CS&SS/STAT 563 — Statistical Demography — Spring 2020 - Homework no. 3

Due Monday April 20 at 2:00pm on the course Canvas site.

1. This question is about mortality in Thailand in 2015–2020.

   (a) Extract and show the age-specific mortality rates for females in Thailand in 2015-2020 by five-year age groups from the 2019 *World Population Prospects*.

   (b) Using only the rates for ages 50 above, estimate the parameters of a Gompertz model and a Gompertz-Makeham model for the mortality rates.

   (c) Plot the fitted rates against the observed rates and comment on how good the model fits are. Is there evidence that the additional constant in the Gompertz-Makeham model is needed?

   (d) Fit a Heligman-Pollard model to the full set of age-specific mortality rates. Plot the fitted rates against the observed rates and comment on how good the fit is.

   (e) Select the Coale-Demeny West model life table that best corresponds to these data, using the `demogR` R package or any other method. Fit a Brass relational model to the data, and fit the observed against the fitted values. Comment on how good the fit is.

   (f) Compare the fits of the four models considered to these data. Which one fits the data best?

2. This question is about mortality rates in Thailand for 1950–2020.

   (a) Extract the age-specific mortality rates for females in Thailand. for each of the 14 five-year periods from 1950 to 2020 by five-year age groups from the 2019 *World Population Prospects*, and show the data in the form of a table.

   (b) Fit the Lee-Carter model to the data using the approximate least squares method described in class.

   (c) Fit the Lee-Carter model to the data using the SVD method described in class, and plot the results, including the estimated parameters and the fitted curves. Compare them to the observed rates graphically.

   (d) Compare the results from the SVD method to those from the approximate least squares method described in class, numerically, graphically and verbally. Find a normalization of the SVD results needed to make the SVD results close to the least squares results.

   (e) Use the Lee-Carter method to obtain probabilistic forecasts of mortality in Mexico for 2020-2025. Obtain probabilistic forecasts of the mortality index, k_t. Hence find a confidence interval for the age-specific mortality rate, ${}_nm_x$ for women aged 75-80 in 2020–2025. This should take account only of uncertainty about future values of the morality index.