Accepted Manuscript

Asymptotic results for ruin probability in a two-dimensional risk model with stochastic investment returns

Fenglong Guo, Dingcheng Wang, Hailiang Yang

Asymptotic Results for Ruin Probability in a Two-dimensional Risk Model with Stochastic Investment Returns

Fenglong Guo[*]

Jiangsu Key Laboratory of Financial Engineering, Nanjing Audit University
Email: fenglongguo@nau.edu.cn

Dingcheng Wang

Jiangsu Key Laboratory of Financial Engineering, Nanjing Audit University
School of Mathematical Sciences, University of Electronic Science and Technology of China
Email: wangdc@nau.edu.cn

Hailiang Yang

Department of Statistics and Actuarial Sciences, The University of Hong Kong
Email: hlyang@hku.hk

Abstract

This paper considers a two-dimensional time-dependent risk model with stochastic investment returns. In the model, an insurer operates two lines of insurance businesses sharing a common claim number process and can invest its surplus into some risky assets. The claim number process is assumed to be a renewal counting process and the investment return is modeled by a geometric Lévy process. Furthermore, claim sizes of the two insurance businesses and their common inter-arrival times correspondingly follow a three-dimensional Sarmanov distribution. When claim sizes of the two lines of insurance businesses are heavy tailed, we establish some uniform asymptotic formulas for the ruin probability of the model over certain time horizon. Also, we show the accuracy of these asymptotic estimates for the ruin probability under the risk model by numerical studies.

Keywords: Two-dimensional risk model, Investment return, Regular variation, Sarmanov dependence, Ruin probability

Mathematics Subject Classification: Primary 62P05; Secondary 62E20, 91B30

1 Introduction

In this paper, we consider a two-dimensional renewal risk model in which an insurer operates two lines of insurance businesses sharing a common claim-number process. The common claim number process $\{N_t, t \geq 0\}$ is a renewal counting process defined by

$$N_t = \sum_{i=1}^{\infty} \mathbf{1}_{(\tau_i \leq t)}, \quad t \geq 0,$$

---

[*]Corresponding Author.

1