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Alpha-Robust Mean-Variance Reinsurance-Investment Strategy

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Abstract

Inspired by the α -maxmin expected utility, we propose a new class of mean-variance criterion, called α -maxmin mean-variance criterion, and apply it to the reinsurance-investment problem. Our model allows the insurer to have different levels of ambiguity aversion (rather than only consider the extremely ambiguity-averse attitude as in the literature). The insurer can purchase proportional reinsurance and also invest the surplus in a financial market consisting of a risk-free asset and a risky asset, whose dynamics is correlated with the insurance surplus. Closed-form equilibrium reinsurance-investment strategy is derived by solving the extended Hamilton–Jacobi–Bellman equation. Our results show that the equilibrium reinsurance strategy is always more conservative if the insurer is more ambiguity-averse. When the dependence between insurance and financial risks are weak, the equilibrium investment strategy is also more conservative if the insurer is more ambiguity-averse. However, in order to diversify the portfolio, a more ambiguity-averse insurer may adopt a more aggressive investment strategy if the insurance market is very ambiguous. For an ambiguity-neutral insurer, the investment strategy is identical to the non-robust investment strategy.

Keywords: α -maxmin utility; Robust reinsurance-investment problem; Mean-variance criterion; Time-consistent equilibrium strategy; Lévy insurance model

1 Introduction

Reinsurance and investment are two core problems of paramount importance in insurance and actuarial science and have been extensively studied in the last decade. Reinsurance can protect insurers against potentially large losses, while investment of insurance premium enables insurers to achieve certain management objectives. The most commonly selected objectives for the reinsurance and investment problems include *minimizing ruin probability* (e.g. Young [44], Promislow and Young [38], Chen et al. [12], Bayraktar and Zhang [6]), *maximizing expected utility* (e.g. Liu and Ma [34], Bai and Guo [2], Liang and Bayraktar [31], Liang and Yuen [32]), and *mean-variance criterion*, which is the objective of this paper and many other works reviewed later.

Among these common objectives, mean-variance criterion appears to have a relatively simple structure. Indeed, many reinsurance and investment problems can be explicitly solved even when

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