The comparison will provide a good indication of the extent to which exhaustiveness adjustments need to be applied on the employment as well.

3.7 Recommendations on adjustments

The adjustments that a country should consider making (if necessary) relate to the coverage of economic territory, the classification of employment by NACE, the adaptation to national accounts definitions and the exhaustiveness.

Recommendation 5: Depending on the data sources used for compiling the employment estimates, countries should identify the cases where adjustments are needed to be made. This entails a careful examination of the coverage achieved in practice by each data source. Where relevant and applicable, adjustments should be made for the conceptual differences arising from the geographical scope, the coverage and the recording thresholds of data sources.

Recommendation 6: To ensure the consistency with main economic aggregates (e.g. output, intermediate consumption, value added) and to improve the comparability of employment estimates across countries, especially when multiple data sources are used, adjustments may be necessary. Identifying the existence of LKAU (linking data sources at micro level, e.g. micro LFS data with administrative data) and estimating the relevant main economic flows and employment, could improve the classification of employment and the consistency with the main economic aggregates by NACE.

Recommendation 7: Data sources used for compiling the employment estimates in hours worked should be checked carefully to identify the measurement concept of hours worked that is captured in practice by the specific data source. This would allow the identification of any necessary adjustments for the adaptation to the national accounts' definitions. In addition, comparative checks with other data sources could allow identifying possible exhaustiveness or measurement issues.

4

Analysing employment data

Data analysis allows for the performance of validation checks and the analysis of the consistency of national accounts employment data with alternative sources and with national accounts' main economic aggregates. The analysis of the questionnaire of the survey performed in this project revealed that most of the countries perform consistency checks between employment estimates and main economic aggregates. Checks mainly consist of analysis of labour productivity (on persons and hours worked) by industry, analysis of growth rate in value added compared to employment growth rate (in persons and hours worked), at annual and quarterly level. Also, consistency with wages and salaries and unit labour cost are implemented. The following sections describe possible analyses for the validation of employment estimation in national accounts by comparing the results obtained by different sources used and thus ensuring consistency with national accounts main economic aggregates.

4.1 Plausibility checks of data sources

Data production process normally implies the combination of several sources, even when the general approach is to use one main source, the result needs to be verified.

Checks and validation can be performed during the regular data production, standard checks can be implemented so that updates can be easily performed during each production round. A simple tool that could eventually be implemented is the visualization of tables, with automatic formatting functions signalling potential problems and outlier values.

Several data analyses can be performed, each of these analyses can signal possible problems or inconsistencies. Namely:

- Comparison of data on persons employed from national accounts (national concept) and LFS. The analysis can be performed separately for employees and self-employed and by sector of economic activity.
- Comparison of data on national and domestic employment within national accounts

estimates.

- Comparison of data on jobs from national accounts (domestic concept) and SBS, on the same domain (NACE B to N). Also, this analysis can be done by economic activity.
- Analysis of hours worked per person employed. To be done by economic activity (possibly at least at level of detail that is published).
- Analysis of value added per worked hour. Also, this analysis can be done by economic activity (possibly at least at publication detail level)
- Analysis of compensation of employees per employees worked hour. Also, this analysis can be done by economic activity (possibly at least at publication detail level).

To begin with, national accounts employment can be compared with other employment estimates. The first comparison can be made on persons employed in national accounts and in LFS. Normally it is expected that national accounts are higher than LFS data in terms of the number of persons employed, given that exhaustiveness and conceptual adjustments (e.g. including institutional households etc.) are increasing the number of persons employed. In any case, the analysis of the deviations between LFS and national accounts in terms of persons employed can be an indicator of the relevance and plausibility of coverage of national or domestic employment (even when LFS is not used as main source). High divergences should be monitored and explained adequately, also to users. The analysis can and should be performed separately for employees and self-employed. Moreover, the analysis can be conducted by economic activity, to reveal if specific industries need further adjustments.

National accounts data can be compared also with SBS data. If jobs are not estimated in national accounts, the comparison should be performed bearing in mind that persons' national accounts are not fully comparable with SBS jobs. The distance can be monitored (if in the expected directions) and explained. The analysis should be performed by economic activity.

A process table explaining how national accounts data are obtained from data sources can be compiled and kept updated. In case the sources are not used as input data, differences can still be analysed and monitored. They could signal missing or excessive adjustments or quality issue in data used for the estimates or in the estimation method. As many sources are available, the analysis of differences can also be useful for explaining divergences between national accounts employment data and sources to the users.

Data can also be compared with national census data if such data are available. Once again, it is necessary to understand the reason of possible differences and to verify if any correction in the estimation procedure can be performed.

4.2 Plausibility checks between national accounts employment measures

The first possible check is comparing the two estimated measures of employment: persons employed, and hours worked. It is possible to compute hours worked per person for the total economy and by NACE, for total employment and separately for employees and self-employed. The presence of employment in all NACEs and sectors where it is expected can be verified, and vice versa (for example, non-self-employed should be reported in NACE Section O – Public

administration). Estimates of persons by type of employment (employees and self-employed) should normally exist in all NACE and sectors where there are estimates of hours worked for the same type or employment, and vice versa.

A ratio of hours worked per person employed can be computed separately for employees and self-employed, and by NACE. Plausibility ranges should be computed separately for employees and self-employed, as it very often can be observed that self-employed persons work for a higher number of hours. They should also differ by NACE, as NACE with a higher incidence of part-time or seasonal worker normally record lower hours per person. The incidence of secondary jobs should be taken into account when calculating hours worked per person. The hours worked in secondary jobs are included in the numerator, while the denominator refers to persons and not to jobs. This could affect the final result, supplying a number of resulting hours per person exceeding the "normal" hours worked in a single job. This effect is proportionally related to the incidence of secondary jobs which varies among NACEs. In those sectors of economic activity where the incidence of secondary jobs is high, the analysis of the average compensation per hour worked or value added per hour worked can help evaluate whether the correct adjustments have been made. Employment adjustments regarding production for own final consumption and own capital formation should be evaluated consistently with main economic aggregates. A corresponding number of secondary jobs (and hours worked) should be added, increasing the average worked hour per person in the relevant sector of economic activity.

Outliers should be investigated and eventually adjusted. To compute plausibility ranges, international comparison can help (for example some distribution around EU average).

Plausibility checks should be performed at the maximum level of detail. The minimum standard should be the dissemination level, but if the level of detail of production and value added is more granular, it is recommended to perform plausibility checks at the same level of detail.

The comparison with LFS and SBS should be monitored, even when these sources are not used as primary or secondary source for employment estimates. These sources are available to users and even if definitions and estimation methods differ, it is expected that the change rate is similar, in total and by NACE. Relevant differences should be analysed, and possible explanation for differences found.

4.3 Consistency checks with economic values

Employment and main economic aggregates are normally estimated independently and by different sources. The comparison of the two estimates can be useful to verify the accuracy of estimates on both sides. The analysis should be performed at the maximum level of detail by economic activity. Outliers and values falling outside a predefined plausibility range can be checked for both employment measures and main economic aggregates. As a plausibility range, the EU average can be used as a reference.

More specifically, value added per person and especially value added per hours worked can be computed. Value added per hour worked is a crucial measure in productivity analysis. It is not straightforward to compute a plausibility range, but for international comparison, the EU average by NACE can be used as a reference, especially in comparison with countries with a similar economic structure. Values outside the plausibility range and outliers can be analysed, both for employment measures and for value added. Values outside the ranges can also signal the need

for adjustments, e.g., in data sources or adjustments for exhaustiveness.

For employees only, it is possible to compare employment measures with compensation of employees. Compensation of employees (and/or wages and salaries) per employee and per hour worked by employees can be computed by NACE. Outliers can be identified, and the corresponding employment measures and compensation can be checked. Compensation of employees (in total and by NACE) per employee and per worked hour can also be compared with other sources: SBS, STS, level established legally or in collective labour agreements. Plausibility range can be set for each NACE and values outside the range can be checked both for employment measures and compensation of employees.

For self-employed, only employment measures with mixed income can be analysed and compared. Mixed income per self-employed and per hour worked by self-employed can be computed. Outliers can be monitored. Moreover, it can be expected that mixed income is generally higher than the corresponding value for compensation of employees, in the same NACE. Also, in this case plausibility range can be set for each NACE and values outside range can be checked (both for mixed income and employment).

These kinds of checks can supply information on the goodness of both employment and main economic aggregates estimates. Where the indicator provides doubtful results, further investigation can be performed on both the numerator and denominator in order to highlight whether these results are due to measurement errors, inconsistencies in classification or to the presence of an economic phenomenon justifying them.

4.4 Use of indicators by NACE for checking time series and variation rates

All indicators described below (hours worked per person, value added per hour worked, compensation of employees per hour worked by employees) should be computed and monitored over time series. It is important to check the rates of change of value added and employment measures (especially hours worked) by NACE to verify if eventual gain or loss in productivity or hourly compensation are actual or due to inconsistent treatment of data. Any inconsistency between changes in employment and changes in value added or compensation of employees should be carefully investigated.

Variation rates of compensation of employees per hour worked can also be compared with the corresponding figure in STS.

BOX 8: PRACTICAL GUIDANCE: CZECHIA

Czechia produces all three employment estimates: persons, hours worked, and FTE jobs.

For persons, the main data source used for establishing the total number is the LFS, while Business Surveys are used as the main data source for establishing the structure by NACE.

The estimate of the total annual hours worked is based on the number of FTE jobs for the given year and the average number of hours actually worked in a full-time equivalent job for that given year.

The data source for the estimation of the average number of hours actually worked in full-time equivalent jobs for the year for employees is business statistics data. The data source for the estimation of the average number of hours actually worked in full-time equivalent jobs for the year for self-employed persons is the LFS.

The estimate of number of full-time equivalent jobs for the year (FTE jobs) is based on the result of the Model of Balance of Labour by the Labour Input Method. Both LFS and Business Surveys data are directly available in FTE or can be computed.

For the FTE jobs, the structure for employees is based on the NACE structure of FTE Jobs as extracted from the Labour Cost Survey (Business Survey). The structure for self-employed is based on the NACE structure of jobs from the Labour Cost Survey (Business Survey) as well as the NACE structure of LFS data.

Conceptual and exhaustiveness adjustments are made depending on the data sources used in each case, their alignment with the concepts and definitions of ESA2010, and their coverage in relation to all exhaustiveness types.

The compilation of the employment estimates, including the application of the conceptual and exhaustiveness adjustments is fully integrated in the national accounts compilation system. This integration allows having a consistency checking procedure in place which is monitored by experienced personnel who have a good overview of all related variables. In this context, it is ensured in practice that any adjustments made in national accounts variables are consistently made also in employment estimates.

4.5 Distribution of employment by NACE according to LKAU criterion, especially when using LFS

The classification of employment by NACE in the LFS can be affected by the inability of the respondent to allocate their job to the correct NACE category. In general, when using the LFS, the classification by NACE should be validated carefully. In addition, the employment classification should be done by LKAU in coherence with main economic aggregates. It is important to investigate in which sectors of economic activities the classification by LKAU differs from the classification by establishment and to adjust employment measures (hours and persons) by NACE accordingly.

The analysis of hours per person employed and even more so, the analysis of value added per person and worked hours, and of compensation of employee per person and per worked hour,

can help. The analysis should be performed in those NACEs where the classification by LKAU, instead of by enterprise main activity, has the highest impact (see paragraphs 3.3).

The described indicators that can be computed and monitored are listed in the following table.

Table 9

List of consistency indicators to monitor the quality of employment estimates

Indicators	Description
1 Data source comparison	Indicator 1a: National employment: (NA-LFS)/NA% Comparing LFS and national accounts total employment (ESA2010 TP Table 0110) for national concept in order to find evidence of possible adjustments done to LFS data whether it is used as main data source. Where it is negative it means that the number of persons employed is higher in national accounts. The indicator is computed for total employment and separately for employees and self-employed. Indicator 1b: Domestic employment (national accounts -SBS)/ national accounts % Comparing SBS and NA total employment (ESA2010 TP Table 0111) for domestic concept; in this case some NACE breakdowns could be explored. It should be considered that national accounts domestic employment is in persons, SBS counts the number of jobs.
2 Economic territory and residency concept	NA employment (National-domestic)/domestic% This indicator captures the most significant conceptual difference between source data (LFS) and national accounts concepts. It can be measured by the difference in persons between the national concept and the domestic concept at the economy level, broken down into total employment, employees and self-employment. The size of the difference is expected to be modest for most of the countries, with relatively larger differences observed for some smaller countries that are more affected by the presence of cross-border workers.
3. Average hours worked per person employed	Hours worked/domestic persons employed The indicator is computed for total employment and separately for employees and self-employed. This indicator could reflect possible problems with the relevant data sources used and/or with the adjustments for working hours that are made for adaptation to the national accounts definitions. It could be measured by dividing the hours worked with the persons employed at economy level and at NACE A10 breakdown, with a breakdown into total employment, employees and self-employment. It should be considered that the inclusion of hours worked in secondary jobs included in the numerator of this indicator and not in the denominator (where persons are classified by main job) could result in a number of hours worked per persons above the contractual/usual hours worked.
4. Gross value added (GVA) per hour worked	GVA/hours worked This indicator could reflect possible inconsistencies between the employment and the national accounts estimates. It could be measured by dividing the GVA with the hours worked (total employment) at economy level and at NACE A10 breakdown. The growth rate of this indicator could possibly indicate some significant changes over the time.

Indicators	Description
5.1 Compensation of employees per hour worked	Compensation of employees/ employees' hours worked This indicator, calculated at total economy level and at NACE A*21 breakdown could reflect possible inconsistencies between the two estimates.
5.2 Mixed income per hour worked for self-employed	Mixed income/self-employed hours worked. Mixed income, available from sector accounts, provides insight into the income distribution for self-employed persons. It could reflect possible inconsistencies between the estimate of hours worked by self-employed and their remuneration. When analysing this ratio, it should be noted that mixed income should include not only the remuneration for work done by self-employed but also profit due to work carried out as an entrepreneur. (see ESA 8.19)

4.6 Recommendations on consistency checks

Even if all necessary adjustments to the data sources are done by the countries, it is important that consistency and plausibility checks are part of the statistical production and compilation process. With respect to exhaustiveness, the need for consistency checks becomes more important due to the significant size of exhaustiveness adjustments done by the countries.

Recommendation 8: Where relevant and applicable, consistency checks should be performed between the exhaustiveness adjustments made in output, intermediate consumption and value added with any corresponding adjustments made in employment in persons.

Recommendation 9: In the context of the exhaustiveness adjustments made in national accounts for non-observed economy, the employment estimates should be adjusted (where relevant and applicable) in accordance with the corresponding adjustments made to the other related variables such as the output, gross value added and compensation of employees.

Recommendation 10: Benchmark revisions are a chance to revise methods and introduce new sources. Countries should investigate the possibility of introducing new sources, implement all coverage and exhaustiveness adjustments, and implement the missing ones in benchmark revision. Changes in methodology affecting levels of employment (in persons or hours) and therefore growth rates should be made in benchmark revisions, to avoid time series breaks.

Recommendation 11: Countries should implement consistency checks with main economic aggregates and consistency and plausibility checks on hours worked per person/job by industry. Consistency and plausibility checks should be introduced on both levels and growth rates.

Recommendation 12: Countries using LFS should evaluate the possible impact of the population census on employment estimates. Countries should consider performing consistency checks between national account estimates and census employment estimates.

Recommendation 13: In the analysis of hours worked per person employed by NACE separated for employees and self-employed, countries are invited to improve controls: for example, plausibility checks for relatively low or relatively high hours worked per person (there are cases where hours worked reach the value of 8 thousand per person).

Recommendation 14: Consistency should be checked also with economic values by NACE. The existence of some regularity is confirmed by the above analysis, also among countries. The analysis of GVA per hour worked and compensation of employees per hour worked by

employees can provide useful information for validation (of both economic values and hours worked).

Recommendation 15: The analysis of all indicators (also detailed by NACE) should be performed also in time series and variation rate.

Recommendation 16: In order to improve the quality of the above-mentioned indicators, countries should develop methods allowing for adequate estimates of multiple jobs. In particular, the allocation of hours worked in secondary jobs by NACE should be investigated in countries calculating the number of hours worked multiplying persons by hours worked per person employed.

Recommendation 17: The analysis of GVA per hour worked can be particularly useful to highlight inconsistencies between the classification of GVA and the classification of employment by LKAUs. Some relatively high/low levels of the indicator may provide a signal on such inconsistencies, which should be taken into account, especially when using LFS as a unique or main source of employment data.

5

Conclusion

The 2023 Eurostat questionnaire on labour input allowed a much better understanding of data sources and estimation methods used by countries and shed light on possible causes of differences in labour input and productivity levels across countries. Therefore, a number of possible improvements in the compilation of employment data were presented.

Notably, expanding the data sources used in the employment estimates can lead to significant improvements. The 2023 Eurostat survey showed that countries using their sources in a combined way appear to report relatively bigger adjustments. In addition, the approach of using multiple sources of information (either in a combined way or using one source as the main and the others as complementary) maximises the benefits obtained from each individual data source.

To widen the data sources used, the countries need firstly to explore, assess and identify all the available data sources in the country in terms of their strengths and weaknesses. This is crucial for the selection of a particular source(s) and its (their) use of employment estimates and the identification of any necessary adjustments, e.g. aiming at improving the coverage, aligning with provisions of ESA2010, increasing exhaustiveness and generally rectifying any deficiencies that the relevant data source(s) may have.

Certain aspects in the estimation method itself can also have a significant impact on the estimates. Secondary jobs are a key issue in this respect. The estimation of secondary jobs is not performed in most countries. Developing methodologies for their estimation can improve the estimation of hours worked by industry. Consistency and plausibility checks (especially at detailed level) should be well integrated in the calculation framework in order to detect and examine outliers in data, to verify the results or trigger further examination to identify additional improvements needed.

The 2023 Eurostat questionnaire on labour input highlighted that more emphasis should be placed on the exhaustiveness adjustments. The close cooperation within the NSIs ensuring the coordinated application of the exhaustiveness adjustments in both the national accounts main economic aggregates and the employment estimates is crucial. In addition, the perceived or assumed exhaustiveness of the data sources used should be checked carefully.

In conclusion, the comprehensive analysis of employment sources and methods suggests that while national contexts and specificities must be considered, some further refinement of employment estimation methods across EU and EFTA countries could enhance the accuracy and comparability of these key labour market indicators.

For compilers, benchmark revisions provide an opportunity to introduce changes and improve the whole time series (persons and hours worked, levels and growth rates) without breaks that confuse the users. A simultaneous improvement of employment and other aggregates should therefore be considered with the next benchmark revision to enhance the consistency and comparability of national accounts data across different datasets and across countries.

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Improving the measurement of employment in national accounts – Recommendations and good practices

The aim of this paper is to provide good practices in the compilation of employment estimates and recommendations on data adjustments, analysis, and checks to obtain high-quality employment data. The target audience includes new staff in national statistical institutes or Eurostat, as well as users interested in information on sources and methods for employment estimates.

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