Guidelines on seasonal adjustment by Task force on Seasonal adjustment of QNA endorsed by the CMFB

1 General recommendations

(a) Seasonal adjustment of QNA should cover at least Table 1 of the ESA transmission programme. All series should be tested for the significance of seasonality and calendar effects and adjusted accordingly if these are present.

(b) Adjusted data complements raw data, but cannot replace the raw data.

(c) Adjusted results should be produced for data in current prices, volumes and deflators by adjusting any two of these and deriving the third from the seasonally adjusted and benchmarked other two series. When the deflator is the derived one, care should be taken to prevent its path being affected by arbitrary difference in the separate adjustment of current price and volume data.

(d) Documentation on the practices adopted at national, euro area and EU level (*metadata*) should be published according to the template on seasonal adjustment of Quarterly National Accounts and the respective arrangements on implementing, publishing and updating the metadata information. The template should be updated at annual frequency or whenever major changes occur.

(e) There should not be a complete dependence on the automatic default options of the programmes. Seasonal adjustment and Quarterly National Accounts expertise should be used to verify and supplement decisions about the options used (e.g. for outlier treatment, model selection).

[unchanged recommendation]

(f) For the sake of quality, Census X-12 RegARIMA and TRAMO-SEATS are recommended for seasonal adjustment.

2 Recommendations on calendar and other pre-adjustment

(a) The calendar effect is the impact of working/trading days, fixed and moving holidays, leap year and other calendar related phenomena (e.g. bridging days) on a time series. The calendar effect can be divided into a seasonal and a non-seasonal component: the former corresponds to the average calendar situation that repeats each year at the same season; the latter corresponds to the deviation of the calendar variables (such as numbers of trading/working days, moving holidays, leap year days) from the long-term month- or quarter-specific average. The seasonal component of the calendar effect is part of the seasonal component of the series and removed by seasonal adjustment. The non-seasonal part of the calendar effect is called the "calendar effect component" and adjusted for by calendar adjustment as defined in the following recommendations.

(b) Calendar adjustment removes those non-seasonal calendar effects (the calendar effect component) from the series, for which there is statistical evidence and an economic explanation. Calendar effects, for which a series are adjusted for, should be identifiable and sufficiently stable over time or, alternatively, it should be possible to model their changing impact over time appropriately. In order to ensure that the estimated calendar component is sufficiently stable over time, the selection of relevant calendar effects used for calendar adjustment should be kept constant over appropriately long time periods, even if the value of statistical indicators might be at the border of the significance threshold. Changes in the selection of calendar effects should be based on both empirical evidence and economic explanation.

Calendar adjustment should include working/trading day adjustment, moving holiday adjustment as well as a removal of leap year effects. The length of a moving holiday effect (e.g. Easter) should be tested and appropriately adjusted for. The adjustment for other effects, such as effects related to the weather, school holidays etc. should not be done. However, it might be useful to model these effects in order to improve the estimate of the seasonal and calendar component if there is clear statistical evidence and if sufficient and sound information is available. Other pre-adjustments (outliers and intervention variables) should be carried out to improve the estimate of the seasonal and calendar component. The modelling of these effects should be based either on information directly available or estimated in a regression framework.

(c) In order to obtain accurate estimates of the seasonal component, the calendar adjustment should be performed prior to the seasonal adjustment.

(d) The regression approach with ARIMA-based error modelling is recommended for calendar adjustment. Where more appropriate information is available, a direct correction of the raw data for calendar effects may be made. Proportional methods should not be used.

(e) QNA data should be calendar adjusted. The adjustment should be made for those variables for which there is a statistical evidence and economic explanation of calendar effects. When deciding whether or not to apply a calendar adjustment to QNA data consideration has also to be given to the QNA accounting coherence and stability over time of the parameter estimates.

(f) Purely calendar adjusted data should be compiled in order to enable the analysis of the impact of the non-seasonal calendar effect. Equivalent relevant information should be made available, if the compilation of pure calendar adjusted series is technically not feasible. Information about calendar adjustment should be provided in the metadata template on seasonal adjustment. Pure calendar adjusted data covers according to the ESA95 transmission programme at least Gross Domestic Product and total Gross Value Added and, on a voluntary basis, all the other items in Table 1.

(g) For calendar adjustment the following could be used to improve the accuracy of results:

- multiple regressors, for example the split of regressors for certain periods of the year or weekdays when there is evidence that the estimated parameters differ;
- different regressors for different series (e.g. output and consumption);

– derivation of quarterly calendar factors from monthly indicator/source series;

– derivation of calendar factors for QNA aggregate series from QNA component series or from indicator component series.

(h) Calendar adjustment based on quarterly indicators or direct adjustment of quarterly national account components should be limited to the cases in which source data at higher (monthly) frequency are not available or not suitable for this purpose.

(i) National calendar regressors should be used in the calendar adjustment to ensure more accurate results, taking into account national and regional holidays if they may have a significant impact on the national result. Indicator/sector/industry-specific calendar regressors should be used, whenever it leads to a significantly improved accuracy of calendar adjustment.

When a direct approach is chosen for the seasonal adjustment of European aggregates, the use of European calendar regressors obtained by aggregating, according to a weighting scheme, country-specific calendar regressors can be considered, in particular if national calendar adjusted series are not available, incomplete or of insufficient statistical quality. The use of a calendar regressor that does not reflect country-specific holidays and working-day patterns, and their differences, should normally be avoided.

(j) All the effects estimated in the pre-adjustment phase should be clearly identified as separate components of the raw series. The final calendar adjusted series should only remove the working/trading-day component as well as moving holiday and leap year effects. The final calendar and seasonally adjusted series should exclude in addition only the seasonal component.

3 Recommendations on seasonal adjustment of QNA, in particular of chain-linked QNA volume measures[1]

(a) QNA may be compiled according to two main approaches (see also ESA95 para. 12.04), a "direct approach" based on the availability at quarterly intervals, with appropriate simplifications, of the similar sources as used in the annual accounts, or an "indirect approach" based on time series disaggregation of the annual accounts with statistical

[1] The following recommendations are generally in line with chapter 16 of the preliminary draft of 1993 SNA Rev1, in particular paragraphs 16.46, 16.48, 16.50 and 16.62.

models using indicator series at monthly or quarterly frequency. While most of the recommendations on seasonal adjustment apply to both approaches, specific guidance for QNA compiled according to the indirect approach are outlined in recommendation (o).

(b) Seasonality is defined as any pattern that repeats on a regular basis in the same quarter each year. Adjusting for seasonality removes the identifiable regular repeated influences, but not the impact of any irregular events. Seasonality includes the length of month/quarter effect.

(c) A generally applicable choice between indirect and direct adjustment of quarterly national accounts is not possible. Case-by-case decisions are necessary, taking into account the achievable gain in accuracy by an indirect adjustment.

(d) Seasonal factors should be updated whenever (significant) revisions in raw data occur and may be updated when a new observation becomes available (concurrent adjustment). In order to reduce the frequency of revisions, projected factors for a period of up to one year may be used. In this case, their quality should be checked every quarter against a concurrent adjustment.

(e) To limit the amount of revisions in concurrent adjustments (especially when a model-based approach is used), the form of the models should be re-specified only on a yearly basis while parameters may be estimated concurrently, except where a known or unusual event requires intervention.

(f) The compilation of seasonal and calendar adjusted QNA chain-linked volume measures is the result of a sequence of operations including seasonal and calendar adjustment, chain-linking, benchmarking and balancing, applied to the available basic or aggregated information.

(g) Unadjusted QNA volume measures in average prices of the previous year shall be chain-linked, followed by a benchmarking of the chain-linked series to the independently derived annual totals. Seasonally adjusted chain-linked QNA volume measures shall be obtained by adjusting the chain-linked series, followed by a benchmarking of the adjusted chain-linked series (see recommendation (j)). Calendar adjustment may be conducted for indicator series used as sources for QNA at monthly or quarterly frequency, in particular if calendar effects can be identified and estimated more straightforwardly for indicators.

There are QNA compilation systems in which seasonally adjusted data are produced at a very detailed level, and even at a level at which no chain-linking is applied (e.g. when producing QNA from quarterly supply and use tables). The order applied in this case is seasonal adjustment, balancing, chain-linking and benchmarking. Since at a disaggregated level the estimates of the seasonal component might not be as reliable as at higher QNA aggregation levels, particular care is needed as regards revisions of the seasonal component. Furthermore, balancing and chain-linking seasonally adjusted data must not introduce a seasonal pattern into the series.

(h) QNA volume measures in average prices of the previous year can be chain-linked by using the one-quarter-overlap, the annual-overlap or the over-the-year technique. From the perspective of seasonal adjustment of QNA volume measures, the one-quarter-overlap and the annual-overlap technique are preferred. The over-the-year technique is not recommended as it may introduce breaks in every single quarter-on-quarter movement of the series, which might impact on the meaningfulness of quarter-on-quarter changes, whose provision in seasonally adjusted form is of key importance for economic analysis.

(i) Unadjusted chain-linked QNA volume measures (or unadjusted indicator series) should be consistent with independently derived chain-linked annual volume measures.[2] This is the case for the annual-overlap technique. For results calculated using the one-quarter-overlap or the over-the-year technique (to a lesser extent) this is not the case. The use of benchmarking techniques is therefore recommended when the one-quarter-overlap or the over-the-year technique is applied. A benchmarking technique which minimises the impact on the quarter-on-quarter changes of the series should be chosen.

(j) Seasonally adjusted chain-linked quarterly volume measures should be made consistent to the respective non-seasonally adjusted chain-linked annual data by using a benchmarking technique which minimises the impact on the quarter-on-quarter changes of the series. The benchmarking is required for purely practical reasons, e.g. the consistency of annual average growth rates. Benchmarking must not introduce a seasonal pattern into the series. The reference should be the independently derived chain-linked annual series in unadjusted form for only seasonally adjusted QNA, and in calendar adjusted form for seasonally and calendar adjusted QNA. The calendar adjusted chain-linked annual series may be derived by applying a calendar factor derived from calendar adjusted quarterly or monthly data. If it can be shown that calendar effects on the annual chain-linked series are systematically

[2] ESA 95 para 12.06 requires: "Since quarterly accounts adopt the same framework as annual accounts they have to be consistent over time with them. This implies, in case of flow variables, that the sum of the quarterly data is equal to annual figures for each year."

negligible, the reference for benchmarking the quarterly seasonally and calendar adjusted series may be the independently derived chain-linked annual series in unadjusted form.

Exceptions from the desired time consistency may be acceptable if the seasonality is rapidly changing. Calendar adjusted quarterly data should not be benchmarked to unadjusted annual data since the number of working days may differ across calendar years.

(k) Chain-linked volume measures in unadjusted and adjusted form are not additive.[3] No correction should be made to remove the non-additivity introduced by chain-linking.

QNA volume measures in average prices of the previous year should be additive. If for data in average prices of the previous year differences between the non-adjusted total GDP and the aggregate of its non-adjusted (expenditure or output) components arise, these should be allocated to a series of statistical discrepancies which is transmitted to Eurostat. Alternatively, the discrepancies could be allocated to a series which typically has a residual character (e.g. changes in inventories) or could be distributed among the components. In the latter case the effect on the pattern of the non-seasonally adjusted series should be minimised.

(l) As for volume measures with a fixed price-base year, there is a choice between indirect and direct seasonal adjustment of QNA volume aggregates for chain-linked measures.[4] Indirect adjustment of chain-linked volume measures means that the adjusted chain-linked aggregate is obtained by aggregating the adjusted component data in average prices of the previous year[5] and chain-linking the result.

The seasonally adjusted data in average prices of the previous year should be derived by unchaining the benchmarked adjusted chain-linked volume series. Discrepancies between the seasonally adjusted total GDP and the aggregate of its seasonally adjusted components expressed in average prices of the previous year which arise due to the direct adjustment of the total GDP should be allocated to a series of statistical discrepancies which is transmitted to Eurostat. Alternatively, the discrepancies could be allocated to a series which typically has a residual character (e.g. changes in inventories) or could be distributed

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[3] "Additivity … implies that at each level of aggregation the volume index for an aggregate takes the form of a weighted arithmetic average of the volume indices for its components with base-period values as weights." (Source: 1993 SNA, Paragraph 6.55).

[4] Generally, the choice between indirect and direct seasonal adjustment requires case-by-case decisions, taking into account the statistical quality achievable by direct or, alternatively, indirect adjustment and the user requirement for consistency.

[5] It has to be noted, that unchaining leads in principle to data which are unrelated across years. A comparison of these data across years may show a seasonal pattern between the fourth quarter of one year and the first quarter of the following year, even if the data in prices of the previous year are derived from seasonally adjusted chain-linked series.

among the components if the annual overlap approach is applied. In such cases the series affected by the distribution should be checked for residual seasonality.

(m) Deriving seasonally adjusted values in average prices of the previous year from benchmarked seasonally adjusted chain-linked volume measures does not require any additional information to those data anyway provided in the ESA95 transmission programme, when the annual overlap method is applied, whereas the other chain-linking methods require additional data for unchaining the adjusted chain-linked series.

According to Regulation (EC) No 1392/2007, the transmission of adjusted QNA volume measures to Eurostat shall include adjusted data in average prices of the previous year. The data are used by Eurostat to validate the consistency in aggregation of the data provided by countries and to calculate European aggregates. The transmission is strictly necessary for countries not using the annual overlap technique for chain-linking. When the annual overlap technique is used it is generally straightforward to derive adjusted data in average prices of the previous year from adjusted chain-linked data. In these cases Eurostat may inform to which extent the transmission of adjusted data in average prices of the previous year is required, taking into account the possible reduction of the reporting burden.

(n) A QNA volume measure which is derived from component series or as residuals may have zero or negative values, although each of its components is strictly positive (e.g. external balance, changes in inventories). For these series chain-linking is not possible. Seasonally adjusted data should be calculated by aggregating the seasonally adjusted data of the strictly positive component series expressed in average prices of the previous year. The seasonally adjusted data of the strictly positive components shall be derived from the seasonally adjusted and benchmarked chain-linked component series.

(o) In several Member States unadjusted or adjusted QNA series are compiled according to the "indirect" approach that derives quarterly time series from annual aggregates by applying temporal disaggregation techniques using unadjusted or adjusted indicator series. Therefore, the order of procedure for chain-linking, benchmarking and seasonal adjustment may differ from the order outlined before. In these cases procedures should be applied that lead to adjusted QNA volume measures that are comparable to the QNA measures produced according to the recommendations above. In particular the following applies:

- In principle, temporal disaggregation techniques should not be applied to annual data expressed in average prices of the previous year. These series might present breaks from one year to the other (due to the shifting of the price base year). Rather, disaggregation techniques should be applied to chain-linked annual series. Volume

indicators with a fixed price-base year can be used when chain-linked indicators are not available.

- Temporal disaggregation can be applied using unadjusted indicator time series for deriving unadjusted QNA data. Temporal disaggregation techniques can also be applied using seasonally adjusted indicators for deriving seasonally adjusted QNA data. In these cases the recommendations 5 to 11 should be applied analogously.

Annex 1: Calendar effects and calendar adjustment – Draft glossary

Calendar effect

The calendar effect is the impact of working/trading days (number and composition), fixed and moving holidays, leap years and other calendar phenomena (e.g., bridging days) on the time series under review.

The calendar effect resumes periodical effects on a time series which are, directly or indirectly, linked to specific calendar situations. While the Christmas effect on economic activity is always caught by the month of December/fourth quarter (therefore it is to a large extent assigned to the seasonal component), the effect of Easter, as well as other moving holidays, may concern varying months or quarters (Catholic Easter can affect March or April, i.e. the first or the second quarter). For this reason, moving holiday effects require a special statistical treatment.

A special calendar correction is the leap year correction.

The calendar effect is normally caught via a quantitative estimation of the effect on the value of a quarterly or monthly time series in a quarter or month, e.g. measured by estimating the effect of the deviation in the number of working days from its long-term average in that quarter or month.

The calendar effect can be divided into a seasonal and a non-seasonal component: the former corresponds to the average calendar situation that repeats each year at the same season; the latter corresponds to the deviation of the calendar variables (such as trading/working days, moving holidays, leap year) from the monthly or quarterly specific long-term average.

Calendar effect component

The calendar effect component is an estimate of the non-seasonal calendar effect, for which there is statistical evidence and an economic explanation.

Calendar adjustment

The calendar adjustment is the removal of the calendar effect component.

Working day/trading day adjustment

Working day or trading day adjustments refer to the removal of the non-seasonal effect related to the number and the composition of working or trading days in a given month/quarter for flow series or the sort/type of day for stock series.

Each month and quarter embody a varying number of Mondays, Tuesdays, ... and Sundays and, consequently the business activity can vary accordingly. The working day effect catches the difference between the “working-days” (i.e. Monday, Tuesdays,..., Friday) and the weekend days (Saturday and Sunday) according to the idea that these two groups of days have different effects. The trading day effect catches the difference between the days of the week.

In practice, trading day adjustment and working day adjustment are often used as synonyms. However, this approach is not followed here. Instead, the above mentioned difference in terminology is used.

Public holidays

A public holiday (also known as "general", "statutory" or, in United Kingdom and Ireland, "bank" holiday) is a holiday established and regulated by national, regional or local authorities.

Fixed holidays

Fixed holidays are holidays which occur each year, at a fixed date (e.g. Christmas).

Moving holidays

Moving holidays are holidays which occur each year, but at varying dates (e.g. Catholic Easter).

Regional holidays

Regional holidays are public holidays established and regulated by regional authorities.

At country level, regional holidays are not to be treated as full holiday but only as partial holidays (according to the share that the data for the regions affected by the holiday customarily take up in the total result for the country).

National holidays

National holidays are public holidays established and regulated by national authorities.

At European level, national holidays, which are not established in all counties within Europe, are not to be treated as full holiday but only as partial holidays (according to the share that the data for the country affected by the holiday customarily take up in the total result for the European Union).

Regional calendar and regional calendar regressors

Regional calendars are the collection of fixed and moving holidays, working/trading days at regional level.

Regional calendar regressors reflect the regional calendar situations for calendar adjustment purposes in terms of numbers of working/trading days, holidays etc.

National calendar and national calendar regressors

National calendars are the collection of fixed and moving holiday, working/trading days at national level.

National calendar regressors reflect national calendar situations for calendar adjustment purposes in terms of numbers of working/trading days, holidays etc. National calendar regressors may be built from weighted averages of regional calendars regressors.

European Union/euro area calendar and European Union/euro area calendar regressors

EU/EA calendars are the collection of fixed and moving holidays, working/trading days at European Union/Euro area level.

EU/EA calendar regressors reflect the EU/EA calendar situations for calendar adjustment purposes in terms of numbers of working/trading days, holidays etc. EU/EA calendar regressors are usually built from weighted averages of national calendars regressors.

Specific indicator/sector/industry calendars

European/national/regional specific indicator/sector/industry calendars are the collection of fixed and moving holidays as well as trading/working days at national level related to a specific indicator/sector/industry.

The number of working or trading days in a given month or quarter can vary significantly for each statistical domain (e.g. production, merchandise trade) because of differing institutional arrangements, trade specific holidays, etc.

Bridging days

Bridging days are days (up to two) lying between a public holiday and a weekend.

Bridging days may generate effects on the time series under review. These result from people taking holidays on bridging days.

School holidays

School holidays are periods in which classes are not given.

The economic activity in a month/quarter is likely to be affected by the schedule of the school holidays. Workers with school-age children take leave above all during the school holidays, and hence interrupt their work.

Weather effects

Weather effects are effects that are linked to specific weather conditions. If they do not occur repeatedly with the exact same intensity in the same month of each year they contain a non seasonal effect.

Non seasonal weather effects are associated with exceptional/atypical weather conditions. Weather effects can affect different economic activities in a different way (for example, construction, tourism services).