Ruin probabilities under optimal investment and proportional reinsurance policy in jump diffusion risk process

Lin Xiang *School of Mathematics, Central South University, China.* E-mail: xlin@mail.csu.edu.cn

KEY WORDS: ruin probability; proportional reinsurance; optimal investment policy; Lundberg's equality; Hamilton-Jacobi-Bellman equation

MATHEMATICAL SUBJECT CLASSIFICATION: 60G44, 60H30

Abstract: In this paper, we consider an insurance company whose surplus (reserve) is modeled by a jump diffusion risk process. The insurance company can invest part of the surplus in n risky asset and purchase proportional reinsurance for claims. Our main goal is to find an optimal investment and proportional reinsurance policy which minimizes the ruin probability. We apply stochastic control theory to solve this problem. We obtain the close form expression for the minimal ruin probability, optimal investment and proportional reinsurance policy. We find that the minimal ruin probability satisfies the Lundberg equality. We also investigate the effects the diffusion volatility parameter, the market price of risk and the correlation coefficient on the minimal ruin probability, optimal investment and proportional reinsurance policy by numerical calculation, respectively.

References

[1] Browne S(1995). Optimal investment policies for a firm with a random risk process: Exponential utility and minimizing the probability of ruin. Mathematics Methods Operator Research, 20:937-957.

[2] Schmidli H(2002). Optimal proportional reinsurance policies in a dynamic setting. Scandinavian Actuarial Journal,1:55-68.

[3] Taksar M, Markussen C(2003). Optimal dynamic reinsurance policies for large insurance portfolios. Finance and Stochastics ,7:97-121.

[4] Luo SZ, Taksar M, Tsoi A(2008). On reinsurance and investment for large insurance portfolios. Insurance: Mathematics and Economics ,42:434-444.

[5] Hipp C, Plum M(2000). Optimal investment for insurers. Insurance: Mathematics and Economics,27:215-228.

[6] Hipp C, Plum M(2003). Optimal investment for investors with state dependent income, and for insurers. Finance and Stochastics,7:299-321.

[7] Liu CS, Yang HL(2004). Optimal investment for a insurer to minimize its probability of ruin. North American Actuarial Journal,8:11-31.

[8] Yang HL, Zhang LH(2005). Optimal investment for insurer with jump-diffusion risk process. Insurance: Mathematics and Economics 2005;37:615-634.

[9] Gaier J, Grandits P, Schachermayer W(2003). Asymptotic ruin probabilities and optimal investment. Annals of Applied Probability,13:1054-1076.

[10] Schmidli H(2002). On minimizing the ruin probability by investment and reinsurance. Annals of Applied Probability, 12:890-907.

[11] Hald M, Schmidli H(2004). On the maximization of the adjustment coefficient under proportional reinsurance. ASTIN Bulletin,34:75-83.

[12] Liang ZB, Guo JY(2008). Upper bound for ruin probabilities under optimal investment and proportional reinsurance. Appl.Stochastic Models Bus.Ind.,24:109-128.

[13] Øksendal B, Sulem A(2005). Applied Stochastic control in jump diffusions. Springer: Berlin.