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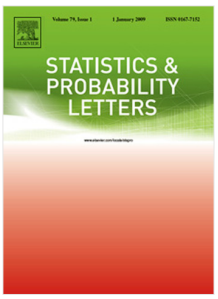

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ACCEPTED MANUSCRIPT

Parametric inference for ruin probability in the classical risk model

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Abstract

Consider the classical insurance surplus model with a parametric family for the claim distribution. Although we can construct an asymptotically normal estimator of the ruin probability from the claim data, the asymptotic variance is not easy to estimate since it includes the derivative of the ruin probability with respect to the parameter. This paper gives an explicit asymptotic formula for the asymptotic variance, which is easy to estimate, and gives an asymptotic confidence interval of ruin probability.

Key words: Ruin probability; small claims; Cramér approximation; delta method; asymptotic confidence interval.

MSC2010: 62G20 (91B30, 62M05).

1 Introduction

1.1 Classical risk theory

Consider the following classical risk model.

$$R_t = u + ct - \sum_{i=1}^{N_t} U_i, \quad t \geq 0, \tag{1.1}$$

where $u \geq 0$ is an initial surplus, $c > 0$ is the known premium rate, $N = (N_t)_{t\geq 0}$ is a Poisson process with the intensity λ, represents the number of claims, U_i's $(i = 1, 2, \dots)$ are i.i.d. random variables with the distribution F_θ, each of which represents claim size, and $\theta = (\theta_1, \dots, \theta_p)^\top \in \mathbb{R}^p$ is a parameter. We assume that $\mu := \mu_\theta = \mathbb{E}_\theta[U_1] < \infty$ and $\lambda = \lambda_\theta$ are continuous functions of the parameter θ. Note that, if we assume the intensity parameter λ does not depend on parameters in the claim distribution F_θ, we can set the model as $\lambda_\theta = \theta_1$; $F_\theta = F_{(\theta_2,\theta_3,\dots,\theta_p)}$ with $\theta = (\theta_1, \dots, \theta_p)$. Moreover, we put

$$\nu_\theta(z) := \lambda_\theta F_\theta(z), \qquad \overline{\nu}_\theta(z) = \int_z^\infty \nu_\theta(\mathrm{d}x).$$

The purpose of the paper is to estimate the ultimate ruin probability

$$\psi_{\theta_0}(u) = \mathbb{P}_{\theta_0}\left(\inf_{t>0} R_t < 0 \,|\, R_0 = u\right),$$

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