Lee-Carter Model and Selection Effect

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Abstract

Age and gender are the two most common risk factors considered in life insurance products. Other risk factors can also be used, depending on the feasibility and marketing as well as data availability. Previous studies showed that the newly insured likely passed certain health exams and had lower mortality rates than those who are already insured. Select and ultimate tables are often used by insurance companies to deal with the mortality discrepancies between the insured with different policy years (i.e., selection effect). However, the selection effect is easily confused with the mortality improvement and its estimate is likely to be influenced by annual reduction in mortality rates. In the present study, we have proposed a modification of Lee-Carter model, including both selection effect and mortality improvement. We first used computer simulation to evaluate the parameter estimation of the proposed approach, and then applied it to the experienced data from Taiwan's largest insurance company. Results from simulation and empirical studies supported the proposed approach, which provided stable and accurate estimates to the selection effect and mortality improvement. We also found that the size of selection effect with respect to policy year was larger than the difference in mortality rates between smokers and non-smokers, and is particularly noticeable for the older age groups.

Keywords: Lee-Carter Model, Selection Effect, Mortality Risk, Mortality Improvement, Simulation

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