Short-term business statistics - seasonal adjustment methods

Statistics Explained

This article describes the seasonal adjustment method used by Eurostat's short-term business statistics (STS). It is part of a set of background articles treating various methodological aspects of short-term business statistics.

Adjustment of short-term statistics data

Economic indicators such as turnover or production do not develop smoothly over time. These data may follow a long-term trend but there are also strong infra-annual influences that make a direct month-on-month or quarter-on quarter comparison of unadjusted data difficult. This article will present the effects due to different seasonal patterns of economic time series and their statistical adjustment. Calendar effects which are e.g. due to holidays falling into different months will be discussed in another article.

Eurostat publishes national and European short-term statistics indicators of the following types:

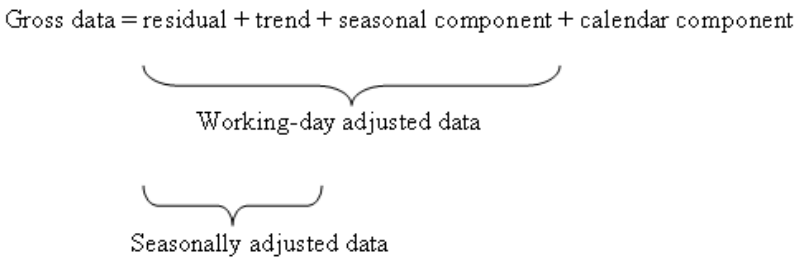

Figure 1: Components of an STS time series

- unadjusted/gross data (nsa), i.e. data without any adjustment;
- calendar adjusted (working day adjusted) data (ca) in which calendar effects (leap years, public holidays, different number of Saturdays and Sundays between months etc.) have been removed;
- seasonally and calendar adjusted data (sca) in which not only calendar effects have been removed but also seasonal effects (e.g. the effect of summer holidays on production or Christmas shopping on retail turnover);
- Until January 2013 Eurostat also published trend data.

An important aspect for the quality of the adjustment is that the residual component of the gross data is rather small, or in other words that most of the development of a time series is either explained by a trend, by seasonal effects or by calendar effects.

Seasonal patterns

A major influence on many STS data series are the summer holidays. Figure 2 shows the average monthly variation of the production in industry for the years 2000 - 2019 for the EU-27. Total industrial production in August is around 16% lower than during the average year. Especially strong is the reduction in textile production (-42%). There are however remarkable differences between industries. The production of electricity, gas, and steam is highest in the months between November and February and lowest during the summer. Food production is spread out relatively evenly during most of the year but increases in September and October.

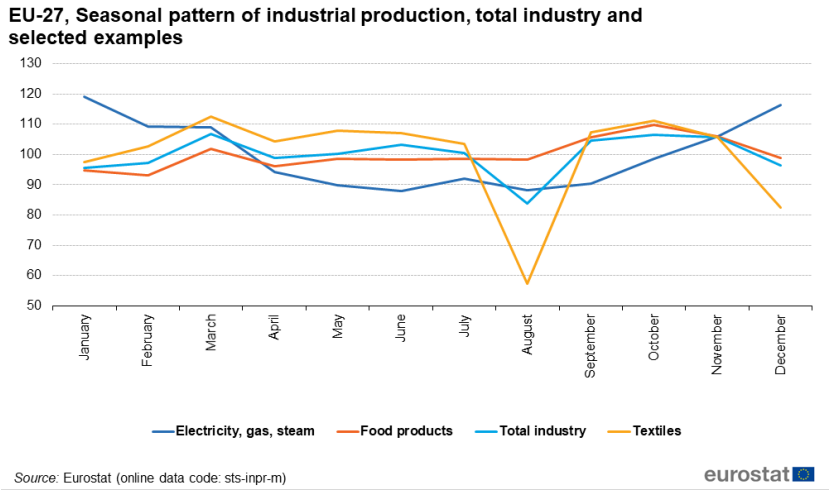

Figure 2: EU-27, seasonal pattern of industrial production, total industry and selected examples

In construction production the pattern is similar to the one for total industrial production. However the levels of production during the winter months are generally lower due to the effects of the weather (Figure 3).

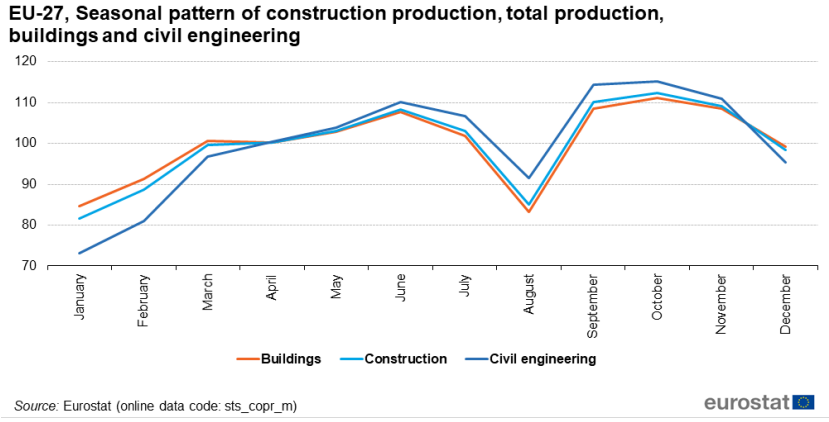

Figure 3: EU-27, Seasonal pattern of construction production, total production, buildings and civil engineering

There are not only different seasonal patterns for different industries, there are also considerable differences in the seasonal patterns of different countries. Figure 4 shows the average seasonal variations in the industrial production of Germany, Italy and Sweden for the years 2000 - 2019. In Germany the overall variations are relatively small, the months with the highest production level are March, September and October. In Italy the production level varies much more strongly from month to month and shows a pronounced reduction during August (-40%). A similar strong reduction during the month of August can also be found in other southern European countries, e.g. in Spain, Portugal, France, and Slovenia. The seasonal pastern of Sweden is similar to the one of other Northern European countries (e.g. Finland, Denmark, Estonia) where the summer holidays

generally are taken in July.

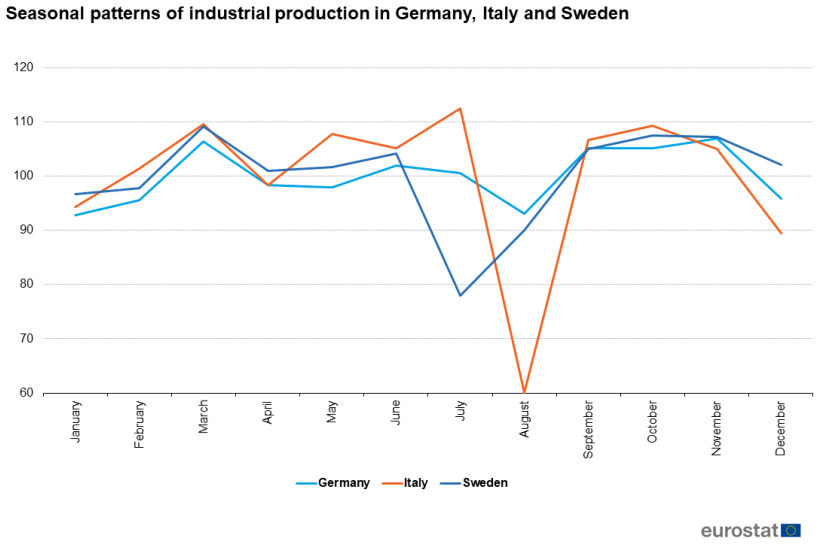

Figure 4: Seasonal patterns of industrial production in Germany, Italy and Sweden

STS requirements

For many variables (e.g. production volume, volume of sales, net turnover, building permits) the European Business statistics Regulation (2019/2152) requires Member States to transmit not only unadjusted data but also calendar adjusted and seasonally adjusted data to Eurostat. In the past, under the STS Regulation (1165/98) usually only unadjusted and calendar adjusted data were required. The transmission of seasonally adjusted data was voluntary. Generally, seasonally adjusted data used to be calculated by Eurostat for most countries and for most time series. Where countries provided seasonally adjuisted data on a voluntary basis Eurostat published the national results in order to avoid discrepancies between European published data and nationally published data.

Indirect geographical seasonal adjustment

As of 1 March 2012 Eurostat changed the method for seasonal adjustment of European Union (EU) short-term statistics (STS) data from a direct to an indirect approach. In this section the two approaches are described and their respective advantages and possible shortcomings are outlined.

Note that in this article the terms "direct" and "indirect" refer to the*geographical* dimension of the STS data, i.e. the way in which national data are aggregated to European data. In another context direct and indirect methods might be used, for instance, to aggregate data from sub-industry level to industry level etc.

Indirect approach (as of March 2012)

In the indirect approach seasonally adjusted European aggregates are calculated as follows:

- where national seasonally adjusted time series are available (see above), these are used;
- where seasonally adjusted series are not available they are calculated by Eurostat on the basis of the available national unadjusted data or calendar adjusted data;
- these seasonally adjusted series for the EU-Member States (or the Euro area) are then weighted and combined to yield an aggregate European time series.

The approach is called indirect because the seasonally adjusted European aggregate is not seasonally adjusted itself but is based on national inputs which have been adjusted before the aggregation.

Direct approach (until March 2012)

Table 1: Industrial Production Index – Total Industry, July 2011

	Working-day adjusted index	Weights (%)	Index * Weight	Different seasonal adjustments	Seasonally adjusted index	Index * Weight
Germany	114.6	44.5	51.0	—SA $_{DE}$→	115.4	51.4
Spain	89.5	13.0	11.6	—SA $_{ES}$→	83.8	10.9
France	94.3	20.6	19.4	—SA $_{FR}$→	95.2	19.6
Italy	98.9	21.9	21.7	—SA $_{IT}$→	89.3	19.6
Indirect			103.7	—/→		∑ = **101.5**
Direct			103.7	—SA $_{aggregate}$→		**99.8**

Table 1: Example - direct and indirect seasonal adjustment

In the direct approach the national time series (either calendar adjusted or unadjusted data) were first weighted and aggregated and the seasonal adjustment was then performed directly on the European aggregate.

Table 1 illustrates the two methods with a simplified example for the industrial production index in July 2011. According to the indirect method the value of the index is 101.5 which is the weighted sum of the independently seasonally adjusted values for Germany, Spain, France and Italy. According to the direct method the value for the index is 99.8 which is calculated from the working-day adjusted weighted index for the four countries with a model that is specific for the aggregate of these four countries.

Benefits and shortcomings of the direct and the indirect approach

The indirect approach has several advantages.

- (Seasonally adjusted) European averages are fully consistent with national seasonally adjusted data. Where e.g. seasonally adjusted national data and European aggregates are published in the same tables, users can check the consistency by weighting and adding up the data for the Member States. This is not the case with the direct approach. Consistent national and European data entail greater credibility of the results.
- Generally Member States are obliged to transmit calendar adjusted data to Eurostat (see STS requirements). The indirect adjustment approach used for the calculation of European calendar adjusted aggregates. Using the same approaches for calendar adjustment and seasonal adjustment thus creates greater consistency.
- If new European aggregates have to be calculated (because the composition of the European Union or the euro area changes, for instance) it is not necessary to define new seasonal adjustment specifications for the new aggregate, only a new weighting scheme would have to be developed.
- National statistical institutes have more detailed information available which they can employ for the calculation of their seasonal adjustment. Using these data as input can be expected to lead to higher quality in the European aggregates than using one single European adjustment method on the aggregated input data.
- One advantage of a direct approach is that for each data series the optimal adjustment method can be found which takes into account specific aspects of this series. In that way the residual component of the data series can be minimised and most of the development of the series can be explained by trend, seasonal effects of calendar effects (see above).

- A direct approach can also have advantages when the various methods for seasonal adjustment that are used by the Member States are very diverse. In such a case the indirect approach would add up national results which are not comparable due to different methods for seasonal adjustment. The development of the European aggregates could than be difficult to interpret.

Quantitative comparison

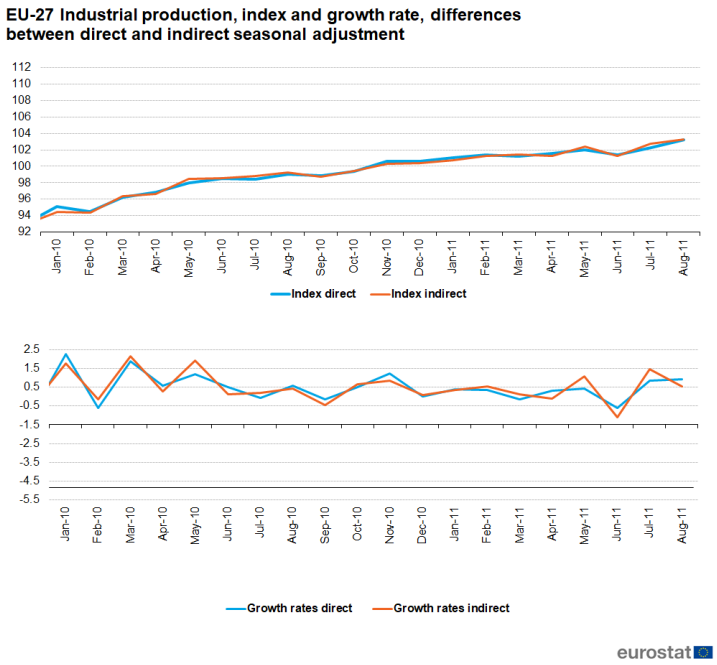

Figure 5: EU-27 Industrial production, index and growth rate, differences between direct and indirect seasonal adjustment

Which method – direct or indirect – is better cannot be decided a priori but depends on the circumstances (see above). For most European STS-indicators the quantitative differences between the two approaches are not very big.

Figure 5 shows the recent development of the EU-27 industrial production index calculated with the direct and the indirect method. For the indices differences are marginal. For the respective growth rates however differences can be observed. The advantage of the indirect method of guaranteeing consistency between European aggregates and national results is therefore of particular importance for the growth rates.

Seasonal adjustment software used by Eurostat

On 26 February 2016 Eurostat changed from an older Tramo-Seats method to a more recent version - implemented as part of the JDemetra+ v. 2.0 package - in order to improve the quality and transparency of the calendar and seasonal adjustment in short-term business statistics (STS). The existing seasonal adjustment specifications have been converted for the use in JDemetra+ in order to ensure stability of the seasonal adjustment process and to minimise revisions.

The new software is recommended by Eurostat and the ECB for seasonal and calendar adjustment of official statistics in the EU. Moreover, the ESS guidelines on seasonal adjustment recommend in a broader sense the use of JDemetra+ by Eurostat and by the Members of the European Statistical System .

The new software does not affect the basic adjustment method used by Eurostat. Eurostat continues to use the geographically indirect approach of seasonal adjustment (see above). Therefore time series that are adjusted for calendar and seasonal effects by the reporting countries are not affected by the introduction of the new software.

As regards the time series that are adjusted by Eurostat the change to the new software will not result in significant revisions for most European STS time series. The current seasonal adjustment specifications are converted to the new production system and comparisons of the results calculated with the old and the new software show differences that are smaller than 0.1 index points for the headline figures (growth rates) published in the Eurostat's regular news releases on volume of retail trade, industrial production and production in construction.

Differences may be bigger for those time series where the irregular component is significantly large which makes it difficult to split normal seasonal from irregular effects, typically for the 2- and 3-digit levels of the activity classification (NACE rev. 2.0) of volume and value indicators and for the STS labour indicators.

STS series for prices, including industrial producer prices, are not seasonally adjusted and will not be affected by this change.

At the same time Eurostat changed its method for the estimation of missing country data, An ARIMA forecast replaced the former method of applying the available countries' growth rates to the missing countries.

Other articles

- All articles on short-term business statistics

Dedicated section

- Short-term business statistics

Methodology

- Methodology of short-term business statistics – interpretation and guidelines
- Methodology of short-term business statistics – associated documents
- Short-term business statistics - Metadata in SDMX format (ESMS metadata file — sts_esms)
- More information on Metadata in Eurostat