NOTES ON SEASONAL AND CALENDAR ADJUSTMENT (updated on 22/01/2024)

Quarterly government finance statistics are reported to Eurostat in the form of non-seasonally adjusted (raw) figures. However, a certain number of the reported series contain seasonal patterns (partly explained by the link with the seasonality of economic activity and by the budgetary planning and accounting practices of national governments), which make it difficult to carry out a direct meaningful cross-country and time series analysis. The same is true for GDP, which reflects the seasonal pattern of all economic activities in the economy.

To overcome this difficulty and thus to gain a better understanding of trends in addition to the non-seasonally adjusted data, seasonally adjusted data is presented for the EU and EA and selected countries. The seasonal adjustment for total revenue and total expenditure is done using an indirect procedure (at country level using Tramo-Seats on JDemetra).

Where available, National Statistical Institutes own estimates are used as input for the aggregates, which are supplied to Eurostat on a gentlemen's agreement basis. Most country level estimates as well as data for the EU aggregates are published on Eurobase. These estimates are supplemented by Eurostat's own estimates for those countries, which do not yet supply their own estimate. Such data is labelled confidential and not published.

Net lending (+)/ net borrowing (-) is derived indirectly from the accounting identity:

Net lending (+)/ net borrowing (-) = total revenue - total expenditure.

As concerns GDP, no independent estimate is derived.

EU AGGREGATES:

Estimated indirectly at Eurostat on the basis of Member States' data a far as this is supplied nationally and complemented by Eurostat's own estimates, where no nationally supplied data is available. Tramo-Seats run on JDemetra is used in all cases.

For the following countries, the estimates are produced by the respective National Statistical Institute, which all follow the "ESS guidelines on seasonal adjustment":

Belgium: The seasonally adjusted series are computed following an indirect approach. The components of the revenue and of the expenditure of the General Government are seasonally adjusted by means of "Tramo-Seats", taking into account the presence of possible outliers and calendar effects. The model of each component (>20) has been individually validated (no automatic modelling). The absence of residual seasonality after aggregation has been checked. The data are benchmarked on annual totals of the non-adjusted series. The annual benchmarking is computed on each component by means of a multiplicative Denton procedure.

Bulgaria: Tramo-Seats on Demetra +. Total expenditure: no trading days effects, no Easter effect, log-transformation, ARIMA model [(0,1,1)(0,1,1)], outliers: AO[2007-IV], AO[2008-IV], TC[2014-IV], 1 pre-specified outlier TC[2020-II]. Total revenue: no trading days effects, no Easter effect, log-transformation, ARIMA model [(0,1,1)(0,1,1)], outliers: 1 pre-specified outlier TC[2020-II].

Czechia: Tramo-Seats on Demetra +. Total expenditure: No trading days effects, no Easter effect, ARIMA model [(0,1,1)(0,1,1)], outliers: AO[2003-I], AO[2003-III], AO[2012-IV], TC[2001-IV], LS [2016-I]. Total revenue: No trading days effects, no Easter effect, ARIMA model [(0,1,1)(0,1,1)], outliers: AO[2003-I]. P.51g: No trading days effects, no Easter effect, ARIMA model [(1,1,1)(0,1,1)], outliers: AO[2003-I], LS[2016-I].

Denmark: X13-ARIMA. Total expenditure: Log-transformation, no trading days effects, no Easter effect, ARIMA model [(0,1,1) (0,1,1)], outliers: TC[2012-II], TC[2020-IV]. Total revenue: Log-transformation, no trading days effects, no Easter effect, ARIMA model [(0,1,1)(0,1,1)], outliers: AO[2009-IV], LS[2018-IV], LS[2015-I], AO[2008-II], AO[2009-I].

Germany: X13-ARIMA. Total expenditure: Log-transformation, no trading day effects, ARIMA model [(0,1,1) (0,1,1)], outliers AO [1995-I, 1995-III, 2010-III, 2021-III, 2022-IV] LS [2020-II, 2020-III, 2022-I].

Total revenue: Log-transformation, no trading day effects, ARIMA model [(0,1,0) (0,1,1)], outliers LS [2020-II] AO [2021-II].

Estonia: Tramo-Seats on Demetra +. The seasonal adjustment of all time series is done with TRAMO-SEATS using JDemetra+ software. For TE and TR no calendar adjustment has been added as it does not have a notable impact on the results. According to ESS guidelines there is also no temporal consistency forced on the time series in order to provide a more purely seasonally adjusted time series for users.

Ireland: JDemetra+ X13 RSA full method. Total revenue: ARIMA Model (2,1,1)(0,1,1), Outlier detected LS (I-2020), LS (II-2021) Total expenditure: ARIMA Model (2,1,1)(0,1,1), Outliers detected AO (I-2010), TC (III-2010), AO (IV-2010), AO (III-2011), LS (II-2020). General government net lending / net borrowing using indirect approach.

Spain: For P.3, OTE, OTR and B.9, the seasonally adjusted series are computed following an indirect approach. The components are seasonally adjusted using Tramo-Seats on JDemetra+ 2.2.2, taking into account the presence of possible outliers and calendar effects. The model of each component has been individually validated (no automatic modelling). The absence of residual seasonality after aggregation has been checked. The data are benchmarked on annual totals of the non-adjusted series. Following Eurostat recommendations and the practice followed in all the INE short-term statistics, an atypical type of impulse (AO) has been introduced into the series when it has been statistically significant in the data referring to the last quarter. When the data for subsequent quarters is available, we analyse whether this impulse should be modified by another type of intervention.
For P.51g: The specifications can be found as part of the Standardised Methodological Report (https://www.ine.es/dynt3/metadatos/en/RespuestaDatos.html?oe=30026)

France: Seasonally adjusted data is transmitted. Working day adjustment is also done when relevant. An indirect method is used. Seasonal adjustment is done using X-12-ARIMA. For more information, you can read INSEE's methodology (starting on page 21) at the following link (the document is available in English and French): https://www.insee.fr/en/information/2579410.
In 2019Q1, non-seasonally adjusted data on taxes on income (D.51REC) decreases strongly due to a change in seasonality. For this reason, the evolution of the seasonally adjusted data differs significantly. Such changes in seasonality are technically complicated to model, hence the seasonally and seasonally and calendar adjusted data for 2019Q1 should be interpreted with caution. The changes in seasonality are primarily due to a new system in the collection of personal income tax (introduction of advance payments and retention at source) and the early repayment of a tax credit in January, introduced in 2019.

Croatia: The direct approach and X11-Arima methods were used for seasonal adjustment. Detailed pre-treatment of the series, including graphical analysis, testing the significance of calendar (trading/working days, leap year, Easter effect, etc) was ran. The series were checked for outliers of different types. Outliers for which a clear interpretation exists are included as regressors in the model. The automatic test for log-transformation suggested the choice of the decomposition scheme. The model, filters, outliers and calendar regressors will be re-identified once a year and the respective parameters re-estimated every time new or revised data become available.

Latvia: Tramo-Seats on JDemetra+ (version 2.0.0). No trading day effect, national calendar adjusted. Total expenditure: Log-transformation, ARIMA model [(0,1,1)(0,1,1)], 3 pre-specified outliers: LS[2006-IV], LS[2020-III], AO[2020-IV], ramp:[I-2009 - IV-2009]. Total revenue: Log-transformation, ARIMA model [(0,1,0)(0,1,1)], pre-specified outlier: AO[2006-IV].

Lithuania: (no change) Tramo-Seats on NbDemetra 2.2.2. Total expenditure: Log-transformation, no Easter effect, ARIMA[(1,0,0)(1,1,1)], outliers AO[2011-IV], AO[199-II], AO[2006-II], LS[2020-I], AO[2022-IV]. Total revenue: Log-transformation, no Easter effect, ARIMA[(0,1,1)(0,1,1)], no outliers. Gross Fixed Capital Formation: Log-transformation, no Easter effect, ARIMA[(0,1,1)(0,1,1)], outlier LS[2009-II].

Luxembourg: All series are seasonally and calendar adjusted with automatic outlier detection and correction. No benchmarking or other adjustments are made. The method used is non-parametric X13 RSA5c with the Luxembourgish calendar. The software used is JDemetra+ (v2.2.2).

Hungary: JDemetra+ TramoSeats method. Hungarian specific calendar is used. Working day, Easter and leap year effects are tested. Total revenue: Log-transformation, no trading day effects, no Easter effect, ARIMA model [(1,1,0)(0,1,1)], 1 predefined outlier: AO (2015-IV). Total expenditure: Log-transformation, no trading day effects, no Easter effect, ARIMA model [(0,1,1)(0,1,0)].

Malta: Total expenditure: Tramo-Seats on JDemetra+ 2.2.2, Series has been log-transformed, No trading days effects, No Easter effects, ARIMA model [(0,1,1)(0,1,1)] with a statistically significant mean, 2 pre-specified outliers: AO(IV-2003), TC(II-2020) Total revenue: Tramo-Seats on JDemetra+ 2.2.2, Series log transformation, No trading days effects, No Easter effects, ARIMA model [(0,1,1)(0,1,0)], 3 pre-specified outliers: AO(III - 2000), AO (IV - 2000), TC (I - 2020)

Netherlands: X13-ARIMA on JDemetra+. Total revenue: Log-transformation, no trading day effects, no Easter effect, ARIMA model [(1,0,1)(1,1,0)], outliers; LS (I-2009), TC (II-2020). Total expenditure: Log-transformation, no trading day effects, no Easter effect, ARIMA model (0,1,0)(0,1,1)], outliers; AO (II-2009), AO (II-2020).

Austria: Seasonal adjustment: Tramo-Seats on jDemetra+. Total expenditure: log-transformation, no trading days effects, no Easter effect, ARIMA model [(0,0,0)(0,1,1)], outliers (specific pre-treatment): [2004-II], [2004-IV], [2009-IV], [2014-IV], [2015-III], [2020-I], [2020-II], [2020-III], [2020-IV], [2021-I], [2021-II], [2021-III], [2021-IV], [2022-I], [2022-II], [2022-III], [2022-IV], [2023-I], [2023-II], [2023-III]. Total revenue: Log-transformation, no trading days effects, no Easter effect, ARIMA model [(0,0,0)(0,1,1)], outlier: LS[2009-II], LS[2016-I], AO[2020-II], AO[2020-III], AO[2020-IV], AO[2021-I], AO[2021-II], AO[2021-III] , AO[2021-IV], AO[2022-I], AO[2022-II], AO[2022-III],AO[2022-IV], AO[2023-I], AO[2023-II], AO[2023-III].

Poland: Tramo-Seats on JDemetra +. Direct method used. Concurrent adjustment for Q1 each year, current adjustment Q2, Q3, Q4 (model revised once a year). Calendar effects adjustment used. Working days with leap year effect (2 regressors) and Easter effect tested for each series - only significant effects used in final specification. Automatic model selection with additional non-automatic verification of problematic cases. Total expenditure: P.2 - log transformation; mean effect, no calendar effect, ARIMA model [(0,0,0)(1,1,0)], outliers: AO(Q3_2010), AO(Q3_2022), AO(Q4_2022), AO(Q1_2023); P.5 - log transformation; no calendar effect, ARIMA model [(1,0,0)(0,1,0)], outliers: TC(Q1_2016), AO(Q1_2022); D.1 - log transformation; no calendar effect, mean effect, ARIMA model [(0,1,1)(0,1,0)], outliers: LS(Q4_2002), LS(Q2_2008), AO(Q4_2013), AO(Q4_2021), AO(Q3_2022); D.6M - log transformation; no calendar effect, ARIMA model [(0,1,1)(0,1,1)], outliers: AO(Q4_2007), LS(Q4_2004), LS(Q2_2019), AO(Q2_2020), AO(Q4_2021), AO(Q2_2022), AO(Q3_2022), AO(Q2_2023); D.4 - log transformation; no calendar effect, ARIMA model [(0,0,0)(0,1,1)], outliers LS(Q4_2008), AO(Q4_2021), AO(Q2_2022), AO(Q3_2022), AO(Q4_2022), AO(Q2_2023); P.29+D.3+… - no-log transformation, no calendar effect, ARIMA model [(0,1,1), (0,0,0)]; Total revenue: D.2 - log transformation; no calendar effect, mean effect, ARIMA model [(0,1,1)(0,1,0)], outliers: AO(Q2_2004), TC(Q1_2009), AO(Q2_2020), AO(Q1_2022), AO(Q3_2022), AO(Q4_2022); D.4 – no-log transformation; no calendar effect, mean effect, ARIMA model [(0,0,0)(1,0,0)], outliers: TC(Q2_2012), AO(Q2_2020), AO(Q2_2021), AO(Q3_2021), LS(Q2_2022), AO(Q4_2022); D.5 - log transformation; no calendar effect, mean effect, ARIMA model [(1,0,0)(0,1,0)], outliers: AO(Q1_2020), AO(Q2_2020), LS(Q2_2009), AO(Q1_2023); D.61 - log transformation; no calendar effect, ARIMA model [(0,1,1)(0,1,1)], outliers: TC(Q1_2001), TC(Q4_2008), AO(Q4_2007), AO(Q3_2011); P.1+D.7+D9 - log transformation; no calendar effect, ARIMA model [(0,1,1)(0,1,1)], outliers: AO(Q4_2007), AO(Q4_2013), AO(Q4_2009), AO(Q4_2012).

Portugal: X13-ARIMA on Demetra+. A manual pre-treatment is performed by identifying and deducting one-off measures. Additional pre-treatment is applied for outlier detection and correction. The seasonal adjustment is applied to total revenue, expenditure except compensation of employees and compensation of employees. Net lending (+)/net borrowing (-) is presented as a result of the difference between the series seasonal adjusted of total revenue and total expenditure. Total expenditure results of the sum of seasonal adjustment series of total expenditure (except compensation of employees) with compensation of employees. Total Expenditure (except compensation of employees): X-13-ARIMA; log-transformation; no trading days effects; no Easter effect; ARIMA Model [(0,1,1)(0,1,1)]; Outliers: AO (IV-2002), TC (III-2002) and SO IV [2012-2020] (user defined variable); Compensation of employees: TRAMO-SEATS; log-transformation; no trading days effects; no Easter effect; ARIMA Model [(0,1,1)(0,1,1)]; Outliers: TC (III-

2005), TC (I-2013), LS (I-2011), LS (I-2012), AO (I-2001), AO (III-2014), SO II [2012-2013](user defined variable) and SO IV [2012 -2017](user defined variable);Total Revenue: X-13-ARIMA; log-transformation; no trading days effects; no Easter effect; ARIMA Model [(1,0,1)(1,1,0)]; Outliers: AO (II-2020), AO (II-2009) and SO III [1999-2008] (user defined variable).

Romania: Tramo-Seats on Demetra+. P.51g series was not log-transformed and the model used was automatic Arima model. Total expenditure was log transformed and the model used was automatic Arima model. Total revenues was log transformed and the model used was automatic Arima model. B.9 is derived indirectly by the difference between seasonally adjusted series of total revenue and total expenditure. Seasonal Adjustments are made every time when Table 25 ESA are compiled.

Slovenia: In September 2023 some changes in seasonally adjustment have been introduced. Time series are seasonally adjusted in two parts: with one model for the period from the beginning of the time series to the end of 2010, and with the second model for the period from the beginning of 2010 to the end of the time series. Results of seasonal adjustment are updated only for the second model. Average of both models is taken into account for 2010. JDemetra+ software (TRAMO/SEATS method) is used for seasonal adjustment. *Time series from the beginning of the time series to the end of 2010:* Total revenue: Log transformation, no trading days effects, no Easter effect; 2 pre-specified outliers: LS (Q1/2009), TC (Q3/2004); ARIMA (0,1,3)(0,1,1); Total expenditure: Log transformation, no trading days effects, no Easter effect; 1 pre-specified outlier: AO (Q1/2001); ARIMA (0,1,0)(0,1,1) + Mean correction; Gross fixed capital formation: Log transformation, trading days effects, no Easter effect; 1 pre-specified outlier: AO (Q1/2000); ARIMA (0,1,0)(0,1,1); Final consumption expenditure (P.3): Log transformation, no trading days effects, no Easter effect; 1 pre-specified outliers: TC (Q1/2007); ARIMA (0,1,0) (0,1,1). *Time series from 2010:* Total revenue: Log transformation, working days effect, holidays effect, leap year effect, no Easter effect; 2 pre-specified outliers: LS (Q1/2021), LS (Q1/2020); ARIMA (0,1,1)(0,1,1) + Mean correction; Total expenditure: Log transformation, no trading days effect, no Easter effect; 5 pre-specified outliers: AO (Q2/2020), AO (Q4/2014), AO (Q1/2013), AO (Q4/2013), SO (Q3/2020); ARIMA (0,1,0)(0,1,1); Gross fixed capital formation: Log transformation, working days effect, holidays effect, leap year effect, no Easter effect; 3 pre-specified outliers: LS (Q1/2016), AO (Q4/2019), LS (Q1/2018); ARIMA (0,1,0)(0,1,1); Final consumption expenditure (P.3): Log transformation, no trading days effects, no Easter effect; 2 pre-specified outliers: LS (Q1/2021), AO (Q2/2021); 1 detected outlier: LS (Q2/2023), ARIMA (0,1,1) (0,1,1).

Slovakia: (no change) Tramo-Seats on JDemetra +. Total expenditure: Log-transformation, no trading days effects, no Easter effect, ARIMA model [(0,1,1)(0,1,1)], 4 pre-specified outliers: LS[2000-IV], AO[2002-IV], AO[2015-IV], AO[2021-II]. Total revenue: Log-transformation, no trading days effects, no Easter effect, ARIMA model [(0,1,1)(0,1,1)], 4 pre-specified outliers: LS[2001-III], AO[2015-IV], LS[2020-I], AO[2020-II].

Finland: The seasonally adjusted series are computed following an indirect approach. The components of the revenue and of the expenditure of the General Government are seasonally adjusted by Tramo-Seats / JDemetra+ 2.0.0, taking into account the presence of possible outliers and calendar effects. The data are benchmarked on annual totals of the non-adjusted series. The annual benchmarking is computed on each component by Denton procedure.

Sweden: Tramo-Seats on JDemetra. Total expenditure: Log-transformation, no trading days effects, no Easter effect, ARIMA model [(1,1,0)(0,1,1)], 7 pre-specified outliers: AO[1998-III], AO[2001-IV], LS[2002-II], AO[2002-III], AO[2010-IV], AO[2020-II], AO[IV-2022]. Total revenue: Log-transformation, no trading days effects, no Easter effect, ARIMA model [(1,0,0)(0,1,1)] with mean, one pre-specified outlier: TC[2020-II].

Iceland: Total revenue and total expenditure are seasonally adjusted using Tramo-Seats / JDemetra+ 2.2.3 taking into account the presence of possible outliers and calendar effects. For each subsector and S.13, total revenue and total expenditure are estimated directly, with B.9 for each subsector and S.13 derived indirectly from total revenue and total expenditure.

Switzerland: The data reported is trend-cycle data. A Denton-Cholette method is used to temporally disaggregate annual data. The quarterly data is extrapolated using smoothed indicators.