



SOCIETY OF ACTUARIES

Article from:

# ARCH 2014.1 Proceedings

July 31-August 3, 2013

## Portfolio Choice with Life Annuities under Probability Distortion

Wenyuan Zheng<sup>1</sup>, James G. Bridgeman

<sup>1</sup> University of Connecticut, USA; [wenyuanzheng09@gmail.com](mailto:wenyuanzheng09@gmail.com)

The expected utility theory is the most widely used model to elucidate the individuals' decision making under uncertainty, while empirical evidence of systematic violations triggered economists to seek alternative models. Within the context of portfolio choice, one key element of Kahneman and Tversky's Cumulative Prospect Theory is that people tend to overweight small probabilities and underweight large probabilities. In our work, by introducing the probability distortion on the utility function, we revisit the optimal portfolio model in a financial market with a riskless bond, a risky asset, and commutable life annuities. The optimal investment strategy and consumption strategy are studied, and the maximum lifetime utility is eventually obtained. We characterize a power probability distortion under the stochastic control framework, establish a dynamic utility-optimization problem with control processes, and solve it via HJB-equation. Based on both the analytical and the numerical derivations, we find that people who distort probability more on gains will invest more and consume less, along with a higher life-time utility. Additionally, the effect caused by probability distortion is very sensitive with parameter being less than 0.5.