Annex

This document illustrates the technical details of the modelling of the monthly unemployment figures for countries supplying Eurostat with a time series of quarterly figures from the Labour Force Survey (LFS) and monthly figures from registers

Countries concerned

For the following countries the methodology as described below is implemented: Belgium, Bulgaria, Ireland, Spain, France, Croatia, Cyprus, Malta, Poland, Slovenia and Slovakia.

Temporal disaggregation

The quarterly LFS employment and unemployment levels are disaggregated into monthly levels using the proportional Denton method. This is a method to disaggregate low frequency into high frequency data by minimizing the differences between any two consecutive data points. The minimization is done subject to the condition that the average value of the three monthly employment or unemployment figures within a quarter remain equal to the corresponding actual quarterly values of the LFS.

For *unemployment* the proportional Denton method as described e.g. in Ch. 6 of the Quarterly National Accounts Manual by the IMF (2001) is applied. This makes use of a monthly indicator, registered unemployment, to disaggregate the quarterly LFS data into monthly figures. In this case, the minimization problem is applied to the differences between any two consecutive benchmark factors, which are here calculated as the monthly unemployment level proxied by the quarterly value of the LFS (X_t) divided by the registered unemployment I_t, with respect to X_t.

$$[1] \quad \min_{(X_1,\ldots X_{3\beta})} \sum_{t=2}^{3\beta} \left[\frac{X_t}{I_t} - \frac{X_{t-1}}{I_{t-1}} \right]^2 \qquad t \in \{1,\ldots(3\beta)\} \quad \text{subject to} \quad \frac{1}{3} \sum_{3q-2}^{3q} X_t = K_q \quad \text{for each q}$$

K_q = level of quarterly benchmark (LFS) for quarter q;
I_t = level of indicator for month t;
t = time, where t =3q-2 is equal to the first month of quarter q, t=3q is the third month of quarter q;
β = last quarter q for which the quarterly benchmark (LFS) is available.

The monthly time-series resulting from this procedure are ratios between the LFS unemployment level and the registered unemployment level which are then used as benchmark factors to scale-up monthly registered unemployment to the level of the LFS unemployment. These series are non-seasonally adjusted.

For *employment* no external monthly indicator is available. The proportional Denton method is therefore directly applied to the quarterly LFS employment levels. The relations [1] above still hold, but the first equation now refers to the employment levels rather than to benchmark factors. In this case, the outcome is non-seasonally adjusted monthly time-series in the employment levels.

Nowcasting of recent figures

Since quarterly LFS data are delivered as late as up to 90 days after the end of the quarter, the values published for recent months is not based on the LFS data for those months but is nowcasted for one up to four months, depending on the timeliness of the quarterly LFS figures and the distance from the previous quarterly release.

For *unemployment*, the monthly benchmark factors derived from the Denton procedure are forecasted, and the values at the end of a series are obtained by multiplying these factors with the available registered unemployment values. The forecasting method used is based on a seasonal ARIMA regression model. For each individual unemployment series (broken down by gender and age), the specifications are selected according to the fitting performance over the last year and the forecasting performance over the previous quarter. Since a forecast of the benchmark factor has to be made for up to four months, significant revisions can still not be excluded. This method is also suggested in Chapter 6 of the Quarterly National Accounts Manual by the IMF (2001).
For *employment*, the assumption is that the yearly growth rate observed for the last month for which data are available remains the same over the nowcasting period:

[2] $$E_{t+h} = (E_t/E_{t-12}) * E_{t+h-12}$$

where E_t is the last observed value for employment and E_{t+h} is the employment forecast h months ahead (with h =1, 2, 3 or 4).

Seasonal adjustment
The employment and unemployment series obtained with the procedures described above are seasonally adjusted using TRAMO-SEATS implemented in Demetra 2.2. The models are identified and estimated once per year, when the LFS data for the last quarter of a year become available.