

RUIN PROBABILITY AND OPTIMAL INVESTMENT AND EXCESS OF LOSS REINSURANCE POLICY

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Abstract. We consider an optimal investment-reinsurance problem of an insurer whose surplus process follows a jump-diffusion risk process. In our model, the insurer transfers part of the risk due to insurance claims via an excess of loss reinsurance and invests the surplus in a financial market consisting of one risk-free asset and a risky asset. The objective of the insurer is to choose an optimal investment-reinsurance policy so as to minimize the probability of ruin. Through solving the corresponding Hamilton-Jacobi-Bellman equation, closed-form expressions for the optimal investment-reinsurance policy and the minimal probability of ruin are obtained in the diffusion approximation risk process. By invoking the use of the martingale approach, we also obtain an upper bound of the minimal probability of ruin in the jump diffusion risk process. Numerical examples are provided to show that the solution to the jump diffusion risk process may be quite different from the solution to the diffusion approximation risk process.

Keywords. Jump diffusion process; diffusion approximation; investment; excess of loss reinsurance; ruin probability; Hamilton-Jacobi-Bellman equation; martingale

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1 Introduction

Reinsurance can be an effective way of managing risk by transferring risk from an insurer (referred to as the cedent) to a second insurance carrier (referred to as the reinsurer). By partially transferring risk to a reinsurer, the cedent incurs additional cost in the form of an upfront reinsurance premium payable to the reinsurer. Naturally it is to be expected that the higher the retained loss, the lower the reinsurance premium. On the other hand, the lower the retained loss, the higher the reinsurance premium. This implies that when an insurer seeks reinsurance protection, the insurer is faced with the classic trade-off between the retained losses and the cost of the reinsurance premium. It is well known that the prosperity of an insurance company is not only due to earnings in its principal business but also due to intelligent investments of the money at its disposal. Apparently, risky investment can be dangerous,