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Robust optimal investment and reinsurance problem for the product of the insurer's and the reinsurer's utilities

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Abstract

In this paper, we study a robust optimal reinsurance-investment problem for a general insurance company which holds shares of an insurance company and a reinsurance company. Assume that the claim process described by a Brownian motion with drift, the insurer can purchase proportional reinsurance, and both the insurer and the reinsurer can invest in a risk-free asset and a risky asset. Besides, the general insurance company's manager is an ambiguity-averse manager (AAM) who worries about model uncertainty in model parameters. The AAM's objective is to maximize the minimal expected product of the insurer's and the reinsurer's exponential utilities . By using techniques of stochastic control theory, we first derive the closed-form expressions of the optimal strategies and the corresponding value function, and then the verification theorem is given. Finally, we present numerical examples to illustrate the effects of model parameters on the optimal investment and reinsurance strategies, and analyze the utility losses from ignoring product utilities.

Keywords: Robust control; Ambiguity-averse; Expected utility; Proportional reinsurance; Investment

1. Introduction

Nowadays, insurance companies have become major institutions in worldwide financial markets. As a big developing country, China has large insurance industry which is developing fast. At the same time, it should be noted that our insurance industry is in a period of developing and on the way to perfection. The companies of our insurance industry are actively involved in trading activities in various financial markets. Consequently, the optimal asset allocation problem is important for them. A typical problem in it is how to use the great accumulated surplus rationally, mostly called optimal investment problem of insurance. For the optimal investment problem of insurance, the key difference between insurance companies and its financial counterparts is the presence of insurance liabilities, which mainly depend on insurance claims. Over the past two decades, many scholars adopt the stochastic control theory and related methodologies to study the optimization control problems with various objectives in insurance risk management. In the

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