Euro area and EU employment flash estimates

2018 edition

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Preface

Policymakers and other users of statistics need up-to-date data to support their analysis and decisions. This is why, in 2014-2015, Eurostat looked into speeding-up the process of estimating and publishing gross domestic product (GDP) figures. GDP is generally held to be one of the most important economic indicators. Eurostat's investigation resulted in the regular release of quarterly euro area and EU GDP 'flash' estimates at t+30 days, as of the first quarter of 2016.

Employment is another important variable in national accounts. Traditionally, Eurostat's quarterly employment estimates for the euro area and the EU (made in the context of national accounts) have been published about 75 days after the end-of-quarter, when a full set of country data is usually available. While Eurostat is among the small number of statistical authorities worldwide which have succeeded in releasing quarterly employment data in the national accounts framework, their delivery is clearly behind the timeliness target set up for Principle European Economic Indicators (PEEIs), as acknowledged in the Economic and Financial Committee's 2015 Status Report on Information Requirements in EMU ([1]). It is for that reason, and also because some countries already provide Eurostat with employment flash estimates, that Eurostat started a feasibility study on producing euro area and EU employment flash estimates earlier ([2]). In addition, to benefit users, Eurostat worked towards advancing and integrating its t+75 days employment estimate with its regular t+65 days estimate of GDP main aggregates, in order to achieve efficiency gains through the introduction of more automated validation and estimation procedures.

In December 2016, Eurostat and NSIs decided to establish a task force on early employment flash estimates. The group's remit was to assess whether sufficiently-reliable flash estimates could be published for total employment (expressed in persons) in the euro area and the EU respectively. The estimates would be based mainly on the EU Member States' national estimates that would be regularly transmitted on a voluntary basis.

The results of the task force's work and the employment flash estimates project are documented in two statistical working papers.

This first working paper begins with the methodology used to produce employment flash estimates for the euro area and the EU. It then presents the results of the test estimates performed for 13 quarters using this methodology, and explains the criteria used to assess the test results. Lastly, it draws conclusions about the possible regular release of euro area and EU employment flash estimates 45 days after the end-of-quarter and continued future work to speed up the release of euro area and EU employment flash estimates to 30 days after the end-of-quarter.

The second statistical working paper, expected to be published in 2019, will present the methods and techniques used by national compilers to produce early flash estimates of national employment data, focusing particularly on the techniques used to estimate the data for the third month of a quarter, which are often still unavailable when early estimates are made.

There are two reasons for publishing the main results of the project in this statistical working paper. First, in publishing all the important information on its employment flash estimates for the euro area and the EU, Eurostat is abiding by its commitment to full transparency vis-à-vis its users. Second, the working paper includes background information that might be important to users in interpreting employment flash estimates.

([1]) http://ec.europa.eu/eurostat/documents/4187653/7065524/EFC-Status-Report-Final.pdf/32a189ce-752c-4545-94e2-d6b114002eff).

([2]) A flash estimate is an early estimate covering the most recent reference period and is normally calculated using a more incomplete set of information than that used for subsequent releases.

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This statistical working paper, produced by Eurostat, is based on the work of Eurostat's task force on early employment flash estimates.

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The task force representatives contributed to its work by providing information on their data sources, developing methods for producing early estimates, and/or providing quarterly national employment flash estimates to be used in producing the test estimates for the euro area and the EU. Without their contributions, the project could not have been completed successfully.

Eurostat is also grateful for the estimates provided by EU Member States not represented in the task force: Bulgaria, Estonia, Luxembourg, the Netherlands, Poland, Portugal and Slovenia.

Finally, the work on the employment flash estimates project also benefited from input from the National Accounts Working Group and the Directors of Macroeconomic Statistics.

As there are many similarities between the employment flash estimates project and the project on GDP flash estimates at t+30 days, several sections of the statistical working paper 'Euro area and European Union GDP flash estimates at 30 days' have been reused in this paper with adaptations where necessary. Eurostat particularly acknowledges the work of Hans Wouters, who was responsible for organising the task force work and the initial drafting of this paper, before his return to Statistics Netherlands (CBS) in May 2018.

Executive summary

Policymakers and other users of statistics require very up-to-date data. Traditionally, Eurostat's quarterly employment estimates for the euro area and the EU in the context of national accounts were produced only about 75 days after the end-of-quarter, when a full set of country data is usually available (hereafter referred to as t+75). This is however clearly behind the timeliness target set up for Principle European Economic Indicators (PEEIs), as acknowledged in the Economic and Financial Committee's 2015 Status Report On Information Requirements in EMU ([3]). This is why Eurostat, in cooperation with some EU and EFTA countries, embarked on a feasibility study on whether earlier euro area and EU employment flash estimates could be produced. The study developed methodology for producing the euro area and EU employment flash estimates, proposed quality criteria for assessing the test estimates, and produced five real-time and eight retrospective test estimates for the euro area and the EU. The work carried out is presented in this report, together with an assessment of the results.

Prior to developing the estimation methodology, a decision was taken on which employment variable(s) to be covered in the feasibility study. Based on the expected reliability and the availability of country data, it was decided to limit the exercise to one variable at a high level of aggregation: total employment in number of persons.

The methodology Eurostat developed for making estimates fell into four stages:

- requesting Member States to provide national employment estimates at 30 days (t+30) and/or 45 days (t+45) after the end-of-quarter (seasonally-adjusted quarter-on-quarter growth rates and unadjusted year-on-year growth rates);
- optional: making estimates for missing countries;
- compiling the euro area and EU growth rates by aggregating estimates of EU countries' growth rates, using weights based on their respective annual data;
- applying the calculated euro area and EU growth rates to the latest-available levels in order to generate the levels for following quarter, and publishing the results in a news release and the Eurostat database.

Test estimates of euro area and EU aggregates were compiled using three different approaches to deal with missing country data:

a. All missing countries were assumed to have the aggregate growth rates, weighted by the reporting countries;

b. Missing estimates for one large country for back estimates and the beginning of real time estimates were added by Eurostat using modelling techniques (ARIMA models). All other missing countries are assumed to have the aggregate growth rates, weighted by the reporting countries;

c. In addition to the estimates added for one missing large country described above, estimates for other missing countries were added by Eurostat by using growth rates available from Labour Force Survey (LFS) data, if available. The remaining missing countries were assumed to have the aggregate growth rates, weighted by the reporting countries.

To assess the quality of the euro area and EU growth rates for the 13 test quarters, four quality criteria were defined as follows:

- the average revision of the t+45 test estimates for the test quarters should lie between -0.05 and +0.05 percentage points at t+75;
- the average absolute revision of the test quarters should be less than or equal to 0.10 percentage points at t+75;
- the input of Member States' national employment flash estimates should represent at least 75% of the euro area and EU totals for the four latest test quarters; and

([3]) http://ec.europa.eu/eurostat/documents/4187653/7065524/EFC-Status-Report-Final.pdf/32a189ce-752c-4545-94e2-d6b114002eff

— a communication plan should be available well before the start of the official release.

Test estimates were performed for 13 quarters: eight back-quarters (2015Q1-2016Q4) and five real-time quarters (2017Q1-2018Q1). For each of the t+30 and t+45 horizons, three alternative estimates were made. The alternatives differed in the way that estimates were made for missing countries, as described above.

The main conclusions of the assessment of the euro area and EU t+45 test estimates are as follows:

— The t+45 quarter-on-quarter seasonally-adjusted test estimates showed very limited revisions. The criteria regarding the average revision, average absolute revision and coverage were fully met. The conclusion is that these estimates are of very high quality;

— No quality acceptance criteria were defined for the t+45 unadjusted year-on-year test estimates. However, the revisions for the 13 quarters were also very low, and absolute revisions and absolute average revisions were small. The conclusion is that these year-on-year test estimates are also of high quality;

— Of the three estimation methods used, the second (model-based estimates for one large missing country) performed the best. Since this particular missing country started to send in its national estimates in 2017Q3, for the period 2017Q3-2018Q1, the second method coincided with the first one (based entirely on data received from all reporting countries). This is why the first estimation method will, in principle, be used for the official releases in the future.

The main conclusions of the assessment of the euro area and EU t+30 test estimates are as follows:

— The t+30 quarter-on-quarter and year-on-year test estimates showed relatively limited revisions. This conclusion applies especially to estimates made when data from reporting Member States were complemented by model-based estimates for one large country and the LFS proxies for other countries, if available (the second and third estimation methods). The assessment criteria developed for the t+45 test estimates were applied to the test estimates at t+30. The conclusion was that the criteria set for the average revision and average absolute revision were fully met. However, Member States' direct contributions of national estimates were well below the predefined (75%) coverage assessment criterion of the euro area and EU total employment aggregates;

— Although promising results were achieved, particularly as regards the limited revisions, the relatively low coverage did not allow the publication criteria to be fulfilled. As a result, it is recommended that the test exercise should continue;

— The t+30 test estimates done so far suggest that using additional available information for modelling missing data, and/or using LFS data, does already provide good quality test estimates for the euro area and EU, despite the low coverage. Therefore, if Member States cannot provide employment flash estimates with relatively limited effort, they are asked to consider providing complementary country-specific data as a good proxy, and to approve it use for country-specific estimates. This could allow advancing the release of European employment flash estimates to t+30 days, after further testing.

Based on these conclusions of the work of the Task Force, which were also supported by NSIs, Eurostat decided that the publication of employment flash estimates could already start from mid-November 2018, while the testing of t+30 estimates should continue. In addition, the t+75 employment estimate should be advanced and integrated with the regular estimation of GDP main aggregates at about 65 days after the end of the reference quarter (t+65). This would streamline the release of the national accounts estimates and bring them closer to the PEEI's targets of t+30/60/90 days for the key national accounts indicators.

Contents

1 Introduction

1.1 Background

The first employment news release at 75 days after the end-of-quarter (t+75) was published on 14 March 2007. In 2018, Eurostat's quarterly employment estimates for the euro area and the EU in the context of national accounts are still being made at t+75 days, when a full set of country data is usually available. While a slightly more advanced first employment estimate could be based on more limited data coverage after about 65 days after the end-of-quarter (t+65) ([4]), it would nevertheless still not meet the policy need for more timely employment data, as specified for the Principal European Economic Indicators (PEEIs). The quality development of these PEEIs is closely monitored at a policy level and assessed annually by the Economic and Financial Committee (EFC). As acknowledged in the 2015 EFC Status Report on Information Requirements in EMU, 'the national accounts-based employment indicator still remains well behind the target for timeliness' ([5]). For that reason, and given that some Member States already send employment flash estimates to Eurostat, Eurostat started investigating whether it would be feasible to produce an earlier euro area and EU employment flash estimate. This feasibility study fits well with Eurostat's mission to provide high quality statistics for Europe.

The proposal for the feasibility study and to establish a task force to conduct it was accepted by national statistical institutes (NSIs) in November 2016.

This task force included representatives from 13 Member States: Austria, Belgium, Croatia, the Czech Republic, Denmark, France, Germany, Hungary, Italy, Lithuania, Slovakia, Spain and the United Kingdom. A further eight Member States contributed to part of the work by providing test estimates: Bulgaria, Estonia, Luxembourg, the Netherlands, Poland, Portugal, Slovenia and Finland.

1.2 Employment flash data and user needs

The need for more timely employment estimates for the PEEIs was the main reason for investigating the possibility of earlier publication. Eurostat also asked some key users, such as the Directorate-General for Economic and Financial Affairs (DG ECFIN), the Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL) and the European Central Bank (ECB), to express their current policy needs. A summary of their replies is provided below.

DG ECFIN welcomed the project idea, expressing that there had always been a long lag between GDP and employment estimates, which became even longer after the quarterly GDP estimate was advanced to

([4]) Making this estimate during the first regular GDP estimation is considered since country coverage increased significantly over time as timeliness derogations regarding the transmission of employment data expired. As a parallel production process would however be difficult in terms of human resources, Eurostat worked also on introducing further efficiency gains in the validation and estimation process through further automation.

([5]) http://ec.europa.eu/eurostat/documents/4187653/7065524/EFC-Status-Report-Final.pdf/32a189ce-752c-4545-94e2-d6b114002eff

30 days after the end-of-quarter (t+30). More timely employment figures would make DG ECFIN's forecasting task easier and facilitate more timely policy responses to unexpected developments. DG ECFIN encouraged the development of flash estimates for total employment, expressed in persons, also conveying that it would be very helpful to have a breakdown of total employment into employees and self-employed persons, even if the study showed that it would not be possible to publish such a breakdown. DG ECFIN pointed out that the inclusion of country data in the news release is very desirable from the point of view of policy needs.

DG EMPL was also consulted. It expressed its support for the project in written consultation but could not attend the first task force meeting.

The ECB welcomed an increase in timeliness for employment data. The employment flash estimate was expected to be less reliable than the GDP flash estimates, as country coverage for employment data was anticipated to be lower. However, improved timeliness would make it more likely that these data could be used in briefing material for ECB Governing Council meetings. Under the current release schedule, these data miss the Governing Council meeting by several days and are 'old news' by the time of the next meeting. Timelier availability of data would also be beneficial for the projection exercises. The ECB noted that level data are preferred for the purpose of its macroeconomic projections.

Beyond the needs of Eurostat's main users, there are many other users who will benefit from earlier employment data that are consistent with other important concepts from national accounts, such as GDP, gross value added and the compensation of employees. These users include other Commission departments, and other institutional users such as the European Council and the European Parliament. Early information on employment growth rates in the euro area and the EU will be useful for national policymakers and governments as well. General users may also be interested in the headline early estimates. Finally, Eurostat's communication unit notes that economic journalists – and news agencies in particular – are always interested in having earlier data on the main indicators.

1.3 Objectives

The general aim of the study was to gauge the feasibility of producing reliable euro area and EU employment estimates at 45 days after the end-of-quarter (t+45) or even earlier. Following a positive assessment of the feasibility study results, and given a commitment on the part of the Member States to supply the necessary data, Eurostat would be able to start releasing these t+45 estimates regularly. This would bring the release of the quarterly employment data forward by at least 30 days, thus meeting the needs of the ECB and the European Commission (DG ECFIN and DG EMPL) for more timely data.

The main components of the feasibility study conducted by Eurostat in cooperation with the task force were:

1. exchanging knowledge between EU Member States and Eurostat on the methods and practices for producing employment flash estimates;
2. making real-time and retrospective national test estimates;
3. developing a methodology for producing euro area and EU employment flash estimates;
4. making real-time and retrospective test estimates for the euro area and the EU;
5. establishing quality criteria to assess the test estimates for the euro area and the EU;
6. assessing the results of the feasibility study in an evaluation report.

This statistical working paper serves as the report as cited under point 6, and includes a description of the work carried out on the issues listed under points 3, 4 and 5.

1.4 Variables to be estimated

Driven by long-standing concerns about the timeliness of employment data, the related user needs, as well as the positive experiences with bringing forward the quarterly GDP flash release from 45 to 30 days after the end-of-quarter, Eurostat started a preliminary investigation in June 2016 into the feasibility of

producing employment flash estimates. The first step was to obtain a more complete picture of what employment data are currently available at t+45 (or earlier). Consequently, Eurostat launched a questionnaire on the availability of 'quarterly employment data within 45 days after the quarter-end', which was completed by all 28 Member States.

Table 1.1: Coverage percentages in total euro area and EU employment in persons

	Level data					
	Seas. adj. (QS/QY)			Unadjusted (QN)		
	EU countries EA countries	% of EA employment	% of EU employment	EU countries EA countries	% of EA employment	% of EU employment
Total employment (in persons)	AT, FI, DE, IT, LU, NL, SK, UK	57%	51%	AT, BG, EE, DE, IT, LT, LU, NL, PL, SK, UK	56%	59%
Employees (in persons)	AT, FI, DE, IT, LU, NL, UK	55%	50%	AT, BG, EE, DE, IT, LU, NL, PL, SK, UK	55%	59%
Self-employed (in persons)	AT, FI, DE, IT, LU, NL, UK	55%	50%	AT, BG, EE, DE, IT, LU, NL, PL, SK, UK	55%	59%
	QoQ percentage change Seas. adj. (QS/QY)			YoY percentage change Unadjusted (QN)		
	EU countries EA countries	% of EA employment	% of EU employment	EU countries EA countries	% of EA employment	% of EU employment
Total employment (in persons)	AT, CZ, FI, DE, IT, LU, NL, SK, UK	57%	53%	AT, BG, DE, IT, LU, NL, SK, UK	55%	51%
Employees (in persons)	AT, FI, DE, IT, LU, NL, UK	55%	50%	AT, BG, DE, IT, LU, NL, SK, UK	55%	51%
Self-employed (in persons)	AT, FI, DE, IT, LU, NL, UK	55%	50%	AT, BG, DE, IT, LU, NL, SK, UK	55%	51%

Source: Eurostat calculations and analysis based on questionnaires completed by the EU Member States

From the questionnaire, it was concluded that the coverage of national data on total employment in hours worked in the euro area and EU total employment were between 35 % and 40 %. Coverage of its components, the hours worked by employees and self-employed persons as shares of total EU employment, were below 25 %. Coverage percentages for the employment variables that are expressed in persons were higher. As Table 1.1 shows, this was true for all types of data: unadjusted and seasonally-adjusted level data, the seasonally-adjusted quarter-on-quarter growth rates and the unadjusted year-on-year growth rates. Table 1.1 shows that these coverage percentages were between 50 % and 60 %.

Considering the questionnaire results and the possible consequences for additional resources, it was decided – after consulting the National Accounts Working Group members – to focus the feasibility study on the variable 'total employment in persons', without any breakdowns. There were further reasons not to investigate a breakdown into employees (expressed in persons) and self-employed persons. Firstly, the growth rates for the variable 'employees, in persons' are often equal to the growth rates of total employment in persons; there is thus little value added. Secondly, the number of self-employed persons is relatively small and sometimes volatile, and therefore less reliable. Similarly, a breakdown into industries was not investigated.

The quarterly estimates of the euro area and EU total employment in persons were based on input from the EU Member States. Both unadjusted data and seasonally-adjusted quarterly employment flash data were collected from the EU Member States for this purpose. On the basis of these inputs, Eurostat was

able to compile the quarter-on-quarter seasonally-adjusted growth rate and the unadjusted year-on-year growth rate for the euro area and the EU. The choice of method for calculating and presenting these growth rates was consistent with the practice and the presentation that is used in the t+75 Eurostat employment release.

Chapter 2 presents the estimation methodology developed by Eurostat. This methodology was used to make the test estimates and is also used for the officially released employment flash data. The key activity covered by the employment flash project was to produce test estimates for eight back-quarters (in 2015 and 2016) and, initially, for real-time quarters in 2017 and 2018 ([6]). Chapter 3 explains the quality acceptance criteria that were defined to assess the results of the test estimates. Chapter 4 presents and discusses the results of the two sets of 13 quarterly test estimates (at t+30 and t+45, respectively), and the assessment of these results against the quality acceptance criteria. Chapter 5 outlines how Eurostat intends to streamline the information and the news releases of GDP and employment. Chapter 6 summarises the main conclusions drawn from the feasibility study.

([6]) In this document, the results of the eight back-quarters and five real-time quarters are evaluated since the publication of the report was advanced due allow publication of t+45 employment flash estimates ahead of the initial time schedule due the good test results.

2 Euro area and EU employment flash estimation method

This chapter opens, in Section 2.1, with an examination of the features of flash estimates, and an explanation of how they differ from regular estimates. Section 2.2 goes on to discuss the methodology used to compile the employment flash estimates for the euro area and the EU. This methodology was initially developed by Eurostat to compile GDP flash estimates, and was adapted to produce the employment estimates for test purposes.

2.1 Features of flash estimates

Increasingly, users of statistics are calling for ever more timely data. The several short-term indicators that are currently available (e.g. production indices, statistics on prices and foreign trade, business surveys, unemployment rates) can help them form a picture of recent economic and social developments as regards a specific variable and/or industrial activity. However to have a more complete picture of developments at the macroeconomic level, a broader system is needed, which shows the relationships between a large number of economic variables in a consistent way.

Quarterly national accounts offer such a system. Ideally, users would like to have flash estimates available for all main quarterly national account variables. In such an ideal situation, reliable data on all variables would be published soon after the end of the quarter. However, experience shows that it is easier to make reliable estimates for an aggregate, than for its components. This is also true of employment flash estimates.

Flash estimates differ from both forecasts and leading indicators. Employment flash estimates at European level estimate developments in employment consistent with the national accounts framework in a similar way than the t+75 employment estimates, but using less complete data sources.

The main features of employment flash estimates based on national accounts and the main ways in which they differ from the t+75 employment estimates can be summarised as follows:

- Employment flash estimates based on national accounts can be used together with other variables based on national accounts variables;
- Timeliness/release date: flash estimates are available earlier than traditional estimates (typically within 45, or even 30 days). Employment flash data thus provide an early snapshot of employment trends;
- Accuracy-reliability([7]): there is a trade-off between timeliness and accuracy-reliability. Flash estimates are generally less accurate/reliable than t+75 estimates. However, the loss of accuracy-reliability is minimised;
- Reference period: flash estimates are produced only for the latest quarter. The data for the preceding and earlier quarters are not usually revised;
- Coverage: the number of breakdowns of variables included in flash estimates is usually limited, as it is easier to ensure reliability at a higher level of aggregation;

([7]) According to the European Statistics Code of Practice, European statistics should accurately and reliably portray reality.

— Information available: flash estimates are based on a more limited set of information. Information from surveys covering the whole quarter, for example, is not often available;

— Use of estimates: owing to the lack of direct information, flash estimates may include components estimated using statistical methods. For example, there may be two months of short-term statistics available, and other available indicators would then be used as proxies to estimate the third month. The flash estimate would typically be produced from these different components using forecasting methods such as autoregressive distributed lag (ADL) models, autoregressive integrated moving average with exogenous variables (ARIMAX) models, and time series regression techniques.

2.2. Compilation methodology

The European Statistical System (ESS) is a partnership between the EU, EFTA countries and EEA countries' national statistical institutes and Eurostat, the European Union's statistical office. The national accounts figures for the euro area and the EU are compiled by Eurostat on the basis of the national accounts data submitted by national statistical institutes. The European aggregates, though calculated by Eurostat, thus depend on input from the ESS as a whole.

Thus, the European aggregates are produced using an indirect approach, i.e. on the basis of data collected at Member State level, rather than by surveying the variables directly at European level. The same indirect approach is taken when compiling employment flash estimates. The employment flash estimates produced by Member States, either published or sent to Eurostat for internal use only, are therefore used as the main data sources.

Methodology for compiling quarterly European employment flash estimates

The methodology and process used to compile the quarterly euro area and EU employment flash estimates, at both t+30 and t+45, are similar to those currently used to estimate the quarterly euro area and EU GDP at t+30 and at t+45. The process has four stages:

1. A group of Member States send Eurostat their quarter-on-quarter seasonally and calendar-adjusted employment growth estimates and their year-on-year unadjusted employment growth rates at least one working day before the agreed publication day (at the test stage, the mock publication date). This group includes countries that already publish their estimates nationally and countries that send confidential estimates to Eurostat;
2. Optional: additional estimates are made for missing countries. This step is detailed below;
3. Eurostat aggregates the countries' quarter-on-quarter and year-on-year growth rates, using the weights of their respective annual data on total employment in persons to produce aggregate growth rates for the euro area and the EU. For this purpose, annual data for year y-2 are used for the first and the second quarters, and annual data for year y-1 for the third and the fourth quarters, since updated annual figures for the previous year were then transmitted by all countries;
4. The resulting growth rates for the euro area and the EU are used to calculate the corresponding level data. Euro area and EU growth rates are published in a news release; growth rates and level data are disseminated via Eurostat's database. If Member States publish their employment flash estimates nationally, these data can also be made available via the database.

MAKING ESTIMATES FOR MISSING COUNTRIES

Eurostat has established several ways of compiling a test estimate for each reference quarter. Table 2.1 provides an overview of estimation methods and data used at t+30 and t+45 days.

Table 2.1: Overview of methods for compiling missing country flash estimates

Esti-mation	Treatment of missing countries	Q-o-q seasonally adjusted growth rates		Y-o-y unadjusted growth rates	
		Euro area	EU	Euro area	EU
1	All missing countries are assumed to have the weighted growth rates of the reporting countries	x	x	x	x
2	An estimate is made for one large missing country by modelling, other missing countries are assumed to have the weighted growth rates of the reporting countries	x	x	x	x
3	An estimate is made for one large missing country by modelling, other missing countries are estimated by using LFS data if available. The remaining missing countries are assumed to have the weighted growth rates of the reporting countries	x	x	x	x

Source: Eurostat

The default method for the treatment of missing countries is the first estimation method. This method can be used if the coverage of the reporting countries is sufficient.

The second method can be recommended if large countries are missing and a sufficiently reliable model can be estimated for them. Annex A provides a description of such models.

The third method also uses the modelling results for one missing large country, and in addition, increases country coverage by making use of available Labour Force Survey (LFS) data at 30 and/or 45 days after the end-of-quarter for the other missing countries. However, the LFS employment definition differs from the ESA 2010 national accounts definition on the following points:

- Residents working for non-resident producer units are included in the LFS definition, but not in the ESA 2010 definition;
- Non-residents working with resident producer units are not included in LFS, but they are included in ESA 2010;
- Conscripted forces are not included in LFS, but are included in ESA 2010;
- Resident workers living permanently in institutions are not included in LFS, though they are included in ESA 2010;
- The LFS only takes into account employed people aged 15 and over, whereas this age limit is not applied in ESA 2010.

Although these differences will lead to different level estimates for LFS on the one hand and national accounts on the other, the impact of the differences on the growth rate estimates is likely to be smaller. The third method therefore uses LFS proxies for some missing Member States. At t+30 and t+45 days, monthly LFS employment data are available for Austria, the Czech Republic, Germany, Denmark, Finland, Italy, the Netherlands, Portugal, Romania and Sweden. In addition, a quarterly LFS employment estimate is available for Spain. The way these LFS indicators are used in producing the euro area and EU test estimates is quite straightforward. The Eurostat LFS database contains both unadjusted and seasonally-adjusted monthly employment level data, expressed as a number of persons. The average quarterly levels are calculated on this basis. Subsequently, the quarter-on-quarter seasonally-adjusted growth rates and the year-on-year unadjusted growth rates are calculated and used in the euro area and EU employment flash estimates.

Annex B provides an overview of the mean features of the EU Labour Force Survey.

The test results for 2015Q1-2018Q1, calculated using each of the three methods listed in Table 2.1, are discussed and analysed in Chapter 4.

For the official releases Eurostat will rely, in principle, on the first method that is based solely on Member States' input, provided that the coverage criterion is met. However, in each production round the two alternative methods are also used, but only:

- to check the plausibility of the results produced using the first method; and/or
- to help in taking difficult rounding decisions (i.e. when the preferred method shows a growth rate very close to x.x5 %).

If in a production round the coverage drops below the threshold, the second method and/or third method will be used to make estimates for the country/countries that are missing for unanticipated reasons.

3 Quality acceptance criteria

3.1 Introduction

The main purpose of the employment flash project is to assess the feasibility of producing employment growth estimates at 30 or 45 days after the end of the reference quarter for both the euro area and the EU ([8]). To test the feasibility, the countries that participated in the task force on early employment flash estimates were asked to provide real-time test data for the quarters 2017Q1-2018Q1 ([9]) and to supply the data at least one working day before the t+30 and t+45 deadlines. In addition, data were to be 'reconstructed' for the back-quarters 2015Q1-2016Q4. Member States that were already producing employment flash estimates at t+30 and/or t+45 were able to simply supply Eurostat with these estimates. Member States not previously producing flash estimates were asked to calculate their national estimate retrospectively (i.e. using the data that would have been available to them at 30 and/or 45 days after the end-of-quarter). In addition to the 13 task force members, eight other EU Member States agreed to participate in the test exercises.

So, for the purpose of compiling the euro area and EU employment flash estimates and testing its quality, national data were available for 13 quarters (five real-time quarters and eight quarters as a mixture of retrospective and real-time results), prepared by a maximum of 21 countries. To assess whether the European aggregates compiled at t+30 and t+45 were of acceptable quality, it was necessary to set criteria that the results of the test estimates would need to fulfil. These quality acceptance criteria and their development are the subject of this chapter.

Section 3.2 examines the definition of quality. Section 3.3 discusses some of the considerations that were taken into account when setting the quality criteria. Section 3.4 presents the criteria used to assess the quality of the employment flash test estimates.

3.2 Definitions of quality and quality indicators

Quality is a term frequently used in statistics, and for users it is important to know that statistics are of acceptable quality. The concept of 'quality' can be defined in different ways. In a narrow sense, quality is more or less synonymous with statistical accuracy. Used in a broader sense, it may include several other dimensions, such as accessibility and timeliness.

([8]) Test estimates have been made for the euro area 19 and the EU 28.

([9]) It was agreed with Member States that real-time national test estimates should be prepared for all the 2018 quarters, but 2018Q2-2018Q4 have not been included in this statistical working paper due to the advancement of the publication date.

The European Statistics Code of Practice recommends considering 15 main principles:

- professional independence;
- mandate for data collection;
- adequacy of resources;
- quality commitment;
- statistical confidentiality;
- impartiality and objectivity;
- sound methodology;
- appropriate statistical procedures;
- non-excessive burden on respondents;
- cost effectiveness;
- relevance;
- accuracy and reliability;
- timeliness and punctuality;
- coherence and comparability;
- accessibility and clarity.

All these principles of quality should be taken into account when developing new statistics. However, for the purpose of determining the quality assessment criteria for the employment flash estimates, the most relevant ones are ‘accuracy-reliability’ and ‘timeliness’. These two dimensions are discussed in more detail below.

The reliability of the employment flash estimates is probably the most important quality indicator. The aim was to produce employment flash estimates that are as close as possible to the t+75 employment estimates and subsequent estimates, but available earlier: 45 (or even 30) days after the end-of-quarter. A ‘good’ t+45 or t+30 employment flash estimate is therefore one that is consistently close to the ones released at a later date (at t+75, t+165). Therefore one of the acceptance criteria was the size of revisions.

It may also be of interest to examine the revisions of the Member States’ national employment flash estimates. However, assessing the quality of the countries’ estimates goes beyond the project’s remit. Consequently, only the revisions of the employment flash estimates for the euro area and the EU were considered when developing the quality acceptance criteria. Moreover, it was also not possible to compare revisions with other main economic partners, notably the United States or Japan, since these countries do currently not publish employment flash estimates that are fully consistent with the framework of the national accounts.

The timeliness – the time between the end of the reference period and the release – is set by definition. The European flash estimates have to be ready by scheduled dates at 45 days after the end of the reference quarters. Member States' national estimates should therefore be available at least one working day before the t+45 deadlines. In the absence of a legal requirement to deliver national employment flash data, Member States should undertake to provide their data by the scheduled dates to avoid any risk of delaying the release of the European aggregates.

3.3 Considerations for setting acceptance criteria

To set the quality acceptance criteria, two sources were considered. The first was the statistical working paper 'Euro area and European Union GDP flash estimates at 30 days'. Chapter 3 of that report defines four quality acceptance criteria for assessing the results of the GDP t+30 flash estimates. The possibility of applying similar criteria to the employment flash test estimates has been assessed.

The second source was an analysis of revisions of the euro area and EU employment estimates that have been regularly produced 75 days after the end of each quarter. More concretely, the growth rates of the first regular t+75 quarterly estimates were compared with the values of the same quarter obtained in the subsequent estimation i.e. after t+165 days. Table 3.1 presents the results.

Table 3.1: Growth rates and revisions of t+75 and t+165 employment estimates
(Quarter-on-quarter employment growth rates, in % and revisions of growth rates, in percentage points)

	Euro area 19			EU 28		
	T+75	T+165	Revision 165-75	T+75	T+165	Revision 165-75
2013Q3	-0.01	0.00	0.01	0.03	0.09	0.07
2013Q4	0.07	0.11	0.04	0.09	0.15	0.06
2014Q1	0.08	0.08	0.00	0.22	0.23	0.01
2014Q2	0.25	0.28	0.04	0.30	0.34	0.04
2014Q3	0.22	0.23	0.01	0.29	0.30	0.01
2014Q4	0.13	0.12	-0.01	0.16	0.19	0.03
2015Q1	0.15	0.19	0.04	0.29	0.32	0.03
2015Q2	0.33	0.39	0.06	0.21	0.27	0.05
2015Q3	0.28	0.31	0.02	0.36	0.35	-0.02
2015Q4	0.31	0.32	0.01	0.14	0.35	0.21
2016Q1	0.34	0.35	0.01	0.35	0.35	0.00
2016Q2	0.39	0.35	-0.04	0.33	0.34	0.01
2016Q3	0.21	0.20	-0.01	0.19	0.18	-0.01
2016Q4	0.25	0.36	0.11	0.23	0.39	0.16
2017Q1	0.43	0.50	0.07	0.41	0.47	0.06
2017Q2	0.42	0.44	0.02	0.42	0.51	0.09
	Euro area 19			**EU 28**		
Average revision			0.02			0.05
Average absolute revision			0.03			0.05
Root mean squared error			0.04			0.08

Note: The large revisions for quarter 2015Q4 (EU) result from a significant error made by an EU country in its initial data. Leaving out this estimate would result in values for average revision, average absolute revision and root mean squared error of 0.04, 0.04 and 0.06 percentage points respectively.

Source: Eurostat calculations

From Table 3.1 it can be concluded that both average revision and average absolute revision at t+165 are limited for both the euro area and the EU. As a large majority of the revisions have a plus sign, it seems that the t+75 employment estimates for both the euro area and the EU have a downward bias. This conclusion is supported by the fact that the average revision and the average absolute revision are very close to each other for both the euro area and the EU. The results of this revision analysis have been taken on board when determining the quality acceptance criteria for the employment flash test estimates.

When establishing the quality acceptance criteria and assessing the test results against them, some other issues have been taken into consideration:

- For the quality assessment, relatively few observations were available. The use of retrospective data from Member States meant that the five real-time quarters could be extended by eight back-quarters. However, the time span – 13 quarters in total – is still rather limited;
- The data for the back-quarters for 2015Q1-2016Q4 were produced retrospectively for most Member States. The results of these back estimates should be interpreted more carefully than the real-time estimates for the 2017Q1-2018Q1 quarters. On the one hand, retrospective data can only be produced using a purely theoretical approach, which may potentially lead to inferior results. On the other hand, when preparing the retrospective estimates, the compilers already have knowledge at their disposal of the outcomes for the complete later estimates; this knowledge may have influenced their estimates;
- The fact that, at the beginning of the test period, several Member States were at an early stage of the development process should also have been borne in mind. It is reasonable to expect that they have refined their methods over the test period, and that their estimates for later quarters were of better quality than for earlier quarters. This process is expected to continue after the end of the test period and may lead, once national quality criteria are met, to the eventual publication of national employment flash data by some of these Member States;
- For more or less the same reason, coverage rose over time: several Member States that could not send their national data at an early stage of the test period were able to join the exercise for later test quarters. It is also expected that countries will continue to deliver their national estimates after the test period is over and publication has started ([10]). As a quality assessment criterion, the coverage rates of recent test period quarters thus seem to be more representative than those for earlier quarters.

3.4 Quality acceptance criteria

The previous sections looked at the definitions of quality in statistics and the factors that need to be taken into consideration when setting the acceptance criteria. Given the available options, and taking into account the limitations of the data series, three acceptance criteria were developed and applied to the test estimates. The criteria apply to euro area and EU seasonally- and calendar-adjusted quarterly growth rates of employment in persons, estimated at 45 days after the end-of-quarter ([11]).

The fourth criterion was a non-technical one that did not relate to the test estimates. It was more general in nature and would require a communication plan to be available before the start of the official release of the European employment flash estimates.

1. Limited average revision

The employment flash estimate should be an unbiased estimate of the t+75 estimate of employment in persons, with an average revision of between -0.05 and +0.05 percentage points.

This criterion has been set to test for bias. The ideal way of testing for bias would be to perform a statistical test. As the sample was too small for this type of test, the recommendation was to use the boundaries -0.05 and +0.05 percentage points. This criterion was the same as the one used for the assessment of the GDP t+30 test estimates, and slightly more relaxed than the average revision of the complete euro area employment t+165 estimates, as presented in Section 3.3. This is justified by the fact that flash estimates have to be based on source information that is incomplete – often only

([10]) Since the contributions to flash estimates are not required by regulation but based on "gentleman's agreements", Eurostat regularly consults countries on the release calendar for the following year to ensure and seeks their commitment for continued contributions to ensure that contributions are sufficient in terms of coverage and well-coordinated.

([11]) The t+30 estimates were provisionally evaluated against the same quality criteria, although it is worth considering whether the same criteria and thresholds should apply.

two of the three months are covered – and are thus more liable to be revised subsequently.

This criterion was tested on all the available test data (from the first flash estimate in 2015Q1 onwards) and should be kept under review once the estimates are published. It was tested for the real-time quarters separately.

2. Limited average absolute revision

The average absolute revision made to the t+45 estimates of the quarterly euro area and EU employment growth rates should be less than or equal to 0.10 percentage points when the regular t+75 employment estimate is published.

This criterion has been set to ensure that the levels of revisions made to the employment flash estimates were acceptable. In theory, criterion 1 (that the average revision must be between -0.05 and +0.05 percentage points) could be met if there were large offsetting revisions in both directions, which would be undesirable. Criterion 2 should guard against this.

Compared to the observed average absolute revision of the regular t+75 employment estimate at t+165, the boundaries for this criterion might be considered rather generous. However, as for the average revision, the fact that flash estimates have to be based on incomplete source information may justify this choice. Furthermore, it should be borne in mind that the employment flash estimates for the euro area and the EU are statistics in development, so the average absolute revision is likely to be relatively high at the start but decrease over time. Finally, the same criterion and identical boundaries were applied for the assessment of the GDP t+30 test estimates.

This criterion was assessed on data for all test quarters, and was also assessed on the data for the real-time quarters separately.

As regards the application of the two quality assessment criteria presented above, one amendment is proposed. If an obvious and substantial mistake is detected in a particular country estimate, the resulting euro area and EU estimate will not take into account the quarter concerned for the calculation of the average revision, the average absolute revision or the root mean square error.

3. Sufficient coverage

The four most recent test quarters should fulfil the following criterion: the input of Member States' national estimates of employment in persons must cover at least 75% of the euro area and EU totals. The coverage percentages for the first and the second quarters were calculated on the basis of the annual data on employment in persons for year y-2, while for the third and fourth quarters, the annual data for year y-1 were used, since updated annual figures for the previous year were then transmitted by all Member States. The test estimates should not only meet this criterion in the past, but there should also be no known reason why it would not be met for quarters in 2018 and later. This was ensured by obtaining commitments from the representatives of the Member States concerned to continue to provide national data in the future[12].

This criterion should ensure sufficient coverage at the t+45 deadline, by reducing the likelihood of insufficient data at national level impacting the quality of employment flash estimates for the euro area and the EU. As explained in Section 3.3, the coverage criterion was applied to the four most recent test quarters only, as these quarters were expected to reflect, better than earlier quarters, the expected future coverage for the regular production and publication of employment flash estimates.

The coverage criterion chosen was stricter than the one used for the assessment of the GDP t+30 test estimates; for the latter, the criterion was 70% coverage for the last two quarters. The first reason for choosing this higher threshold was that better coverage should generate better values for the average and absolute average revision indicators as well. The second reason was that the

([12]) When discussing the possible advanced start of publication of the t+45 employment flash estimates, all 21 Member States contributing to the last test estimates for 2018Q1 confirmed their commitment to continue to send their national employment estimates in the future.

choice of a high coverage percentage is in line with the view, shared by Eurostat and the Member States, that the European employment estimates should be based mainly on inputs from the Member States, and that the use of modelling and indicators should remain limited.

4. Availability of communication plan

A fourth, more general requirement was that a communication plan (and related documents) must be made available well before the start of official releases of the euro area and EU employment estimates.

As monthly LFS unemployment data are already published one month after the reference period, the first release of employment in persons according to the definition used in national accounts is not expected to be a very sensitive issue (unlike the first launch of GDP t+30 data). However, it is still important to prepare users for the first releases the t+45 (and t+30) employment flash estimates. Having a good communication plan in place would help them to better understand and interpret the new statistics. It should also make users aware that there is always a trade-off between timeliness and accuracy-reliability, and that improved timeliness will almost certainly mean more revisions, compared to the current revisions of the regular t+75 employment estimates.

4 Results and assessment of the employment flash estimates

4.1 Introduction

Chapter 2 discusses the way in which the euro area and EU employment flash estimates were drawn up, and Chapter 3 defines the quality assessment criteria against which the test estimates were assessed. This chapter presents the results and assessment of the test estimates over the 2015Q1-2018Q1 period. Of these, the estimates for 2015Q1-2016Q4 were produced retrospectively, while those for 2017Q1-2018Q1 were real-time estimates. Testing of estimates will also continue for the remaining quarters of 2018. Euro area and EU test estimates were produced both for the seasonally- and calendar-adjusted quarter-on-quarter growth rates of variable employment in persons and for the unadjusted year-on-year growth rates. As explained in Section 2.2, three alternative estimates were made; see in particular Table 2.1. The test estimates were produced both at 30 days and at 45 days after the end of the reference quarter.

Section 4.2 presents the results of the t+45 test estimates and the assessment of these results, and Section 4.3 presents the results and their assessment for the t+30 test estimates. Section 4.4 summarises the main conclusions.

4.2 Results of European employment test estimates at t+45 days

This section presents the results of the euro area and EU employment test estimates compiled at t+45 days. As explained in Section 3.3, for the quarters where estimates were produced retrospectively (2015Q1-2016Q4), Member States were asked to provide estimates using only primary source data that would have been available within 45 days after the end of the reference quarter. For these quarters, Germany, the Netherlands and the UK, already published their employment flash estimates around that time, so for these Member States, the published national data were used. Confidential data were received from 14 other EU Member States. For 2017Q1-2018Q1, published data from Germany, the Netherlands and the UK were again used, along with employment data from between 11 to 18 other Member States, sent confidentially, as input for the European estimations (only).

According to the first method, the non-reporting Member States were assumed to have the weighted growth rates of the reporting Member States. One large Member State was missing for most of the retrospective quarters (2015Q1-2016Q4) in the test exercise. In the second method, the estimates for this Member State were made with the help of a model, and the remaining Member States were again assumed to have the weighted growth rates. In addition to the model estimates for one large Member State, the third estimation method also used LFS estimates used for one (2018Q1) to three (2015Q1) non-reporting Member States, while the remaining missing Member States were again assumed to have the weighted growth rates.

Results and analysis of the quarter-on-quarter European employment estimates at t+45 days

Tables 4.1 and 4.2 show the estimated and analysed results of the quarter-on-quarter growth rates for the euro area and the EU. They also show how the t+45 estimates were revised when subsequent estimates were made at t+75 and t+165 days. Table 4.3 contains coverage information: the number of Member States that provided national estimates and their coverage expressed as a percentage of euro area and EU total employment in persons.

Table 4.1 compares, for the three methods used, the euro area growth rates of the t+45 test estimates with the subsequent regular estimates at t+75 and t+165 days – and the resulting revisions.

Table 4.1: Euro area, t+45 employment test estimates compared with t+75 and t+165 estimates
(Quarter-on-quarter employment growth rates, in % and revisions of growth rates, in percentage points)

	Estimates at t+45, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+75	T+165	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS
2015Q1	0.22	0.18	0.17	0.15	0.19	-0.07	-0.03	-0.02	-0.03	0.02	0.02
2015Q2	0.32	0.27	0.26	0.33	0.39	0.00	0.05	0.07	0.07	0.11	0.13
2015Q3	0.32	0.29	0.29	0.28	0.31	-0.04	0.00	0.00	-0.02	0.02	0.02
2015Q4	0.38	0.34	0.33	0.31	0.32	-0.07	-0.03	-0.02	-0.06	-0.01	-0.01
2016Q1	0.37	0.32	0.31	0.34	0.35	-0.02	0.02	0.03	-0.01	0.04	0.05
2016Q2	0.39	0.35	0.35	0.39	0.35	0.00	0.04	0.04	-0.04	0.00	0.00
2016Q3	0.26	0.24	0.24	0.21	0.20	-0.05	-0.03	-0.03	-0.06	-0.04	-0.04
2016Q4	0.29	0.28	0.28	0.25	0.36	-0.04	-0.03	-0.03	0.07	0.08	0.09
2017Q1	0.46	0.42	0.44	0.43	0.50	-0.04	0.00	-0.01	0.04	0.08	0.07
2017Q2	0.43	0.41	0.41	0.42	0.44	-0.01	0.01	0.01	0.01	0.03	0.03
2017Q3	0.39	0.39	0.39	0.39	0.38	0.00	0.00	0.00	0.00	0.00	0.00
2017Q4	0.28	0.28	0.28	0.27	0.26	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
2018Q1	0.38	0.38	0.38	0.38		0.00	0.00	0.00			
Average revision, all quarters						-0.03	0.00	0.00	0.00	0.02	0.03
Average absolute revision, all quarters						0.03	0.02	0.02	0.03	0.04	0.04
Root mean squared error, all quarters						0.04	0.03	0.03	0.04	0.05	0.05
Average revision, 2017Q1-2018Q1						-0.01	0.00	0.00	0.01	0.02	0.02
Average absolute revision, 2017Q1-2018Q1						0.01	0.01	0.01	0.02	0.03	0.03
Root mean squared error, 2017Q1-2018Q1						0.02	0.01	0.01	0.02	0.04	0.04

Source: Eurostat calculations

The revisions of the t+45 employment test estimates at t+75 days were very limited. The first method showed a slight upward bias in the t+45 estimates. The second method and the third, however, showed no such bias. The bias in the first method arose mainly from the fact that one large Member State, whose growth rates have differed systematically from the euro area average, was missing. When the second and third methods were applied, on the other hand, growth rates for this Member State were estimated using an econometric model. The model estimations were used in the second and third method, and the resulting revisions were very limited: at publication level (one digit) they equalled 0.0 percentage points for all quarters except one (second method), or except two (third method) ([13]). Consequently, the average revision, average absolute revision and the root mean squared error over 2015Q1-2018Q1 were also very small. The average revision, average absolute revision and root mean squared error for only the five real-time quarters of 2017Q1-2018Q1, which were considered to be more representative for a future publication situation than the earlier quarters, showed even lower values.

Table 4.2 shows the same information as Table 4.1, but for the EU as a whole.

([13]) Where the text discusses the one decimal revisions, they are calculated as the differences between the one decimal rounded t+75 estimates and the one decimal rounded t+45 flash estimates.

Table 4.2: EU, t+45 employment test estimates compared with t+75 and t+165 estimates
(Quarter-on-quarter employment growth rates, in % and revisions of growth rates, in percentage points)

	Estimates at t+45, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+75	T+165	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS
2015Q1	0.36	0.32	0.30	0.29	0.32	-0.08	-0.03	-0.01	-0.05	0.00	0.01
2015Q2	0.22	0.20	0.18	0.21	0.27	-0.01	0.01	0.03	0.05	0.07	0.08
2015Q3	0.35	0.32	0.33	0.36	0.35	0.02	0.05	0.04	0.00	0.03	0.02
2015Q4	0.46	0.41	0.42	0.14	0.35	-0.31	-0.27	-0.27	-0.10	-0.06	-0.07
2016Q1	0.36	0.32	0.33	0.35	0.35	-0.01	0.02	0.02	-0.01	0.03	0.02
2016Q2	0.41	0.38	0.39	0.33	0.34	-0.08	-0.05	-0.06	-0.07	-0.04	-0.05
2016Q3	0.24	0.23	0.21	0.19	0.18	-0.05	-0.04	-0.02	-0.06	-0.05	-0.04
2016Q4	0.27	0.26	0.27	0.23	0.39	-0.04	-0.04	-0.04	0.12	0.12	0.12
2017Q1	0.48	0.45	0.47	0.41	0.47	-0.06	-0.03	-0.05	0.00	0.03	0.01
2017Q2	0.46	0.44	0.44	0.42	0.51	-0.04	-0.02	-0.02	0.05	0.07	0.07
2017Q3	0.29	0.29	0.29	0.28	0.23	-0.01	-0.01	-0.01	-0.05	-0.05	-0.06
2017Q4	0.25	0.25	0.26	0.24	0.24	-0.02	-0.02	-0.02	-0.01	-0.01	-0.02
2018Q1	0.42	0.42	0.42	0.43		0.01	0.01	0.01			
Average revision, all quarters						-0.05	-0.03	-0.03	-0.01	0.01	0.01
Average absolute revision, all quarters						0.06	0.05	0.05	0.05	0.05	0.05
Root mean squared error, all quarters						0.10	0.08	0.08	0.06	0.06	0.06
Average revision, 2017Q1-2018Q1						-0.02	-0.01	-0.02	-0.01	0.01	0.00
Average absolute revision, 2017Q1-2018Q1						0.03	0.02	0.02	0.03	0.04	0.04
Root mean squared error, 2017Q1-2018Q1						0.04	0.02	0.03	0.04	0.05	0.05

Source: Eurostat calculations

The analysis of the quarter-on-quarter employment test estimates for the euro area (Table 4.1) is largely applicable to the EU results (Table 4.2) as well. Here too, the t+45 employment test estimates according to the first estimation method at t+75 days have been systematically revised downwards. The explanation is the same – a missing large Member State with growth rates different from the EU average. Once this country was included in the second and third estimates, using a model estimate, the bias largely disappeared. For most quarters, the revisions at t+75 days at one digit level were 0.0 percentage points again. For some quarters, however, figures were revised by -0.1 or 0.1 percentage points, and for one quarter the revision figure was -0.3 percentage points. The -0.3 percentage point revision can be explained fully by the fact that a large Member State provided t+75 data which contained a reporting error, and this error was not corrected until after publication. Statistics for the average revision, average absolute revision and root mean squared error again showed moderate values. These statistics were even smaller when considering only the real-time quarters.

Table 4.3 presents the number of Member States that supplied data which were included in the European estimates, and the corresponding coverage percentages.

Table 4.3: Coverage of country contributions in euro area and EU total employment
(Number of countries submitting data; coverage as % of euro area and EU employment in number of persons)

	Euro area 19						EU 28					
	T+45		T+75		T+165		T+45		T+75		T+165	
	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %
2015Q1	11	74.5	18	99.7	19	100.0	17	75.9	27	99.8	28	100.0
2015Q2	11	74.5	19	100.0	19	100.0	17	75.9	28	100.0	28	100.0
2015Q3	11	74.5	19	100.0	19	100.0	17	75.9	28	100.0	28	100.0
2015Q4	11	74.5	18	99.8	19	100.0	17	75.9	27	99.8	28	100.0
2016Q1	11	74.5	18	99.7	19	100.0	17	75.9	27	99.8	28	100.0
2016Q2	11	74.5	19	100.0	19	100.0	17	75.9	28	100.0	28	100.0
2016Q3	11	74.5	19	100.0	19	100.0	17	75.9	28	100.0	28	100.0
2016Q4	11	74.5	19	100.0	19	100.0	17	75.9	28	100.0	28	100.0
2017Q1	10	71.9	19	100.0	19	100.0	14	66.5	28	100.0	28	100.0
2017Q2	13	76.9	18	99.7	19	100.0	19	78.2	27	99.8	28	100.0
2017Q3	13	93.4	18	99.7	19	100.0	21	89.9	27	99.8	28	100.0
2017Q4	14	95.0	18	99.7	19	100.0	21	91.0	27	99.8	28	100.0
2018Q1	14	95.0	18	98.7			21	91.0	27	99.1		

Source: Eurostat calculations

Table 4.3 shows that between 10 and 14 euro area Member States provided national estimates that were used as input to calculate the aggregate euro area employment estimate. The corresponding coverage percentages constituted between 72 % (2017Q1) and 95 % (2018Q1) of total euro area employment in thousands of persons.

For the EU employment estimates, national estimates were available for between 14 to 21 EU Member States, corresponding to coverage percentages of between 67 % (2017Q1) and 91 % (2018Q1).

For the four latest test quarters, both the euro area and EU aggregates were above the predefined quality threshold of 75 %.

Results and analysis of the year-on-year European employment estimates at t+45 days

Whereas Tables 4.1 and 4.2 include the European quarter-on-quarter employment estimates and their revisions, Tables 4.4 and 4.5 provide similar information on European year-on-year growth rates and the revised figures at t+75 and t+165 days. The coverage information for the year-on-year estimates differed only slightly from the corresponding quarter-on-quarter information as presented in Table 4.3 and is not shown.

Table 4.4 shows the euro area year-on-year growth rate test estimates at t+45, t+75 and t+165 days, and the t+45 revisions at t+75 and t+165 days.

Table 4.4: Euro area, t+45 employment test estimates compared with t+75 and t+165 estimates
(Year-on-year employment growth rates, in % and revisions of growth rates, in percentage points)

	Estimates at t+45, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+75	T+165	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS
2015Q1	1.04	0.85	0.83	0.81	0.82	-0.23	-0.04	-0.01	-0.23	-0.03	-0.01
2015Q2	0.97	0.80	0.77	0.85	0.98	-0.12	0.04	0.08	0.01	0.18	0.22
2015Q3	1.20	1.02	0.99	1.09	1.06	-0.11	0.07	0.10	-0.14	0.04	0.07
2015Q4	1.28	1.13	1.10	1.18	1.24	-0.10	0.05	0.08	-0.03	0.11	0.15
2016Q1	1.53	1.36	1.33	1.41	1.45	-0.13	0.05	0.08	-0.09	0.09	0.12
2016Q2	1.58	1.45	1.42	1.41	1.34	-0.17	-0.04	-0.01	-0.24	-0.11	-0.08
2016Q3	1.36	1.24	1.22	1.18	1.22	-0.18	-0.06	-0.04	-0.14	-0.02	0.00
2016Q4	1.28	1.18	1.16	1.15	1.36	-0.13	-0.03	-0.01	0.08	0.18	0.20
2017Q1	1.54	1.39	1.45	1.45	1.56	-0.09	0.06	0.00	0.02	0.16	0.11
2017Q2	1.74	1.61	1.61	1.59	1.61	-0.15	-0.02	-0.02	-0.13	0.00	0.00
2017Q3	1.71	1.71	1.71	1.72	1.70	0.01	0.01	0.01	-0.01	-0.01	-0.01
2017Q4	1.57	1.57	1.57	1.62	1.59	0.05	0.05	0.05	0.02	0.02	0.02
2018Q1	1.42	1.42	1.42	1.44		0.02	0.02	0.02			
Average revision, all quarters						-0.10	0.01	0.02	-0.07	0.05	0.06
Average absolute revision, all quarters						0.11	0.04	0.04	0.09	0.08	0.08
Root mean squared error, all quarters						0.13	0.04	0.05	0.12	0.10	0.11
Average revision, 2017Q1-2018Q1						-0.03	0.02	0.01	-0.03	0.04	0.03
Average absolute revision, 2017Q1-2018Q1						0.06	0.03	0.02	0.05	0.05	0.04
Root mean squared error, 2017Q1-2018Q1						0.08	0.04	0.03	0.07	0.08	0.06

Source: Eurostat calculations

The euro area year-on-year employment growth rates were revised by a larger amount at t+75 days than the quarter-on-quarter growth rates, given the nature of the quantities measured. The fact that the figures were revised downwards shows that the t+45 estimates made using the first estimation method now showed a clearer upward bias because one large Member State with growth rates differing systematically from the euro area average was missing. At one digit level, the figures were revised by -0.2 (five times), -0.1 (four times) and 0.0 percentage points (four times). The estimates produced using the second and third estimation methods were better and showed no upward bias. The figures resulting from both the second and third method were revised by -0.1 (once), 0.0 (nine times) and 0.1 percentage points (three times). The average revision, average absolute revision and the root mean squared error over 2015Q1-2018Q1 were very small, except for the first method (average revision of -0.10 and average absolute revision of 0.11 percentage points). Taking into account only the real-time quarters, the average revision, average absolute revision and root mean squared error were even smaller for all three estimates.

Table 4.5 presents the EU year-on-year growth rate test estimates at t+45, t+75 and t+165, and the t+45 revisions at t+75 and t+165 days.

Table 4.5: EU, t+45 employment test estimates compared with t+75 and t+165 estimates
(Year-on-year employment growth rates, in % and revisions of growth rates, in percentage points)

	Estimates at t+45, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+75	T+165	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS
2015Q1	1.30	1.13	1.14	1.11	1.01	-0.19	-0.02	-0.03	-0.29	-0.12	-0.13
2015Q2	1.08	0.95	0.94	0.88	1.04	-0.20	-0.07	-0.06	-0.04	0.09	0.11
2015Q3	1.21	1.09	1.06	1.12	1.04	-0.09	0.04	0.07	-0.17	-0.05	-0.02
2015Q4	1.41	1.29	1.27	0.97	1.29	-0.44	-0.32	-0.30	-0.11	0.01	0.02
2016Q1	1.49	1.37	1.38	1.36	1.40	-0.13	-0.01	-0.02	-0.08	0.03	0.03
2016Q2	1.63	1.53	1.55	1.47	1.37	-0.16	-0.06	-0.09	-0.26	-0.16	-0.18
2016Q3	1.31	1.24	1.24	1.12	1.07	-0.19	-0.12	-0.12	-0.24	-0.17	-0.17
2016Q4	1.13	1.08	1.09	0.99	1.14	-0.14	-0.09	-0.10	0.01	0.06	0.05
2017Q1	1.49	1.39	1.46	1.41	1.52	-0.08	0.02	-0.05	0.03	0.13	0.07
2017Q2	1.60	1.53	1.54	1.48	1.67	-0.12	-0.05	-0.06	0.07	0.15	0.13
2017Q3	1.59	1.59	1.62	1.76	1.64	0.16	0.16	0.14	0.05	0.05	0.02
2017Q4	1.44	1.44	1.45	1.51	1.49	0.07	0.07	0.05	0.05	0.05	0.04
2018Q1	1.36	1.36	1.39	1.42		0.05	0.05	0.03			
Average revision, all quarters						-0.11	-0.03	-0.04	-0.08	0.01	0.00
Average absolute revision, all quarters						0.15	0.08	0.08	0.12	0.09	0.08
Root mean squared error, all quarters						0.18	0.11	0.10	0.16	0.11	0.10
Average revision, 2017Q1-2018Q1						0.02	0.05	0.02	0.05	0.09	0.06
Average absolute revision, 2017Q1-2018Q1						0.08	0.05	0.05	0.05	0.09	0.07
Root mean squared error, 2017Q1-2018Q1						0.08	0.05	0.05	0.05	0.12	0.09

Source: Eurostat calculations

The revision pattern of the quarter-on-quarter growth rates shown in Table 4.2 is more clearly visible in the EU year-on-year growth rates shown in Table 4.5. As for the quarter-on-quarter EU growth rates, revisions according to the first estimation method were negative for all quarters except three, and vary between -0.4 and 0.2 percentage points. However, the addition of a model estimate (second method) and LFS data (third method) significantly improved the revision results, bringing them down to values between -0.1 and 0.2 percentage points. There was one exception: estimates made by all three methods showed large negative revisions for 2015Q4. This was the consequence of the reporting error in the t+75 data provided by one large Member State. The figures shown in Table 4.5 for the average revision, average absolute revision and root mean squared error were similar to those for the euro area shown in Table 4.4, in that they were highest for the first method and smaller for the real-time quarters than for the full series 2015Q1-2018Q1. However, generally, these statistics for the year-on-year EU growth rate revisions were, while still moderate, less favourable than the corresponding statistics for the euro area.

4.3 Results of European t+30 employment test estimates

This section presents the results of the euro area and EU employment test estimates compiled at t+30 days. For the back-quarters (2015Q1-2016Q4), published data for Germany and confidential data supplied for five or six other Member States were used. For the real-time quarters, confidential employment data on between five to ten Member States were used as input into European estimates, in addition to the published data from Germany.

As for the European t+45 employment test estimates, the estimates made at t+30 were prepared for the both the quarter-on-quarter and year-on-year growth rates. For both, three alternative estimates were again made, using the first, second and third methods described above. As regards the third method, some large Member States were missing for most of the back-quarters (2015Q1-2016Q4) in the test exercise. So far, the growth rates of only one Member State were estimated with the help of a model. As regards the third method, depending on the test quarter, LFS indicators were used for

four (2018Q1) to seven (2015Q1) Member States.

The results for the euro area and EU t+30 employment flash estimates are presented in Tables 4.6 to 4.10. As the results show similar patterns to those discussed in Section 4.2 for the t+45 estimates, they will be summarised by main conclusions only.

Tables 4.6 and 4.7 show the estimated and analysed results of the euro area and EU quarter-on-quarter growth rates at t+30, t+75 and t+165 days and the revisions of the t+30 test estimates at t+75 and t+165 days. Table 4.8 contains information on the coverage of employment data provided by euro area Member States and on EU totals. Tables 4.9 and 4.10 provide the year-on-year growth rates at t+30, t+75 and t+165 days, and the subsequent revisions to the t+30 estimates at t+75 and t+165 days.

Table 4.6: Euro area, t+30 employment test estimates compared with t+75 and t+165 estimates
(Quarter-on-quarter employment growth rates, in% and revisions of growth rates, in percentage points)

	Estimates at t+30, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+75	T+165	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS
2015Q1	0.30	0.22	0.15	0.15	0.19	-0.15	-0.07	0.00	-0.11	-0.02	0.04
2015Q2	0.42	0.32	0.30	0.33	0.39	-0.09	0.01	0.02	-0.03	0.07	0.09
2015Q3	0.33	0.28	0.34	0.28	0.31	-0.05	0.00	-0.06	-0.03	0.03	-0.03
2015Q4	0.46	0.38	0.29	0.31	0.32	-0.15	-0.07	0.02	-0.14	-0.05	0.03
2016Q1	0.46	0.37	0.32	0.34	0.35	-0.12	-0.02	0.02	-0.11	-0.01	0.03
2016Q2	0.35	0.31	0.41	0.39	0.35	0.03	0.08	-0.03	0.00	0.04	-0.06
2016Q3	0.29	0.26	0.29	0.21	0.20	-0.08	-0.05	-0.09	-0.09	-0.06	-0.10
2016Q4	0.24	0.24	0.24	0.25	0.36	0.01	0.01	0.01	0.12	0.12	0.12
2017Q1	0.50	0.43	0.41	0.43	0.50	-0.07	-0.01	0.02	0.00	0.07	0.09
2017Q2	0.36	0.35	0.36	0.42	0.44	0.06	0.07	0.06	0.08	0.09	0.08
2017Q3	0.39	0.36	0.36	0.39	0.38	0.00	0.03	0.02	-0.01	0.03	0.02
2017Q4	0.28	0.24	0.27	0.27	0.26	-0.01	0.02	0.00	-0.01	0.02	-0.01
2018Q1	0.41	0.37	0.39	0.38		-0.03	0.00	-0.02			
Average revision, all quarters						-0.05	0.00	0.00	-0.03	0.03	0.03
Average absolute revision, all quarters						0.07	0.03	0.03	0.06	0.05	0.06
Root mean squared error, all quarters						0.08	0.04	0.04	0.08	0.00	0.00
Average revision, 2017Q1-2018Q1						-0.01	0.02	0.01	0.02	0.05	0.05
Average absolute revision, 2017Q1-2018Q1						0.03	0.03	0.02	0.02	0.05	0.05
Root mean squared error, 2017Q1-2018Q1						0.04	0.03	0.03	0.04	0.06	0.06

Source: Eurostat calculations

Table 4.7: EU, t+30 employment test estimates compared with t+75 and t+165 estimates
(Quarter-on-quarter employment growth rates, in % and revisions of growth rates, in percentage points)

	Estimates at t+30, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+75	T+165	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS
2015Q1	0.31	0.23	0.16	0.29	0.32	-0.02	0.06	0.13	0.00	0.09	0.16
2015Q2	0.42	0.32	0.30	0.21	0.27	-0.21	-0.11	-0.09	-0.15	-0.06	-0.04
2015Q3	0.32	0.27	0.34	0.36	0.35	0.05	0.10	0.03	0.03	0.08	0.01
2015Q4	0.47	0.38	0.31	0.14	0.35	-0.33	-0.24	-0.17	-0.12	-0.03	0.04
2016Q1	0.45	0.36	0.36	0.35	0.35	-0.10	-0.01	-0.01	-0.10	-0.01	-0.01
2016Q2	0.35	0.31	0.42	0.33	0.34	-0.01	0.02	-0.09	0.00	0.04	-0.08
2016Q3	0.30	0.27	0.26	0.19	0.18	-0.10	-0.07	-0.07	-0.12	-0.09	-0.09
2016Q4	0.23	0.23	0.26	0.23	0.39	0.00	0.00	-0.03	0.16	0.16	0.13
2017Q1	0.50	0.43	0.39	0.41	0.47	-0.08	-0.02	0.02	-0.02	0.04	0.08
2017Q2	0.36	0.35	0.35	0.42	0.51	0.06	0.07	0.07	0.15	0.16	0.16
2017Q3	0.38	0.35	0.38	0.28	0.23	-0.10	-0.07	-0.10	-0.15	-0.12	-0.14
2017Q4	0.28	0.25	0.27	0.24	0.24	-0.04	-0.01	-0.03	-0.04	-0.01	-0.03
2018Q1	0.39	0.35	0.39	0.43		0.04	0.07	0.04			
Average revision, all quarters						-0.07	-0.02	-0.02	-0.03	0.02	0.02
Average absolute revision, all quarters						0.09	0.07	0.07	0.09	0.07	0.08
Root mean squared error, all quarters						0.12	0.09	0.08	0.11	0.01	0.01
Average revision, 2017Q1-2018Q1						-0.03	0.01	0.00	-0.02	0.02	0.02
Average absolute revision, 2017Q1-2018Q1						0.07	0.05	0.05	0.09	0.08	0.10
Root mean squared error, 2017Q1-2018Q1						0.07	0.06	0.06	0.11	0.10	0.12

Source: Eurostat calculations

Table 4.8: Coverage of country contributions in euro area and EU total employment
(Number of Member States sending data; coverage as % of euro area and EU employment in number of persons)

	Euro area 19						EU 28					
	T+30		T+75		T+165		T+30		T+75		T+165	
	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %	Nr of MS	Coverage in %
2015Q1	6	48	18	99.7	19	100	7	32	27	99.8	28	100
2015Q2	6	48	19	100.0	19	100	7	32	28	100.0	28	100
2015Q3	6	48	19	100.0	19	100	7	32	28	100.0	28	100
2015Q4	6	48	18	99.8	19	100	7	32	27	99.8	28	100
2016Q1	6	48	18	99.7	19	100	7	32	27	99.8	28	100
2016Q2	6	48	19	100.0	19	100	7	32	28	100.0	28	100
2016Q3	7	64	19	100.0	19	100	8	43	28	100.0	28	100
2016Q4	7	64	19	100.0	19	100	8	43	28	100.0	28	100
2017Q1	6	49	19	100.0	19	100	6	32	28	100.0	28	100
2017Q2	8	66	18	99.7	19	100	9	45	27	99.8	28	100
2017Q3	8	66	18	99.7	19	100	10	46	27	99.8	28	100
2017Q4	8	66	18	99.7	19	100	10	46	27	99.8	28	100
2018Q1	8	66	18	98.7			11	48	27	99.1		

Source: Eurostat calculations

Table 4.9: Euro area, t+30 employment test estimates compared with t+75 and t+165 estimates
(Year-on-year employment growth rates, in % and revisions of growth rates, in percentage points)

	Estimates at t+30, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+75	T+165	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS
2015Q1	1.29	0.96	0.87	0.81	0.82	-0.48	-0.15	-0.06	-0.47	-0.14	-0.05
2015Q2	1.27	0.95	0.90	0.85	0.98	-0.42	-0.11	-0.05	-0.28	0.03	0.09
2015Q3	1.36	1.07	1.05	1.09	1.06	-0.27	0.02	0.04	-0.30	0.00	0.01
2015Q4	1.56	1.28	1.13	1.18	1.24	-0.39	-0.10	0.05	-0.32	-0.04	0.12
2016Q1	1.73	1.43	1.30	1.41	1.45	-0.32	-0.02	0.11	-0.28	0.02	0.15
2016Q2	1.58	1.40	1.47	1.41	1.34	-0.17	0.01	-0.06	-0.24	-0.06	-0.13
2016Q3	0.98	0.93	0.99	1.18	1.22	0.20	0.25	0.19	0.24	0.29	0.23
2016Q4	1.21	1.11	1.16	1.15	1.36	-0.06	0.04	-0.02	0.15	0.25	0.19
2017Q1	1.71	1.46	1.55	1.45	1.56	-0.25	-0.01	-0.10	-0.15	0.10	0.01
2017Q2	1.53	1.43	1.46	1.59	1.61	0.06	0.16	0.13	0.08	0.18	0.14
2017Q3	1.71	1.57	1.57	1.72	1.70	0.01	0.15	0.15	-0.01	0.12	0.12
2017Q4	1.68	1.51	1.54	1.62	1.59	-0.06	0.11	0.08	-0.09	0.08	0.06
2018Q1	1.40	1.29	1.36	1.44		0.04	0.15	0.08			
Average revision, all quarters						-0.16	0.04	0.04	-0.14	0.07	0.08
Average absolute revision, all quarters						0.21	0.10	0.08	0.22	0.11	0.11
Root mean squared error, all quarters						0.26	0.12	0.10	0.25	0.02	0.02
Average revision, 2017Q1-2018Q1						-0.04	0.11	0.07	-0.04	0.12	0.08
Average absolute revision, 2017Q1-2018Q1						0.09	0.12	0.11	0.08	0.12	0.08
Root mean squared error, 2017Q1-2018Q1						0.12	0.13	0.11	0.10	0.13	0.10

Source: Eurostat calculations

Table 4.10: EU, t+30 employment test estimates compared with t+75 and t+165 estimates
(Year-on-year employment growth rates, in % and revisions of growth rates, in percentage points)

	Estimates at t+30, t+75, t+165					Revisions at t+75			Revisions at t+165		
	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+75	T+165	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS	T+30 trans-mission	T+30 trans. + model	T+30 trans. + model + LFS
2015Q1	1.30	0.97	0.95	1.11	1.01	-0.19	0.14	0.16	-0.29	0.04	0.07
2015Q2	1.29	0.98	0.96	0.88	1.04	-0.42	-0.10	-0.08	-0.25	0.06	0.08
2015Q3	1.33	1.05	1.03	1.12	1.04	-0.20	0.08	0.09	-0.29	-0.01	0.00
2015Q4	1.56	1.28	1.15	0.97	1.29	-0.59	-0.31	-0.18	-0.27	0.01	0.15
2016Q1	1.71	1.42	1.35	1.36	1.40	-0.36	-0.06	0.00	-0.31	-0.02	0.05
2016Q2	1.55	1.38	1.52	1.47	1.37	-0.09	0.09	-0.05	-0.18	-0.01	-0.15
2016Q3	1.00	0.94	1.07	1.12	1.07	0.12	0.17	0.05	0.07	0.12	0.00
2016Q4	1.19	1.10	1.21	0.99	1.14	-0.20	-0.11	-0.22	-0.05	0.04	-0.07
2017Q1	1.71	1.46	1.53	1.41	1.52	-0.30	-0.05	-0.12	-0.19	0.06	-0.01
2017Q2	1.53	1.43	1.48	1.48	1.67	-0.04	0.06	0.01	0.15	0.25	0.20
2017Q3	1.70	1.57	1.62	1.76	1.64	0.06	0.18	0.14	-0.06	0.07	0.02
2017Q4	1.70	1.53	1.56	1.51	1.49	-0.19	-0.02	-0.06	-0.21	-0.04	-0.08
2018Q1	1.43	1.32	1.42	1.42		-0.01	0.09	0.00			
Average revision, all quarters						-0.19	0.01	-0.02	-0.16	0.05	0.02
Average absolute revision, all quarters						0.21	0.11	0.09	0.19	0.06	0.07
Root mean squared error, all quarters						0.27	0.13	0.11	0.21	0.01	0.01
Average revision, 2017Q1-2018Q1						-0.10	0.05	-0.01	-0.08	0.08	0.03
Average absolute revision, 2017Q1-2018Q1						0.12	0.08	0.06	0.15	0.10	0.08
Root mean squared error, 2017Q1-2018Q1						0.16	0.10	0.09	0.16	0.13	0.11

Source: Eurostat calculations

The main conclusions regarding the t+30 test estimates are as follows:

- All t+30 test results – revisions for the quarter-on-quarter and year-on-year estimates, for the euro area and the EU, for each of the three methods used – were somewhat larger than the corresponding t+45 test results;
- However, the results were still satisfactory. Almost all revised figures at t+75 days, apart from 2015Q4 estimates for the EU, were between -0.1 and 0.1 percentage points of the t+30 quarter-on-quarter estimates, for each of the three methods. The resulting average revision, average absolute revision and root mean squared error were limited too. For the year-on-year estimates, the results produced by the second and third methods for revisions at t+75 days were also quite acceptable: between -0.2 and 0.2 of the t+30 test estimates for most quarters. The estimates produced with these two methods also showed satisfactory outcomes for average revision, average absolute revision and root mean squared error. The results produced with the first method were less satisfactory, and the estimates showed an upward bias. Average revision, average absolute revision and root mean squared error were significantly higher than those produced with the other two methods;
- One significant difference between the t+30 and t+45 test estimates concerned the coverage. The coverage of the t+30 estimates was significantly lower than for the t+45 estimates. For the back-quarters (2015Q1-2016Q4), the coverage of the national data provided by the Member States as a percentage of total euro area/EU employment varied between 48 % and 64 % for the euro area, and between 32 % and 43 % for the EU. For the real-time quarters, coverage was between 49 % and 66 % for the euro area, and between 32 % and 48 % for the EU;
- Two observations mentioned in Section 4.2 also apply to the t+30 estimates. First, the results produced with the second and third estimation methods were, in terms of revisions, better than results generated with the first method. The results of the first method also showed upward bias. Second, both the EU quarter-on-quarter and year-on-year estimates for 2015Q4 showed higher revisions at t+75 days than the other quarters. This was because one Member State made a significant error in the t+75 data it provided, which could not be corrected before publication.

4.4 Assessment of European employment test estimates

Sections 4.2 and 4.3 presented and analysed the euro area and EU test estimates at t+45 and t+30 days, respectively. This section assesses the main estimation results against the predefined quality criteria.

Assessment of the euro area and EU test estimates at t+45 days

Table 4.11 shows the key results of the three t+45 quarter-on-quarter estimations for the euro area and the EU and their assessment against the predefined quality acceptance criteria.

Apart from the quarter 2015Q4 for the EU, the revisions of growth rates for the t+45 test estimates for all three sets of test quarters were between -0.1 and 0.1 percentage points. The exceptional revisions for 2015Q4 are explained in Sections 4.2 and 4.3 above. In contrast to the values shown in Table 4.2, the quarter 2015Q4 for the EU has not been taken into account in Table 4.11 for the calculation of the average revision, average absolute revision and root mean squared error.

Comparing the test results with the predefined assessment criteria, we conclude that all three sets of estimations easily met the criteria regarding the average revision and average absolute revision. The test estimations are therefore considered to be of very good quality.

Table 4.11: Assessment of t+45 employment test estimates against quality acceptance criteria
(Revisions of growth rates, in percentage points; coverage of national employment data as percentage of euro area and EU total employment)

	Euro area, revisions at t+75 days			Quality acceptance criteria	EU, revisions at t+75 days		
	T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS		T+45 trans-mission	T+45 trans. + model	T+45 trans. + model + LFS
2015Q1	-0.1	-0.1	-0.1		-0.1	0.0	0.0
2015Q2	0.0	0.0	0.0		0.0	0.0	0.0
2015Q3	0.0	0.0	0.0		0.1	0.1	0.1
2015Q4	-0.1	0.0	0.0		-0.4	-0.3	-0.3
2016Q1	-0.1	0.0	0.0		-0.1	0.0	0.0
2016Q2	0.0	0.0	0.1		-0.1	-0.1	-0.1
2016Q3	-0.1	0.0	0.0		0.0	0.0	0.0
2016Q4	0.0	0.0	0.0		-0.1	-0.1	-0.1
2017Q1	-0.1	0.0	0.0		-0.1	0.0	-0.1
2017Q2	0.0	0.0	0.0		-0.1	0.0	0.0
2017Q3	0.0	0.0	0.0		0.0	0.0	0.0
2017Q4	0.0	0.0	0.0		-0.1	-0.1	-0.1
2018Q1	0.0	0.0	0.0		0.0	0.0	0.0
Average revision, all quarters excl. EU 2015Q4	-0.03	0.00	0.00	**-0.05 - 0.05**	-0.03	-0.01	-0.01
Average absolute revision, all quarters excl. EU 2015Q4	0.03	0.02	0.02	**=<0.10**	0.03	0.03	0.03
Root mean squared error, all quarters excl. EU 2015Q4	0.04	0.03	0.03		0.04	0.03	0.03
Coverage, 2017Q2-2018Q1 quarters, %	77-95	77-95	77-95	**=>75**	78-91	78-91	78-91

Note: The revisions were calculated as the difference between the one decimal rounded t+75 estimates and the one decimal rounded t+45 flash estimates. The average revisions, average absolute revisions and the root mean squared errors were calculated on the basis of the unrounded t+75 and t+45 flash estimates.

Source: Eurostat calculations

As regards the assessment of the coverage of national test estimates as a percentage of the euro area and EU total employment, the coverage percentages for the latest four test quarters 2017Q2-2018Q1 were above the 75% threshold. These more recent quarters are considered to be representative of a 'real publication situation'.

All three estimation methods used performed well, although the estimates produced with the first method showed a slight upward bias. The second method seems to represent the real publication situation best. Unlike method one, it included a model estimate for one missing large Member State for 2015Q1-2017Q2. This country started to send its national estimates in 2017Q3, thus the first and second methods produced identical results for the three quarters from 2017Q3 to 2018Q1.

Assessment of the euro area and EU test estimates at t+30 days

Table 4.12 shows the key results of the three t+30 quarter-on-quarter estimations for the euro area and the EU. Although quality acceptance criteria were only developed for the t+45 quarter-on-quarter estimates, they were also applied to the t+30 estimates, as presented below, to get an indication of their accuracy.

Table 4.12: Assessment of t+30 employment test estimates against quality acceptance criteria
(Revisions of growth rates, in percentage points; coverage of national employment data as percentage of euro area and EU total employment)

	Euro area, revisions at t+75 days			Quality acceptance criteria	EU, revisions at t+75 days		
	T+30 trans-mission	T+30 trans.+ model	T+30 trans.+ model + LFS		T+30 trans-mission	T+30 trans.+ model	T+30 trans.+ model + LFS
2015Q1	-0.2	-0.1	-0.1		0.0	0.1	0.1
2015Q2	-0.1	0.0	0.0		-0.2	-0.1	-0.1
2015Q3	0.0	0.0	0.0		0.1	0.1	0.1
2015Q4	-0.2	-0.1	0.0		-0.4	-0.3	-0.2
2016Q1	-0.2	-0.1	0.0		-0.2	-0.1	-0.1
2016Q2	0.0	0.1	0.0		0.0	0.0	-0.1
2016Q3	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1
2016Q4	0.1	0.1	0.1		0.0	0.0	-0.1
2017Q1	-0.1	0.0	0.0		-0.1	0.0	0.0
2017Q2	0.0	0.0	0.0		0.0	0.1	0.1
2017Q3	0.0	0.0	0.0		-0.1	-0.1	-0.1
2017Q4	0.0	0.1	0.0		-0.1	0.0	-0.1
2018Q1	0.0	0.0	0.0		0.0	0.0	0.0
Average revision, all quarters excl. EU 2015Q4	-0.05	0.00	0.00	**-0.05 - 0.05**	-0.04	0.00	-0.01
Average absolute revision, all quarters excl. EU 2015Q4	0.07	0.03	0.03	**=<0.10**	0.07	0.05	0.06
Root mean squared error, all quarters excl. EU 2015Q4	0.08	0.04	0.04		0.09	0.06	0.07
Coverage, 2017Q2-2018Q1 quarters, %	66	66	66	**=>75**	46-48	46-48	46-48

Note: The revisions were calculated as the difference between the t+75 estimates rounded to one decimal place and the t+45 flash estimates rounded to one decimal place. The average revisions, average absolute revisions and the root mean squared errors were calculated on the basis of the unrounded t+75 and t+45 flash estimates.

Source: Eurostat calculations

For all three estimation methods, and for almost all quarters except 2015Q4 for the EU, the one digit revisions of the t+30 test estimates at t+75 days were between -0.1 and +0.1 percentage points. The average revision statistics were below or on the edge of the quality threshold for the estimates made using the three estimation methods. This table differs from Table 4.7 in that quarter 2015Q4 for the EU was not taken into account when calculating the average revision, average absolute revision and root mean squared error. The assessment criteria set for the average absolute revision over all quarters were met by all three methods.

Considering that Member States have to send their national estimates to Eurostat within 30 days, and therefore probably have a limited availability of sources for their estimates, the revision results were still very good. However, in one respect the quality assessment criteria were not met. The coverage rates remained far below the 75% set as the threshold for coverage. So the t+30 estimates clearly failed to meet the coverage criterion as applied to the t+45 estimates.

As for the t+45 estimates, the second and third estimation methods that included a model estimate (second method) and LFS proxies (third method) in the estimation performed better than the first method, which was entirely reliant on the inputs from the reporting Member States only. However, these methods do not fully respect the principle that the European aggregates should, as far as possible, be based solely on input from the Member States.

5 Streamlining of estimations and news releases

In addition to responding to the long-standing request to investigate the feasibility of employment flash estimates, Eurostat also worked on further streamlining its overall estimation and release schedule for national accounts. The aim was to move closer to the t+30/60/90 estimation schedule recommended for the national accounts indicators published as PEEIs.

The traditional practice of publishing national accounts estimates in several stages was the result of data availability considerations, taking into account the requirements of the ESA transmission programme and the evolution of specific country derogations.

The decision to publish employment data at t+75 days was related to the ESA 95 transmission programme, which generally requested the transmission of quarterly national accounts after 70 days, even if the publication practice of major EU economies allowed already to publish a first estimate of main GDP aggregates of the output and expenditure before this deadline, after about 65 days.

While the introduction of ESA 2010 in September 2014 advanced the transmission deadline to t+2 months (i.e. about t+60 days), several countries requested temporary derogations allowing them to still transmit some data, notably employment and income aggregates, after this deadline. As these derogations shall progressively cease to apply until 2020, Eurostat has started to introduce more efficient validation and estimation processes, to allow for further streamlining of its release schedule of main national accounts aggregates.

While a consolidated estimation of all GDP aggregates from the output, expenditure and income side was already introduced in 2017, the integration of the t+65 employment estimates in the release schedule is now also considered feasible from both the country coverage perspective, and that of technical feasibility.

Following the successful completion of t+45 employment test estimates, Eurostat also decided to modify its overall release schedule for main national accounts aggregates as follows:

- t+30: preliminary GDP flash news release presenting European aggregates only;
- t+45: introduction of employment flash estimates (euro area and EU aggregates only) starting mid-November 2018 and GDP flash including country data in the news release,
- t+65: consolidated estimation of European main GDP aggregates (including employment data) and news release based on Member States' regular data transmissions received after t+2 months;
- t+100: database release of updated European and country main aggregates estimates to incorporate additional or updated country estimates received.

Since it is anticipated that the availability of country data will improve further over time, the process of streamlining the estimation and news releases for main aggregates will continue. This will bring published estimates even closer to the overall 30/60/90 day estimation schedule recommended for PEEI. Following further testing of estimates, it could be possible at some stage to advance the release of employment flash estimates to t+30, and also to satisfy users' requests to publish more country specific flash estimates in Eurostat's news releases and/or database over time.

6 Conclusions

Policymakers and other users of statistics increasingly require the very latest data. For that reason in 2017 Eurostat started investigating the possibility to accelerate the estimation and publication of an important national accounts variable – total employment in persons – from t+75 to t+45, or t+30 days.

For that purpose Eurostat prepared t+45 and t+30 test estimates for 2015Q1-2018Q1 for the euro area and the EU, with estimations based, to the greatest possible extent, on Member States' input.

The t+45 test estimates were assessed against predefined t+45 quality acceptance criteria with respect to the average revisions, average absolute revisions and coverage of data provided by the Member States as a share of the euro area and EU totals. No explicit quality acceptance criteria were developed for the t+30 test estimates. However, to have an idea of the quality of the t+30 test estimates, they were also assessed against the quality assessment criteria used for the t+45 estimates.

Quality of European t+45 test estimates

The main conclusions of the assessment of European t+45 test estimates are as follows:

- The European t+45 quarter-on-quarter seasonally-adjusted test estimates showed very limited revisions. The criteria for the average revision, average absolute revision and coverage were fully met. The conclusion is that these estimates are of very high quality;
- No quality acceptance criteria were defined for the t+45 unadjusted year-on-year European test estimates. However, the revisions of growth rates for the 13 quarters were also very low, and absolute revisions and absolute average revisions were small. We therefore conclude that the year-on-year test estimates are also of high quality;
- Of the three estimation methods used, the second one, which took into account the national data provided by Member States and a model estimate for one missing large Member State, performed best. As the missing Member State started to send its national estimates in 2017Q3, the second method coincided with the first method (based entirely on data received from the Member States) for 2017Q3-2018Q1. The first estimation method will therefore, in principle, be used for the official releases.

Quality of European t+30 test estimates

The main conclusions of the assessment and the decisions regarding the publication of the European test estimates at 30 days after the end-of-quarter are as follows:

- European t+30 quarter-on-quarter and year-on-year test estimates showed relatively limited revisions. This conclusion applies especially to estimates made using the second and third estimation methods, with data provided by Member States, enriched with a model estimate for

one missing large Member State, and with LFS proxies (third method). The assessment criteria developed for the t+45 test estimates were applied to the test estimates at t+30. The conclusion was that the criteria set for the average revision and average absolute revision were fully met. However, Member States' direct contributions of national estimates were well below the predefined (75%) coverage assessment criterion of the euro area and EU total employment aggregates;

— Although the results are promising, especially as regards the limited revisions, the results are not ready for publication because of the relatively low coverage. It was therefore decided to continue the test exercise for these estimates.

Start of t+45 employment flash estimates with streamlined publication schedule

Based on these conclusions of the work of the Task Force, which were also supported by members of the National Accounts Working Group and Directors of Macroeconomic Statistics meeting, Eurostat decided in July 2018 that the publication of employment flash estimates at t+45 days could already start from mid-November 2018 while the testing of flash estimates at t+30 days should continue. In addition, an advancement and integration of the t+75 employment estimate with the regular estimation of GDP main aggregates at about t+65 days after the end of the reference quarter will be introduced to achieve a more streamlined release schedule of national accounts estimates.

Annexes

Annex A: Use of modelling for missing Member States

General description

Calculating flash estimates from 2015Q1 to 2018Q1 for the European aggregates with data provided by Member States generated a systematic bias. The employment estimates were systematically too high.

To correct this bias, missing estimates were produced by Eurostat for Member States whose weight has a significant impact on the aggregates. Several methods for estimating seasonally adjusted quarter-on-quarter data were tested:

- LFS data as a direct proxy;
- ARIMA model;
- ARIMA model with explanatory variable.

A visual analysis of LFS series and employment series shows a strong correlation for some Member States, but also a high volatility in series for some other Member States, which reduces the quality of any estimate.

When LFS data are not yet available or too volatile, a model based on the historical values of the series is a possible alternative (e.g ARIMA models).

Models have been estimated using Jdemetra. This is a software package whose main purpose is to generate seasonally adjusted series, but it also has a modelling function. This function, called 'RegArima', automatically selects the best ARIMA model and produces a forecast for the next four quarters. It also provides several quality indicators of the model: out-of-sample tests ([14]), t of Student, standard error of the regression, normality of the residuals ([15]), independence of the residuals ([16]), autocorrelation function and partial autocorrelation function.

As a preliminary task, Jdemetra detects and deletes outliers.

For each estimate, modelling was performed with the historical series up to the last available quarter (for example, up to 2014Q4 to estimate 2015Q1).

Modelling was performed for some large missing countries. Four types of models were compared:

([14]) Statistical tests of a model's forecast performance are commonly conducted by splitting a given data set into an in-sample period, used for the initial parameter estimation and model selection, and an out-of-sample period, used to evaluate forecasting performance.
([15]) Skewness and Kurtosis.
([16]) Ljung-Box and Box-Pierce tests.

- a simple ARIMA model;
- an ARIMA model with LFS data;
- an ARIMA model with current GDP;
- an ARIMA model with lagged GDP (GPD of the previous quarter).

The selected model was the one with the best quality indicators mentioned above. A final visual comparison between real and forecast data (see the following example) validates the selected model and provides information about its quality.

Models generated by Jdemetra are of good quality in terms of the regressors coefficient being significantly different from zero, normality and independence of residuals.

Estimates are compared with actual data for 2015Q1-2017Q2: differences between the two vary from 0.02 to 0.18 percentage points, with an average error between 0.03 and 0.11 percentage points.

Model estimated for a missing large country (specification for 2016Q2)

ARIMA model : (0,1,1)(0,0,1).

Modelling was performed on seasonally adjusted series, so no four quarter-differencing was necessary.

Regressors' coefficients:

	Coefficients	T-Stat	P[|T| > t]
Theta(1)	0.4799	4.70	0.0000
BTheta(1)	-0.5050	-5.08	0.0000
Lagged_GDP	0.0228	1.49	0.1413

Durbin-Watson statistic: 2.0752

Normality of the residuals:

	P-value
Mean	0.9023
Skewness	0.0698
Kurtosis	0.1639
Normality	0.1104

Independence of the residuals:

	P-value
Ljung-Box(16)	0.0634
Box-Pierce(16)	0.1280
Ljung-Box on seasonality(2)	0.9428
Box-Pierce on seasonality(2)	0.9467

Out-of-sample test:

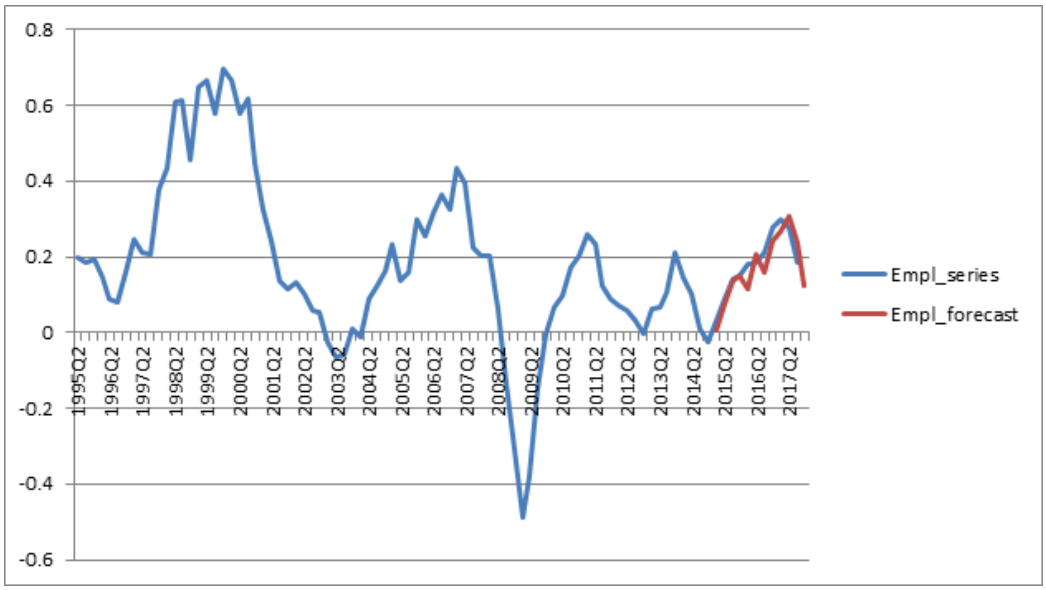
	Mean squared error
In sample	0.0060
Out of sample	0.0009

Test for equality of MSE = 0.1511

Distribution: F(6,77)

P-Value: 0.9883

Comparison between actual and estimated data:



Annex B: Main features of the EU-Labour Force Survey and scope of data

The EU Labour Force Survey (EU-LFS) is Europe's largest household sample survey, providing quarterly and annual data on labour participation of people aged 15 and over and on people outside the labour force. It covers residents of private households (excluding conscripts), broken down by labour status:

- employment;
- unemployment;
- inactivity.

The data can be broken down by multiple dimensions including age, sex, educational attainment, and distinctions between permanent/temporary and full-time/part-time employment.

The EU-LFS currently covers 33 participating countries, providing Eurostat with data from national labour force surveys: the 28 EU Member States, three EFTA countries (Iceland, Norway and Switzerland), and two EU candidate countries, i.e. the Former Yugoslav Republic of Macedonia and Turkey.

Main concepts

The EU Labour Force Survey's main statistical objective is to divide the working-age population (15 years and above) into three mutually exclusive and exhaustive groups — persons in employment, unemployed persons and inactive persons — and to provide descriptive and explanatory data on each category..

While demographic data are gathered for all population age groups, questions relating to labour market status are restricted to persons aged 15 and up.

The variables collected depend on individuals' labour status (employed, unemployed, economically inactive).

To ensure that the statistical results are comparable across countries and over time, the EU-LFS:

- uses the same concepts and definitions;
- follows International Labour Organisation (ILO) guidelines;
- uses common classifications (NACE, ISCO, ISCED, NUTS);
- records the same set of characteristics in each country.

For an overview of the concepts, classifications, questionnaires and other methodological issues, please see: EU Labour Force Survey – methodology (Statistics Explained).

Main EU-LFS definitions

Employed persons are those aged 15 and up who, during the reference week, performed work, even for just one hour a week, for pay, profit or family gain, or who were not at work but had a job or business from which they were temporarily absent because of something like illness, holiday, industrial dispute or education and training.

Unemployed persons are people aged 15-74 who were without work during the reference week, but who are currently available for work and were either actively seeking work in the past four weeks or had already found a job to start within the next three months.

The economically active population comprises employed and unemployed persons.

Inactive persons are those classified neither as employed nor as unemployed.

For information on exceptions to the standard labour force age groups, together with an overview of other important definitions used in the EU-LFS (e.g. professional status, working time, atypical work or full-time or part-time work), see EU Labour Force Survey – methodology (Statistics Explained).

The reference document for the definitions is the EU-LFS explanatory notes, which contain detailed information on the definition of each variable.

Data collection

Each quarter more than 1.7 million interviews are conducted throughout the participating countries to obtain statistical information on some 100 variables. Sampling rates in the countries involved vary from 0.2 % to 2.1 %.

Use of data

The LFS is an important source of information on the situation and trends in the EU labour market. Most notably, it forms the basis for the monthly harmonised unemployment rate, one of Eurostat's key short-term indicators. Given the diversity of information and the large sample size, the EU-LFS is also an important source for other European statistics, e.g. education or regional statistics.

For a detailed overview of the EU-LFS, please see: EU Labour Force Survey (Statistics Explained).

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Euro area and EU employment flash estimates

Eurostat will start to publish euro area and European Union employment flash estimates based on early estimates provided by National Statistical institutes on a voluntary basis. This paper describes the reasons for advancing the employment estimates and elaborates the estimation method applied. It also discusses the assessment results of the test estimates carried out after 30 and 45 days by a Eurostat Task Force in 2017 and 2018 based on agreed criteria. The conclusion of this work is that the release of employment flash estimates for the euro area and the European Union after 45 days can start mid-November 2018. Testing to advance the estimates further to 30 days will continue.

For more information
https://ec.europa.eu/eurostat/

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