Type of publication: Only Abstract

Type of presentation: Invited Talk for an Organized SessionSession: Advances in quantitative finance and insurance

Invited by: Asmerilda Hitaj

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Title: Evaluating compound sums through Panjer's formula and discretization of continuous random distributions

Keywords: discrete distributions, distribution theory, insurance, risk management

Abstract: The accurate evaluation of compound sums is an important task in actuarial science and operational risk management. The total claims amount that a non-life insurance company has to pay in a specific period of time can be modeled as $S_N=X_1+...+X_N$, with N being the number of occurring claims and X_i the $i-$-th claim size, $i=1,...,N$; the X_i are assumed to be iid random variables, typically continuous, and N is assumed to be independent of the X_i. While determining the first integer moments of S_N (when they exist) is easy, the evaluation of the whole distribution based on convolution is, in general, not analytically viable and is computationally demanding if addressed numerically. Approximations to the Gaussian and translated Gamma distributions can be employed. Alternatively, a recursive approach for the determination of the single probabilities of S_N is available (Panjer's recursive formula); however, a special type of distribution for the number of claims N and, more importantly, for the claim size X_i is required, which limits the range of application in practice. We show how discretizing the (continuous) claim size X_i on a lattice, according to some criterion for determining the relevant probabilities, and then applying Panjer's formula, can lead to acceptable and computationally feasible approximations of the distribution of S_N.