Nonparametric approach for approximating the ruin probability of Sparre Andersen risk models

Atik Touazi[1,2] **and Djamil Aissani**[2]

[1] *Faculty of Sciences, University of Algiers 1, Algeria*
[2] *Research Unit LaMOS, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria*

Abstract

Ruin probability is one of the main features of a risk model which is the probability that the insurer capital falls bellow the level zero. However, it cannot be found explicitly for many risk models except in rare cases. This is so-called Cramér-Lundberg risk model where claims follow an exponential distribution,(see Asmussen and Albrecher (2010)). In such situation the stability question has been investigated for stochastic risk models in one-dimensional (Kalashnikov 2000; Enikeeva 2001) and in two-dimensional (Benouaret and Aissani 2010). The strong stability method was developed in the beginning of the 1980s (Aissani and Kartashov 1983). It is applicable to all models which can be represented by a Markov chain. The advantage of this method is its ability to realize a qualitative and quantitative analysis of some complex models. In contrast to other methods, we suppose that the perturbation of the transition kernel is small with respect to a certain norm in the operator space. Such a strict condition allows us to obtain better estimate of the ruin probability of the perturbed risk model (see Touazi et al(2017); Harfouche and Bareche (2021)).

The aim of this work is to prove the applicability of the strong stability method of the Sparre Andersen risk model when the claims inter-occurrence times distribution function is general and unknown. In this case, we should use kernel density estimation methods to estimate the unknown density function of claims inter-occurrence times. Using simulation approach, we evaluate numerically the approximation error between the ruin probability in the Sparre Andersen model and the ruin probability in the Cramér-Lundberg model.

Keywords

Nonparametric statistics, Strong stability, Stochastic risk models, Simulation.

References:

Aissani, D., Kartashov, N. V.(1983), *Ergodicity and stability of Markov chains with respect to operator topology in the space of transition kernels*, Dokl. Akad. Nauk Ukr. Ser. A11 3-5.

Asmussen, S. , Albrecher, H.(2010)*Ruin probabilities*,Word Scientific.

Benouaret, Z. and Aissani, D. (2010), *Strong stability in a two-dimensional classical risk model with independent claims*, Scandinavian Actuarial Journal, 2, 83-93.

Harfouche, Z., Bareche, A. (2021) *Semi-parametric approach for approximating the ruin probability of classical risk models with large claims*, Communication in Statistics- Simulation and Computation. doi:10.1080/03610918.2021.1992636.

Touazi, A., Benouaret, Z., Aissani, D., Adjabi, S. (2017)*Nonparametric estimation of the claim amount in the strong stability analysis of the classical risk model*,Insurance : Mathematics and Economics 74, 78-83.