EUROPEAN COMMISSION
EUROSTAT

Directorate F: Social statistics
**Unit F-2: Population**

# Description of the Eurostat method for the calculation of the life expectancies at all ages

The adopted method produces, with a minimum data input requirement, a quick value for the life expectancies at all ages, comparable across countries.

To achieve this goal, a set of simplifying assumptions and decisions has to be taken:

(1) the input data are the age-specific death rates $M_{x,t}$ by age completed (age at last birthday) and by sex;

(2) for both sexes, death and population (on 1 January) series have been adjusted for unknown age proportionally to the relative size of each age, if any, before calculating $M_{x,t}$;

(3) the maximum age class (open-ended) is set at 85+ for all countries, sexes and years;

(4) deaths are assumed to occur halfway through the year which means that the $a_{x,t}$ coefficient is equal to 0.5 for all ages *x* except for age 0, where the coefficient is set to 0.2.

The raw method calculates the probabilities of dying between age *x* and *x*+1 in the year *t* as:

$$\hat{q}_{x,t} = \begin{cases} \dfrac{M_{x,t}}{1+(1-a_{x,t})M_{x,t}} & for\ x = 0,...,84 \\ 1 & for\ x = x_{85+} \end{cases}$$

the probability $p_{x,t}$ of surviving from age *x* to age *x+1* as:

$$p_{x,t} = \begin{cases} 1-\hat{q}_{x,t} & for\ x = 0,...,84 \\ 0 & for\ x = x_{85+} \end{cases}$$

the survivors at age *x* in the year *t* as:

$$l_{x,t} = \begin{cases} 1 & for\ x = 0 \\ l_{x-1,t} \cdot \left(1-\hat{q}_{x-1,t}\right) & for\ x = 1,..., x_{85+} \end{cases}$$

and the life table deaths $d_{x,t}$ as:

$$d_{x,t} = l_{x,t} - l_{x+1,t} \qquad for\ x = 0,...,84$$

For the person-year lived $L_{x,t}$ the formula is:

$$L_{x,t} = \begin{cases} l_{x+1,t} + a_{x,t} \cdot d_{x,t} & for\ x = 0,...,84 \\ l_{85+} / M_{85+} & for\ x = x_{85+} \end{cases}$$

and it immediately follows the formula for the person-years lived above age $x$:

$$T_{x,t} = \sum_{\alpha=x}^{85+} L_{\alpha,t}$$

Finally, the life expectancies are calculated as:

$$e_{x,t} = \frac{T_{x,t}}{l_{x,t}} \ for\ x = 0,...,84$$

$$e_{85+,t} = \frac{1}{M_{85+,t}}.$$