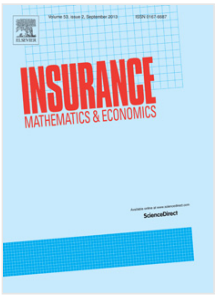
Accepted Manuscript



Notes on discrete compound Poisson model with applications to risk theory

Huiming Zhang, Yunxiao Liu, Bo Li

PII: S0167-6687(14)00127-9
DOI: http://dx.doi.org/10.1016/j.insmatheco.2014.09.012
Reference: INSUMA 1992

To appear in: *Insurance: Mathematics and Economics*

Received date: April 2013
Revised date: July 2014
Accepted date: 30 September 2014

Please cite this article as: Zhang, H., Liu, Y., Li, B., Notes on discrete compound Poisson model with applications to
risk theory. *Insurance: Mathematics and Economics* (2014),
http://dx.doi.org/10.1016/j.insmatheco.2014.09.012

Notes on Discrete Compound Poisson Model with Applications to Risk Theory

Huiming Zhang

Department of Mathematics and Statistics,Central China Normal University, Wuhan 430079, PR China

Yunxiao Liu

Department of Statistics and Operations Research , University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7420, United States

Bo Li[1]

Department of Mathematics and Statistics,Central China Normal University, Wuhan 430079, PR China

Abstract

Probability generating function(p.g.f.) is a powerful tool to study discrete compound Poissson(DCP) distribution. By applying inverse Fourier transform of p.g.f., it is convenient to numerically calculate probability density and do parameter estimation. As an application to finance and insurance, we firstly show that in the generalised CreditRisk+ model, the default loss of each debtor and the total default of all debtors are both approximately equal to a DCP distribution, and we give the Le Cam's error bound between the total default and a DCP distribution. Next, we consider geometric Brownian Motion with DCP jumps and derive its rth moment. We establish the surplus process of the difference of two DCP distributions, and numerically compute the tail probability. Furthermore, we define the discrete pseudo compound Poisson(DPCP) distribution and give the characterizations and examples of DPCP distribution, including the strictly decreasing distribution and the zero-inflated discrete distribution with $P(X = 0) > 0.5$.

Keywords: compound Poisson distribution, integer-valued Lévy process, CreditRisk+ model, geometric Brownian Motion with jumps, pseudo compound Poisson distribution, Wiener-Lévy theorem

Highlights

1. We give out the literature review of the applications of discrete compound Poisson model to the risk theory;
2. We discuss the issues of numerical computation and parameter estimation and new applications of discrete compound Poisson model in risk theory;
3. We redefine discrete pseudo compound Poisson distribution and give its characterization.

1. Introduction

By generalizing the "rare events" property of Poisson distribution (i.e., there is at most one event taking place in sufficiently short time), one can obtain a generalized version of Poisson distribution, which can be called discrete compound Poisson distribution. The discrete compound Poisson possess has the property that more than one event can arrive in sufficiently short time, which is widely used in actuarial sciences(See

Email addresses: at352693585@gmail.com (Huiming Zhang), yunxiao@live.unc.edu (Yunxiao Liu), haoyoulibo@163.com (Bo Li)

[1]Corresponding author. Tel.: +86 15392929512.