A Study of the Lee-Carter Model with Age-Shifts

Jack C. Yue,[1] Sharon S. Yang[2] and Hong-Chih Huang[3]

Presented at the Living to 100 and Beyond Symposium

Orlando, Fla.

January 7-9, 2008

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[1] Professor, Department of Statistics, National Chengchi University, Taipei, Taiwan, R.O.C.
[2] Associate Professor, Department of Business Mathematics, Soochow University, Taipei, Taiwan, R.O.C.
[3] Associate Professor, Department of Risk Management and Insurance, National Chengchi University, Taipei, Taiwan, R.O.C.

Abstract

The Lee-Carter (LC) model is one of the most popular methods for modeling mortality rates for all ages, because it is easily applied and provides fairly accurate mortality estimations and population projections. However, the parameters of the LC model, including its intercepts and slopes, are assumed to be constant, whereas empirical studies in various countries do not support such an assumption. Therefore, further modifications of the LC model are required to deal with non-constancy in parameters. We propose an age-shift model to modify the LC model and deal with the problem of parameters. We use previously reported data with non-constant parameters from countries such as Japan, Taiwan, Great Britain and the United States to verify if the proposed method can capture their non-constant nature. The proposed method attains smaller estimation errors (with respect to mean absolute percentage error or mean square error). We also apply the proposed age-shift model to the mortality rates of these four countries to evaluate the longevity risk in annuity products by measuring life expectancy. The research findings can benefit the actuary to deal with longevity risk in pricing and valuation.