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重尾索赔条件下现代风险模型的破产概率估计:多险种混合情形

白建明, 尹晓玲, 陈云

兰州大学管理学院, 甘肃 兰州 730000

Ruin Probability Estimation for Modern Risk Model with Heavy-Tailed Claims and Multiple Insurance-Types

BAI Jian-ming, YIN Xiao-ling, CHEN Yun

School of Management, Lanzhou University, Lanzhou 730000, China

摘要
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摘要 破产概率是非寿险保险风险理论的核心问题。与经典的Cramér-Lundberg模型相比, 由Li Zehui等建立的现代风险模型更为准确地描述了非寿险保险运营的主要特征, 对现实保险业务具有较好的解释力。本文基于现代风险模型, 考虑保险公司多个险种混合经营这一更为现实的情形, 在索赔额服从正则尾分布条件下获得了破产概率的渐近等价估计。我们发现, 在具有大额索赔特征的多个险种混合的条件下, 公司面临的极端索赔风险将由索赔额分布尾部最厚的那些险种决定, 而索赔额分布尾部相对较薄的那些险种的影响作用将被淹没。该结论的有效性可用MATLAB数值模拟得到理想的验证。本文结果是对风险模型研究的重要推广, 也为多险种混合情形下保险公司的风险控制与初始保证金界定提供了依据。

关键词 ： 现代风险模型　混合险种　破产概率　渐近等价　正则尾分布　数值模拟

Abstract ： Ruin probability is the core theme of non-life insurance risk theory. Compared with the classical Cramér-Lundberg Model, the modern risk model presented by Li Zehui et al is more fully considerate for the main characteristics of non-life insurance operation and has a more suitable description to realistic insurance business. Based on the modern risk model, a more realistic situation with multiple types of insurance and aggregate risk is studied. Asymptotically equivalent estimations for ruin probability are derived when the claim sizes from different insurance types have regular-tailed distributions. It can be found that, under the conditions of multiple insurance-types with large claims, the extreme claim risk faced by the company will be determined inherently by those insurance types with the heaviest tail of claim size distributions, while the effects of other insurance types which have not too heavy distributed tails are vanished. The effectiveness of results is remarkably verified by a MATLAB numerical simulation. This work is a valuable promotion for insurance risk model study. It provides a convictive evidence for risk management and initial capital setting of practical insurance businesses with multiple insurance types.

引用本文:

.重尾索赔条件下现代风险模型的破产概率估计:多险种混合情形[J] 中国管理科学, 2014,V22(11): 114-121

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