Session 1B: Mortality Compression

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Paper Presented:

“Temporal Evolution of Some Mortality Indicators. Application to Spanish Data”

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This paper studies temporal evolution of age-specific mortality rates in Spain from 1981 to 2008. The authors applied the Lee-Carter model, which allows researchers to make a compact description of a large set of mortality data without excessive loss of information. In contrast to aggregated indicators such as life expectancy, the knowledge of the Lee-Carter model parameters allows researchers to reconstruct values of age-specific mortality rates and their temporal evolution with reasonable accuracy. The authors found a clear, almost linear declining trend of a Lee-Carter model parameter, k_t, responsible for historical changes in mortality rates (Figure 3c on page 18 of the discussed manuscript). This finding allows us to make a plausible short-term forecast of age-specific mortality rates in Spain by extrapolating the temporal trend for the Lee-Carter time-dependent parameter, k_t.

One limitation of this study is related to the assumption of the Lee-Carter model, that historical evolution of mortality at all age groups is driven by one factor (parameter) only. However, a factor analysis of mortality evolution found this approach turns out to be overly simplistic (Gavrilov and Gavrilova 1991; Gavrilov and Nosov 1985). For example, factor analysis of mortality dynamics over the period of 1900-2007 in developed countries found that at least two time-dependent factors are responsible for observed decline of mortality (younger age groups have a different factor of mortality decline compared to older groups). One-factor model was applicable to earlier historical periods only (before 1950s), when a decline in mortality rates was driven mainly by a decrease of the age-independent mortality component (the Makeham parameter of the Gompertz-Makeham law) (Gavrilov and Gavrilova 1991; Gavrilov, Gavrilova and Nosov 1983).

Thus, for more accurate description of mortality evolution, the following model would be preferable in future studies:

Mortality force (age, time) = a0(age) + a1(age) x F1(time) + a2(age) x F2(time)

where a0(age), a1(age), a2(age) are three parameters depending on age only, while F1(time) and F2(time) are two parameters depending on time only (sets of coefficients determined by factor analysis models).

The Lee-Carter model takes into consideration only the age effects (changes in mortality with age) and the period effects (changes in mortality over time), while ignoring the cohort effects (effects of the date of birth). Fortunately, the authors made diagnostic checks for the fitted model by plotting residuals at the Lexis diagram (with time being on the horizontal axis and age at the vertical axis; see Figure 4 on page 19). These diagrams demonstrate remarkable diagonal trajectories for residuals values, indicating strong cohort effects. Moreover, these cohort effects look like high frequency differences between very close birth cohorts (zebra-like data structure). Although this observation of high frequency cohort effects is not mentioned or discussed by the authors themselves, it could be an interesting phenomenon indicating that cohort effects have very fine structure and could be easily overlooked when data are aggregated in broader age categories. We observed a similar phenomenon in our study: We

found that the effects of date of birth on old-age mortality are much higher when data are studied for each month of birth, rather than for a broader traditional category (year of birth) (Gavrilov and Gavrilova 2005). Deeper studies of cohort effects on mortality may improve the accuracy of demographic forecasts.

The models and forecasts presented in this paper are based on the past experience. We need to keep in mind that economic crisis and challenges of population aging may change mortality trends, so continuous monitoring of current mortality trends is needed for better mortality forecasting.

References

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