1. Introduction

- Social security retirement benefits can be claimed between the ages of 62 and 70 in America.
- Claiming before your Full Retirement Age (or FRA), results in a permanently lower monthly annuity payment, and claiming after your FRA results in a higher payment.
- We examined how different claim ages impact the expected present value of different scenarios, as well as whether an equivalent lump sum bonus could help retirees overcome a present bias phenomenon.

2. Motivation

- Sanders, De Waegenaere, and Nijman found that retirement benefits were “actuarially unfair” for retirees of different claiming periods, based on the Vasicek interest rate model.
- About 80% of Americans claim their benefits before their FRA. However most experts agree that claiming after the FRA is the best deal economically.
- Some potential distribution systems that could help retirees overcome this present bias phenomenon include a lump sum bonus system.

3. Formulation

- We used the Gompertz-Makeham law of mortality to compute survival probabilities.

\[ n(x, t) = -\lambda_T + (1 - e^{\lambda_T}) \alpha \]  

- We chose to compute survival probabilities with a dynamic mortality model rather than static mortality tables.
- About 80% of Americans claim their benefits before their FRA. However most experts agree that claiming after the FRA is the best deal economically.
- Some potential distribution systems that could help retirees overcome this present bias phenomenon include a lump sum bonus system.

4. Methods and Analysis

- To evaluate the actuarial fairness for different claim ages, we used Sander’s Money’s Worth Equation,

\[ MW(x, y) = \frac{n(y - x)}{(1 + a(y - x))(1 + a(y - x))(1 + a(y - x))} \]  

- We used the Cox-Ingersoll-Ross (CIR) model to find short interest rates.

\[ dr_t = (\alpha - \beta r_t)dt + \sigma \sqrt{r_t} dw_t \]  

- The time i zero coupon bond price to generate the term structure of interest rates.

\[ Y_i(T) = \frac{\log(A_i(T))}{(1 - i)} \]  

\[ A_i(T) = \frac{\log(A_i(T))}{(1 - i)} \]  

\[ B_i(T) = \frac{\log(A_i(T))}{(1 - i)} \]  

\[ h = \sqrt{\beta^2 + 2\sigma^2} \]  

5. Results

- We re-estimated Money’s Worth ratio using the GM law and CIR model, and found that the ratio was greater than 1 for all delayed claim ages. This indicates that social security retirement benefits in the United States are currently actuarially fair for retirees.
- We have developed a lump sum bonus system, which are actuarially equivalent to the current social security distribution system in the United States.
- The lump sum or bonus system could motivate a delay in claiming social security benefits. This would result in an overall higher net present value of benefits for retirees.

References