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Methodological description of the Trend indicator of Output

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Chapter 1 Overview of the Trend Indicator of Output

1.1 Organisation

The Trend Indicator of Output is compiled by the National Accounts Unit of Statistics Finland’s Economic Statistics Department. The compiling is performed by one full-time person (summariser) and between one and three other national accounts experts.

1.2 Publication timetable, revisions policy and dissemination

The Trend Indicator of Output is published some 65 days (the first two months of a quarter) or 45 days (last month of a quarter) from the end of the statistical reference month. A calendar showing all future release dates for the current year can be found on the web pages of the Trend Indicator of Output: http://tilastokeskus.fi/til/ktkk/tjulk_en.html.

Trend Indicator of Output data become revised after their first release. It is, therefore, advisable to always retrieve the latest version from the Trend Indicator of Output web pages when using time series.

1.3 Compilation of the Trend Indicator of Output

The calculation of the Trend Indicator of Output is based on monthly indicators. These indicators are used because, in contrast to annual accounts, exhaustive monthly data on the values of the different transactions are generally not available. Data at current prices are mainly calculated by means of extrapolation of indicator changes, i.e. the monthly Trend Indicator of Output data from twelve months back are multiplied with the year-on-year change in the indicator. Data at current prices are deflated according to the average prices of the year before. This produces volume figures at previous year's prices, in which the previous year is always the base year. Volume changes at previous year's prices are used to chain a continuous volume series at reference year 2000 prices with the so-called annual overlap method. This series is published as the Trend Indicator of Output.

1.4 Benchmarking

Chained volume series are benchmarked to the quarterly national accounts value added series using the proportional Denton method.

1.5 Seasonal adjustment and working day correction

In the Trend Indicator of Total Output seasonal adjustment and working day corrections are performed with the TRAMO/SEATS method by using the Demetra software. The data are calculated as original and adjusted for working days for the whole economy and for three main industries. A seasonally adjusted and a trend series are also calculated for the whole

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economy. Seasonally adjusted, working day corrected and trend time series are not benchmarked to quarterly or annual accounts after adjustment.

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Chapter 2 Publication timetable, revisions policy and dissemination of the Trend Indicator of Output

2.1 Release timetable and revisions to data

The Trend Indicator of Output is published some 65 days (the first two months of a quarter) or 45 days (last month of a quarter) from the end of the statistical reference month. A calendar showing all future release dates for the current year can be found on the web pages of the Trend Indicator of Output: http://tilastokeskus.fi/til/ktkk/tjulk_en.html.

The Trend Indicator of Output is not published between calculation rounds even if some data have changed in some other statistics included in national accounts, such as quarterly or annual accounts. Such changes will show up in the next regular publication of the Trend Indicator of Output.

Trend Indicator of Output data become revised after their first release. It is, therefore, advisable to always retrieve the latest version from the Trend Indicator of Output web pages when using time series. The revisions can be divided into those arising from revisions in the source data and revisions caused by benchmarking to quarterly annual accounts.

Revisions arising from revisions in the monthly source data occur within roughly one year of the initial publication. In each calculation round the time series are recalculated starting from the 1996 data. However, in the revisions of Trend Indicator of Output data from earlier than the most recent 1 to 3 months, the benchmarking to quarterly national accounts is more significant than the revisions arising from revisions in the source data.

2.2 Contents published

The publication format of the Trend Indicator of Output is a free online release comprising a brief release text and time series accessible via the “Tables” link. The entire data content is included in the tables of the online release. The time series start from January 1996.

The tables can illustrate the original index series of the whole national economy and the three main industries, namely primary production, secondary production and services, the working-day corrected index series as well as change percentages for both when compared with the respective month of the year before. Seasonally-adjusted and trend series are available as index series for the whole economy as well as their change percentages form the previous month.

2.3 Special transmissions

The time series and change percentages included in the online release of the Trend Indicator of Output are also delivered to the ASTIKA service.

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The quarterly accounts flash estimate for the national economy, which is based on the Trend Indicator of Output and not published separately, is sent to Eurostat at a lag of 43 days from the end of a quarter.

2.4 Metadata

The description of the Trend Indicator of Output is available on the home page of the statistics at http://tilastokeskus.fi/til/ktkk/meta_en.html.

A quality description (in Finnish only) is also available on the home page of the Trend Indicator of Output at:

http://tilastokeskus.fi/til/ktkk/laa.html.

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Chapter 3 Compilation of the Trend Indicator of Output

3.1 Overall compilation approach

3.1.1 Calculation system of the Trend Indicator of Output

The calculation of the Trend Indicator of Output is based on monthly indicators. Indicators refer to such quickly released statistics or other source data that are considered to correlate with or develop in the same direction as a certain national accounts transaction. These indicators are used because, in contrast to annual accounts, exhaustive monthly data on the values of the different transactions are generally not available. Even if exhaustive data were available monthly at some time lag, it would be very rare for them to be available in the timetable required by the Trend Indicator of Output, i.e. within 40 or 60 days from the end of a month.

Data at current prices are calculated by means of extrapolation of indicator changes, i.e. the monthly Trend Indicator of Output data from twelve months back are multiplied with the year-on-year change in the indicator. For the time being, intermediate consumption is not estimated separately, but the development of industries is estimated on the basis of the development of output indicators.

Example 1: Extrapolation with one indicator

Time period	Indicator	Value, EUR million	Extrapolated value, EUR million
2006 Jan	100.0	1,478	
2006 Feb	101.4	1,499	
2006 March	102.1	1,530	
2006 Apr	103.9	1,590	
2007 Jan	102.7		(102.7/100.0)*1,478 = 1,518
2007 Febr	104.0		(104.0/101.4)*1,499 = 1,537
2007 March	103.5		(103.5/102.1)*1,530 = 1,551
2007 Apr	105.2		(105.2/103.9)*1,590 = 1,610

Data on volume are obtained by deflating the current priced figure with the price index change from previous year's average price and by chaining thus obtained volumes at the previous year's prices into values at reference year 2000 prices with the Annual overlap method (see 3.2). In the Trend Indicator

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of Output the chained volume series are benchmarked to correspond to the value added series of quarterly national accounts. Working day corrections and seasonal adjustments are performed on benchmarked time series. Seasonally adjusted and working day corrected series are not benchmarked again, which means they do not follow exactly the development of quarterly national accounts.

3.1.2 Trend Indicator of Output data sources

The source data used in the calculation of the Trend Indicator of Output cover most of the data used in quarterly national accounts. The calculation uses 64 sources to describe both value data and price development. The calculation is performed at the 2-digit level of the classification of industries but not by a breakdown by sector as in quarterly national accounts. Intermediate consumption is not estimated separately either. For manufacturing and private services the primary sources of value data are preliminary data from turnover indices and for public services preliminary data from wage and salary indices, while producer price indices and indices of wage and salary earnings are used as sources for price data. The source data for primary production derive from information on volumes of milk received by dairies, slaughterhouse statistics, crop production statistics, data on market fellings, and unit price data corresponding with these unit volume data.

3.1.3 Estimation in preliminary data

Estimates based on statistical prediction models or expert estimates are used in the estimation of some sub-series when an indicator describing the development of the sub-series is not available, typically because of the release timetable. In time series benchmarking and seasonal adjustment statistical models are, of course, used.

3.2 Volume data

Trend Indicator of Output volume data are published as chained series at reference year 2000 prices. The chaining is performed with the Annual overlap method.

3.2.1 Chaining with the Annual overlap method in the Trend Indicator of Output

Calculation of volume data starts with the so-called deflation in which time series at current prices are converted to series at the average prices of the previous year by dividing monthly current price figures with a deflator. The simplest deflator is the ratio between the index point figure for one calculation month and the previous year’s average of the index, which expresses the price level of the calculation month relative to the average price level of the previous year.

Several price indices which receive their weights from current priced data are used in the deflation of one published series. Deflation is performed at the level of sub-series, so weighting is automatic when the deflated sub-

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series are summed to main industries at the publication level where the chaining takes place.

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Example 2: Deflation with one price index (NB this produces 104.8 as the average for the price index of 2006)

Time period	Estimate at current prices	Price index	Deflator	Volume at previous year's average price
2006 Jan	1,478	103.4		
2006 Feb	1,499	103.1		
2006 March	1,530	104.0		
2006 Apr	1,590	104.5		
2007 Jan	1,518	104.4	104.4 / 104.8 = 0.996	1,518 / 0.996 = 1,524
2007 Feb	1,537	104.8	104.8 / 104.8 = 1.000	1,537 / 1.000 = 1,537
2007 March	1,551	105.2	105.2 / 104.8 = 1.004	1,551 / 1.004 = 1,545
2007 Apr	1,610	105.9	105.9 / 104.8 = 1.010	1,610 / 1.010 = 1,593

When the previous year's average priced volumes have been calculated, they are chained into reference year 2000 prices. The chaining is done by first calculating change in the volume (at previous year's average prices) of each month from the current priced average of the previous year. This monthly change in the volume is used to multiply the average of the previous year's volume, which produces a chained monthly volume series.

In chained series the reference year means that volumes are expressed relative to the current priced level of the reference year. Because the price weights change annually in chained series, we cannot actually claim that chained volume series would be at the prices of 2000. The drawback of chained series is loss of additivity, in other words, the series cannot be summed up together. For example, the chained volume of total value added or total output does not exactly equal the sum of its components.

3.3.2 Chaining and benchmarking

Chained volume series are benchmarked to quarterly national accounts with the proportional Denton method (see 3.3). This procedure differs from the quarterly national accounts benchmarking, in which volumes at the previous year's prices are benchmarked using the pro rata method and current priced

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values are benchmarked using the proportional Denton method before chaining.

3.2.3 Chaining and seasonal adjustment

Chained and benchmarked volume series are seasonally adjusted with the TRAMO/SEATS method using the Demetra software. Each chained volume series is adjusted separately (so-called direct approach) because chained series cannot be summed up together. The data are calculated as original and working day adjusted series for the whole economy and for three main industries. In addition, a seasonally adjusted series and a trend series are calculated for the whole economy. Seasonally adjusted, working day corrected and trend time series are not benchmarked to quarterly or annual accounts after adjustment.

3.3 Benchmarking with quarterly national accounts

The Trend Indicator of Output is benchmarked to correspond to the most recent quarterly national accounts. After benchmarking the trend development of the monthly time series corresponds to that of the quarterly national accounts time series. Time series are benchmarked before their working day and seasonal adjustment.
Trend Indicator of Output time series are benchmarked to quarterly national accounts with the proportional Denton method[1] which is basically mechanical and aims to just to maintain the originality of the trend development between the months. If an observation in an original series at point in time t is denoted with i_t and an observation in the benchmarked series at point in time t with x_t, the sum of squares

$$\sum_{t=2}^{T}\left[\frac{x_t}{i_t}-\frac{x_{t-1}}{i_{t-1}}\right]^2$$, where T denotes the last month of the time series,

is minimised under the condition that the sum of all the months in a quarter is the value obtained from quarterly national accounts. The benchmark to indicator ratio

$$BI_t = \frac{x_t}{i_t},$$

will thus be estimated for every month, which, when the entire time series considered, deviates as little as possible from the BI ratio of the previous point in time.
There are also various benchmarking methods that are based on time series models and in which the original time series is used as the external regressor. A simple example of this is Chow-Lin[2], and if suitably formulated, the Denton method can also be regarded as a special case of this

[1] Denton, F.T. (1971), “Adjustment of monthly or quarterly series to annual totals: An approach based on quadratic minimization.” Journal of the American Statistical Association, 82, 99-102.
[2] Chow, G.C. – Lin, A.-L. (1971), “Best Linear Unbiased Interpolation, Distribution and Extrapolation of Time Series by Related Series.” The Review of Economics and Statistics, 53 (4) s. 372–375.

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kind of a model. With the exception of cases of particularly problematic series, the Denton method and methods based on simple time series modelling produce in practice the same benchmarked series, and no reasons for changing the method have emerged from the examinations performed. In addition, the proportional version of the Denton method is recommended by the IMF[3]. More complex models would make it possible to study interesting connections with e.g. seasonal adjustment, but then the benchmarking proper would not necessarily succeed equally reliably. Further reading about time series model-based methods is available in the master's thesis written at Statistics Finland (Hakala, 2005)[4].

3.4 Seasonal adjustment and working day correction[5]

3.4.1 Background information on seasonal adjustment

Time series of the Trend Indicator of Output show strong variation between the observations periods of a year, which is typical of time series on economic trends. This is known as seasonal variation. The reasons for this variation could be the cycle of seasons, changes in the observed phenomenon caused by sales seasons favourable for different products and the timing of transactions. In addition to the variation between winter and summer months, consumption over the Christmas and Easter seasons, payments of tax refunds and back taxes that in Finland fall due in December, as well as companies' payments of dividends in spring after the closing of accounts are examples of causes of seasonal variation in monthly and quarterly series.

Seasonal variation in a trend series makes it difficult to detect turning points relative to the previous observation. The direction and shape of development in the longer term are also difficult to detect from an original series. Indeed, in a time series containing observations at intervals shorter than one year, seasonal variation is often seen as a nuisance which has very little to do with the picture of development over a longer time period. The conclusion must not be drawn from this that seasonal adjustment would be standard or deterministic, and that its modelling or adjustment would be a triviality in the way of bigger things. (See also Takala 1994, pp. 69-71[6])

When analysing monthly time series on the national economy, it would be beneficial to compare an observation with the previous one as well as to calculate the change from the respective month one year previously. Turning

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[3] http://www.imf.org/external/pubs/ft/qna/2000/Textbook/ch6.pdf
[4] Hakala, Samu (2005), "Aikasarjojen täsmäyttäminen" (*Benchmarking time series*).
[5] Much of this chapter is based on the article "Aikasarjan ARIMA-mallipohjaisesta kausitasoituksesta" (*On the ARIMA model-based seasonal adjustment of a time series*) by Arto Kokkinen ja Faiz Alsuhail (2005). The Finnish Economic Journal, Issue 4/2005, Volume 101 (http://www.ktyhdistys.net/Aikakauskirja/sisallys/PDFtiedostot/KAK42005/KAK42005Kokkinen.pdf) as well as on the materials of Statistics Finland's courses on seasonal adjustment (2006) (Kokkinen).
[6] Takala, K. (1994): "Kahden kausipuhdistusmenetelmän vertailua; X11 ja STAMP" (*Comparing to methods of seasonal adjustment; X11 and STAMP*), in Suhdannekäänne ja taloudelliset aikasarjat (*Turns in economic trends and economic time series*), pp. 67–103, Statistics Finland. Studies 210, Helsinki.

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points in the examined variable can be observed by comparing development since the previous observation. To be able to do this, a time series must be broken down to its components and seasonal variation within the year evened out.

It is often suggested that time series on economic trends that contain more frequent than annual observations should be broken down to four components: trend (development over an extended time period), business cycle (medium-term variation caused by economic trends), seasonal variation (variation within one year) and irregular variation. The last one of these is presumed to be random white noise with no information that would be useful to the analysis of the series. Because making an unambiguous and clear distinction between the trend and the business cycle is difficult, these components are usually estimated together, and this combination is referred to as the trend cycle. When the concept of trend is used in this methodological description it refers to the trend cycle as is typical in analyses of time series on economic trends. When seasonal variation is evened out, a seasonally adjusted series is obtained which contains the trend cycle and irregular variation.

3.4.2 TRAMO/SEATS

The ARIMA model-based TRAMO/SEATS method recommended by Eurostat is used in seasonal adjustments of monthly and quarterly national accounts series. The ARIMA model-based (ARIMA Model Based (AMB)) seasonal adjustment starts by modelling the variation in the observation series by means of the ARIMA model. The obtained ARIMA model is utilised in breaking down the variation in the time series into the trend, seasonal and irregular components. The division into the components is done so that the obtained components can be presented with ARIMA models. The most significant difference from the ad hoc approach (e.g. methods X11/X12, Dainties, Sabl, BV4) is that in TRAMO/SEATS own, series-specific filter formulas are formed for each time series for the adjustment of the data.

The method also contains an efficient means for making corrections for working and trading days and for identifying outlying observations. TRAMO/SEATS also enables the calculation forecasts, standard errors and confidence intervals by component. The software and method have been developed into their current form by Maravall and Gomez[7].

Whenever a time series is being adjusted, the autocorrelation structure of the original series is interfered with. If the used filter (be it a common ad hoc filter or one based on an unsuitable model) fails to screen out expressly and only the seasonal adjustment frequencies of a time series, or trend frequencies when a trend is being estimated, the autocorrelation structure of the original time series becomes skewed with the temporally repeated characteristics of the original phenomenon.

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[7] See e.g. V. Gomez, and A. Maravall (1996): Programs TRAMO and SEATS. Instructions for the User, (with some updates). Working Paper 9628, Servicio de Estudios, Banco de España.

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The ARIMA model-based seasonal adjustment and the TRAMO/SEATS method offer one analytical solution to this problem. In the TRAMO part, the original series is pre-adjusted for e.g. outlying observations and variations in numbers of working and trading days so that the pre-adjusted series can be ARIMA-modelled. This modelling of the autocorrelation structure of the entire pre-adjusted series is utilised when variation in the time series at different frequencies is broken down to its components in the SEATS part.

The point of departure in the decomposition is that each component should only describe the precise part of the autocorrelation structure of the whole series and the variation that relates to it, i.e. the components are mutually orthogonal. Interpretationally this means that the reasons that cause seasonal variation (such as time of year) in a time series are uncorrelated with the reasons behind a long-term trend, such as investments or R&D activity. In addition it is presumed that a time series is made up of components that are realisations of linear stochastic processes. Then each component (with the exception of the irregular term) can be described with an ARIMA model.

Both the pre-adjusted series and its components are ARIMA modelled while respecting the dynamic characteristics of the original series which recur in time. Finally the deterministic factors, outliers and variation caused by working or trading days that are observed in the pre-adjustment are assigned to the components as follows: extreme observations of level change (level shift (LS)) to *trend*, variation caused by numbers of working days and trading days (working day/trading day effects (WD/TD)) to *seasonal variation*, and individual outlying observations (additive outliers (AO)) and momentary outlying observations lasting for the duration of several observations (transitory outliers (TC)) to *random variation.* Thus the variation in the entire original time series becomes distributed to the components of final trend cycle, final seasonal variation and final irregular variations.

Because the said components are initially unobservable in the original time series they can be formed in many ways. In the TRAMO/SEATS method a solution is sought in the decomposition of a pre-adjusted time series where the variance of random variation is maximised. This solution is known as canonic decomposition and it produces an unambiguous decomposition of a time series.

When comparing the variance of the random variation factor (and the component of irregular variation) produced by means of canonical decomposition with other methods, such as the other model-based method, STAMP, and the aforementioned ad hoc methods, it is good to bear in mind that:

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1. The modelling of a pre-adjusted series is made with diverse (pdq)*(PDQ) models[8] of the seasonal ARIMA model family which produce quite small random variation proven as random variance.

2. The identification of a seasonal ARIMA model for a pre-adjusted series is based on the Bayesian Information Criterion (BIC)[9] according to which the selection of the model is determined by as small a variance as possible in random variation achieved with as small a number of estimated parameters as possible.

Thus when a series pre-adjusted in the SEATS phase is divided into its components, the variance of random variation (residual of ARIMA model) produced by the seasonal ARIMA model fitted to a time series is very small. This minimising of the random variation of an entire time series in other components of the SEATS phase, and the assignment of most of it expressly to the variance of the random variation component cannot be assumed to lead to any greater variance of the random variation component (and the irregular components) than in the mentioned other methods in which the whole time series is not first modelled with a model of the seasonal ARIMA model family. By contrast, the combination of the deterministic modelling of working and trading day variation often leads to a greater variance of the seasonal component in TRAMO/SEATS. The stochastic modelling strategy of seasonal variation also works well on seasonal variation that transforms in time, which helps not only the capture of working and trading day effects but also that of seasonal variation.
In order to reduce the revision of the latest adjusted observations, a projection a few observations forward must be produced in all seasonal adjustment methods. It is usually done basing on an ARIMA model, such as X11-/X12 ARIMA, even if the seasonal adjustment filter were not connected with the model concerned in any way. One logical justification of ARIMA model-based seasonal adjustment is that the filter used in the adjustment of a series is based on the same series-specific ARIMA model with which the forward projection is made. In all eventualities, in all methods the latest 1 to 3 adjusted observations will become revised against new statistical observations.

With standard regression and ARIMA model symbols, the phased TRAMO/SEATS method can be presented as follows:

[8] Symbols p,d,q refer ot the basic ARIMA part of the models and symbols P,D,Q to the seasonal ARIMA part, where p (or P) is an ar-parametric number, d (D) a differentiated number, q (Q) a ma-parametric number. The T/S model selection is based on the following maximum limits p=3,d=2,q=2; P=1,D=1,Q=1

[9] Min BIC (p, q) = $\log\sigma^2 + \log(p+q)T^{-1}\log T$, where p and q are the numbers of ar- and ma-parametres in the model and T the number of observations in the time series. When T approaches infinity BIC locates the model which has produced the time line on the basis of simulations.

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Tramo (**I**) / Seats (**II**):

I) $$y_t = x_t'\beta + z_t$$

Pre-adjustment regressions	Pre-adjusted remainder
- working/trading day effects (WD/TD)	according to the ARIMA model
- outlying observations (LS, AO, TC)	

II) $$z_t = p_t + s_t + u_t$$

$$\Rightarrow \frac{\theta(B)}{\phi(B)} z_t = \frac{\theta_p(B)}{\phi_p(B)} a_{pt} + \frac{\theta_s(B)}{\phi_s(B)} a_{st} + u_t$$

Residual of ARIMA modelling, random (WN)

(pre-adjusted series = (initial) trend + (initial) seasonal component + random variation)

Finally the deterministic factors of part I and the stochastic factors of part II are combined and the original series is divided into its final components:

$$y_t = p_t(+LS) + s_t(+WD/TD) + u_t(+AO,TC)$$

Final Irregular

observation series = trend + seasonal component + irregular component

The above final decomposition shows that when the seasonal component is being removed, calendar effects are also eliminated in seasonal adjustment.

3.4.3 Policy for seasonal adjustment

In the Trend Indicator of Output the seasonally adjusted time series and the trend series are published at the level of the whole economy as a chained volume series at year 2000 prices. Time series chained into reference year prices are adjusted directly, which means that time series are adjusted separately, and e.g. a seasonally adjusted series for the whole economy is not produced by summing together three main industries. Apart from this publicly available methodological description, the users also receive information about the implementation of seasonal adjustment on courses organised by Statistics Finland and simply by asking about it. The policies

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applied in describing the modelling of time series are openness and sharing of information.

The governing principle in seasonal adjustments is to make the modellings carefully once a year and keep both the deterministic pre-adjustment factors and the identified ARIMA model fixed between annual reviews of the modelling, yet so that the parameter values are re-estimated on each calculation round. An exception to this are outlying observations mid-way through the year, such as a labour dispute, for example. The model might, however, be adjusted if the modelling no longer fits the data due to new observations. The main principle is to keep the adjustment filters formed with the model identified for a series (apart from the estimation of parameter values) unchanged so that adaption of filters does not cause revisions to the history of a seasonally adjusted series on every round. The aim in the updating of parameter values is to produce forward projections with as full information as possible on the past on every calculation round. The objective in this is to reduce revisions to the latest observations in adjusted series when new observations become available.

3.4.4 Policy for working day correction

Working day corrected (more generally calendar adjusted) time series are published as chained volume series at reference year 2000 prices. The main principle in the working or trading day correction (inclusive of adjustments for leap years, Easter and national public holidays) is the testing of statistical significance during several modelling rounds.

Working or trading day correction factors (inclusive of omission of working day correction of a series) are not changed mid-way through the year between modelling rounds. In the best case, based on experiences of several years' modelling over a longer term, a logical and stable solution in terms of the content of each individual series is sought for performing working or trading day corrections.

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Chapter 4 Flash estimates

4.1 Quarterly flash estimate of GDP

A quarterly flash estimate of gross domestic product is calculated as Trend Indicator of Output. The flash estimate is not published but produced for Eurostat only.

The calculation of the flash estimate is based as exhaustively as possible on the same data sources as the quarterly national accounts. Due to the fast release timetable, completely identical data cannot be used, and industries are not split into different sectors. Intermediate consumption as well as taxes and subsidies on products are not estimated in the compilation of the flash estimate, but quarterly GDP is carried forward with an annual change based on indicators of output.

Apart from the aforementioned exceptions, the same methods are used in the calculation of the flash estimate as in the calculation of quarterly national accounts. Development in the value and price of output is mainly estimated basing on data describing turnover and corresponding indices of produce prices, or data on wage and salary sums and indices of wage and salary earnings. The calculation is performed monthly with the annual overlap method. Except for the currently calculated quarter, chained time series are benchmarked to correspond to quarterly and annual accounts. Monthly series are summed up to quarterly series. Quarterly series are seasonally adjusted with the TRAMO/SEATS method.