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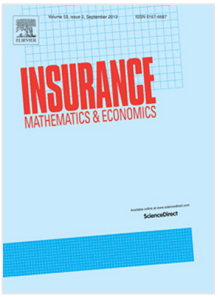

On compound sums under dependence

Serkan Eryilmaz

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On compound sums under dependence

Serkan Eryilmaz*

December 8, 2016

Abstract

In this paper, we study the compound random variable $S = \sum_{t=1}^{N} Y_t$ when there is a dependence between a random variable N and a sequence of random variables $\{Y_t\}_{t\geq 1}$. Such a compound random variable has been found to be useful in several fields including actuarial science, risk management, and reliability. In particular, we develop some results on distributional properties of the random variable S when N is a phase-type random variable that is defined on a sequence of binary trials and depends on $\{Y_t\}_{t\geq 1}$. We present illustrative examples and an application for the use of results in actuarial science.

Key words. Compound distributions; Dependence; Phase-type distributions; Probability generating function; Waiting times

1 Introduction

For a sequence of independent and identically distributed (iid) random variables $\{Y_t\}_{t\geq 1}$ which is independent of discrete valued random variable N, the distribution of a compound random variable $S = \sum_{t=1}^{N} Y_t$ has attracted a great deal of attention in the literature due to its wide applications in various fields such as insurance, risk management, and reliability (Eisele (2006), Kolev and Paiva (2008), Bakouch et al. (2014), Koutras et al. (2016), Danilenko and Šiaulys (2016)). Different methods have been applied to investigate distributional properties of S under the most common assumption of independence between the sequence $\{Y_t\}_{t\geq 1}$ and counting random variable N.

As pointed out in Koutras et al. (2016), the compound random variable S might be useful for an insurance company to create a surveillance mechanism over a specific portfolio. Let $X_1, X_2, ...$ denote the individual claim sizes arriving at the company. Define a threshold c such that $\{I_t = 1\} \equiv \{X_t > c\}$, and $\{I_t = 0\} \equiv \{X_t \leq c\}$, where "1" represents an unexpected loss (i.e. loss exceeding c). A binary sequence

*Department of Industrial Engineering, Atilim University, 06836, Incek, Ankara, Turkey, e-mail: serkan.eryilmaz@atilim.edu.tr

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