Longevity Greeks: What Should Insurers and Capital Market Investors Know About?

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Abstract: Recently, it has been argued that capital markets may share some of the overwhelming longevity risk exposures borne by the pension and life insurance industries. The transfer of risk can be accomplished by trading standardized derivatives such as q-forwards that are linked to published mortality indexes. To strategize such trades, one may utilize "longevity Greeks," which are analogous to equity Greeks that have been used extensively in managing stock price risk. In this paper, we first derive three important longevity Greeks—delta, gamma and vega—on the basis of an extended version of the Lee-Carter model that incorporates stochastic volatility. We then study the properties of each longevity Greek and estimate the levels of effectiveness that different longevity Greek hedges can possibly achieve. The results reveal several interesting facts; for example, in a delta-vega hedge formed by q-forwards, the choice of reference ages does not materially affect hedge effectiveness, but the choice of times to maturity does. These facts may help insurers to better formulate their hedge portfolios, and issuers of mortality-linked securities to determine what security structures are more likely to attract liquidity.