

Modeling Longevity Risk: An Empirical Study

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Abstract

In this research, we propose a mortality model with age-shift to forecast mortality. This model is examined using principle component (PC) analysis and is constituted with two PCs(called PCA model). We carry out an empirical study to make a quantitative comparison of the goodness fit of this proposed PCA model with the well-known LC model and the first age-period-cohort model by Renhsaw and Haberman(2006). We explore the mortality experience based on six countries from Asian(Taiwan, Japan)、 Europe(The Britain, France) and North America(US, Canada) using Human mortality database from the period of 1970 to 2005. We found the proposed PCA model produces better goodness fit in mortality forecast for all illustrated countries with respect to mean absolute percentage error(MAPE), Akaike's information criterion(AIC) and Schwarz-Bayesian criterion (BIC). The advantage of the proposed PCA model is easy to employ for mortality projection because of the linearity in the two PCs. We then illustrate the use of proposed PCA model to project future mortality rates and measure the prices for whole life annuity and deferred whole life annuity. The model risk is addressed and measured. The research findings can benefit the actuary to deal with longevity risk in pricing and valuation.

Keywords: Age-period-cohort model; Lee carter model, Principle component Analysis

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