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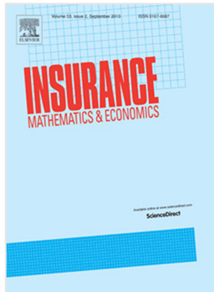

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A Pair of Optimal Reinsurance-Investment Strategies in the Two-sided Exit Framework

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Abstract

In this paper, we derive and study a pair of optimal reinsurance-investment strategies under the two-sided exit framework which aims to (1) maximize the probability that the surplus reaches the target b before ruin occurs over the time horizon $[0, e_\lambda]$ (where e_λ is an independent exponentially distributed random time); (2) minimize the probability that ruin occurs before the surplus reaches the target b over the time horizon $[0, e_\lambda]$. We assume the insurer can purchase proportional reinsurance and invest its wealth in a financial market consisting of a risk-free asset and a risky asset, where the dynamics of the latter is assumed to be correlated with the insurance surplus. By solving the associated Hamilton–Jacobi–Bellman (HJB) equation via a dual argument, an explicit expression for the optimal reinsurance-investment strategy is obtained. We find that the optimal strategy of objective (1) (objective (2) resp.) is always more aggressive (conservative resp.) than the strategy of minimizing the infinite-time ruin probability of Promislow and Young [28]. Due to the presence of the time factor e_λ , the optimal strategy under objective (1) or (2) may lead to more aggressive positions as the wealth level increases, a behavior which may be more consistent with industry practices.

Keywords: Optimal reinsurance-investment problem; Two-sided exit framework; Hamilton–Jacobi–Bellman (HJB) equation; Ruin probability.

1 Introduction

Given that investment is an integral component of an insurer's risk management practices, risk models taking both insurance and investment risks into consideration have received a great deal of attention in the literature. In addition to investment, insurers frequently rely on reinsurance to control their risk exposure. Subject to a control on investment and reinsurance, optimization problems under various objective functions have become a popular research topic in the actuarial literature. Common objective functions include the *ruin probability minimization* (e.g., Young [29], Promislow and Young [28], Chen et al. [19], Bayraktar and Zhang [11]), the *bequest goal optimization* (e.g., Bayraktar et al. [8][9], Bayraktar and Young [10]), the *expected utility maximization* (e.g.,

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