

# Regular Discount Sequence and Longevity Bond

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## Abstract

Due to the declining mortality and fertility rates, the population aging is a common phenomenon over the world, especially for the developed countries. The welfare and policy issues related to the aging society become popular and important in the 21<sup>st</sup> century. In Taiwan, the rapid prolonging life expectancy forces the reform of National Health Insurance (a national health care system) and labor pension insurance. Similarly, Taiwan's Insurers also face the risk of financial insolvency, caused by the dual impact of mortality improvement and low interest rate. Developing mortality models for projecting the future longevity is an intuitive approach to deal with the longevity risk, but the existing data limit the development. Instead, transferring the longevity risk is one of the possible alternatives and the mortality bond is a popular choice for the insurers. Still, the selection of mortality model is quite important in setting the mortality bond. If the investors anticipate that the number of survivors is likely to exceed the given strike level, the investors will expect to gain less coupons and thus the price of mortality bond will go down.

In this study, we apply the idea of regular discount sequence from the bandit problem to determine the strike level of mortality bond. We hope to consider the fairness and feasibility for both the investors and the insurers in pricing the mortality bonds. In particular, we use the regularity of discount sequence ratio to simplify the design of the mortality bond strike level, and the Brownian motion to describe the fluctuation in mortality ratio. In addition, we employ the mortality data from Taiwan and Japan to evaluate the proposed approach. Based on the empirical study, we found that there are differences in variance (i.e., risk) of strike level among ages, possibly due to different pace in the mortality improvement.

Key words: Population Aging, Brown Motion, Regular Discount Sequence, Mortality Improvement, Longevity Bond

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