A Study of Measuring the Mortality Compression

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Abstract

Mortality compression, a popular longevity risk research issue, means that age-at-death would concentrate on a narrower range; it is also related to the concept of rectangularization of the survival curve. In terms of statistical distribution, the mortality compression indicates age-at-death would degenerate to a certain age, or life expectancy has a limit and the variance of age-at-death distribution converges to zero. The convergence of life expectancy and the variance would shed light on longevity risk. Life expectancy is predicted to grow for the near future, but there is still no consensus on the convergence of the variance of age-at-death distribution.

In this study, we use statistical methods to evaluate mortality compression (or the convergence of variance) while considering data quality. Instead of applying the nonparametric methods, such as the shortest confidence interval for the distribution of age-at-death and of the modal age used in previous studies, we propose optimization methods for estimating the standard deviation of age-at-death distribution. Specifically, we compare the standard deviation of age-at-death above the mode, SD(M+), proposed by Kannisto (2000) and the method of nonlinear maximization (NM), and check which method has a smaller MSE (mean squared error). For the issue of data quality, we compare the estimation results of mortality rates from life table data and raw data.

We first use a computer simulation to evaluate the method. Then, based on data from the Human Mortality Database (HMD), we apply the NM method to both life table data (i.e., graduated mortality rates) and raw data, and check if there are significant differences. We found the proposed method can provide reliable estimates of life expectancy and its variance, even when age-at-death is recorded in integer.

Also, the estimates from the proposed method and raw data are smoother. However, there is not enough evidence to conclude if there is mortality compression based on the proposed NM method.