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Risk analysis of annuity conversion options in a stochastic mortality environment

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While extensive literature exists on the valuation and risk management of financial guarantees embedded in insurance contracts, both, the corresponding longevity guarantees as well as interactions between financial and longevity guarantees are usually ignored. The present paper provides a framework for a joint analysis of financial and longevity guarantees and applies this framework to different annuity conversion options in deferred unit-linked annuities. In particular, we analyze and compare different versions of so-called guaranteed annuity options (GAO) and guaranteed minimum income benefits (GMIB) with respect to the value of the option and the resulting risk for the insurer. The analysis is based on a combined stochastic model which means that both, the financial market as well as future survival probabilities, are modeled stochastically. This allows us to identify the main risk drivers for each annuity conversion option. Additionally, we examine whether and to what extent the insurance company is able to reduce the risk by risk management measures. We show that different annuity conversion options have significantly different option values and that different risk management strategies lead to a significantly different risk for the insurance company. By means of sensitivity analyses we see that the question whether GAOs or GMIBs imply a higher risk for the insurer highly depends on the parameter assumptions. The lower the long term interest rate level and the higher the volatility of mortality, the higher is the risk of GAOs. In contrast, GMIBs are less sensitive with respect to the interest rate level and mortality, but show a much higher sensitivity to equity volatility. Altogether, comparing the risk drivers, the risk of decreasing fund values seems to be the predominant risk in GMIBs, whereas for GAOs interest and mortality risks are of higher importance. In particular, for all considered annuity conversion options the mortality risk seems to be more substantial than generally assumed.