

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

Kenneth Q. Zhou

Department of Statistics and Actuarial Science, University of Waterloo, Canada

Johnny S.-H. Li

Department of Statistics and Actuarial Science, University of Waterloo, Canada

Presented at the Living to 100 Symposium
Orlando, Fla.
January 4–6, 2017

Copyright © 2017 by the Society of Actuaries.

All rights reserved by the Society of Actuaries. Permission is granted to make brief excerpts for a published review. Permission is also granted to make limited numbers of copies of items in this monograph for personal, internal, classroom or other instructional use, on condition that the foregoing copyright notice is used so as to give reasonable notice of the Society's copyright. This consent for free limited copying without prior consent of the Society does not extend to making copies for general distribution, for advertising or promotional purposes, for inclusion in new collective works or for resale.

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

Kenneth Q. Zhou and Johnny S.-H. Li

Department of Statistics and Actuarial Science, University of Waterloo, Canada
E-mail: kenneth.zhou@uwaterloo.ca, shli@uwaterloo.ca

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.