Modeling Coherent Mortality Forecasts in Lee-Carter Framework

Sharon S. Yang[1], Jack C. Yue[2], Yi-Pi Chang[3], Yu-Yun Yeh[4]

Abstract

In this research, we study the effect of coherent mortality improvement for a group of populations between countries. Thus, we study a coherent mortality modeling built on the Lee-Carter(LC) model to deal with the mortality forecasts for a group of populations instead of a single population. The parameters for the coherent LC model are estimated using maximum likelihood estimation method. Based on the Human mortality database for the European countries, the coherent pattern of mortality improvement is studied. In addition, the goodness fits of the proposed coherent LC model are investigated using the Akaike information criterion and residual analysis. We calculate both Pearson residuals and deviance residuals and examine the normality of the residuals. The performance of the coherent LC model is compared with the original LC model. We found that the residuals produced by the original LC model do not follow the identical and independent properties but those by the coherent LC model do. Therefore, we apply the coherent LC model to analyze the bootstrapped confidence interval for both projected life expectancy and the price of annuity products.

Keywords: Lee-Carter Model; Coherent, Mortality Forecasting; Bootstrap Method; Longevity Risk.

[1] Associate Professor, Department of Finance, National Central University, Taiwan. Corresponding author, Email: syang@ncu.edu.tw

[2] Professor, Department of Statistics, National Chengchi University, Taiwan.

[3] Professor, Department of Financial Engineer and Actuarial Mathematics, Soochow University, Taiwan

[4] Actuarial Specialist, Cathay Life Insurance Company, Taiwan.