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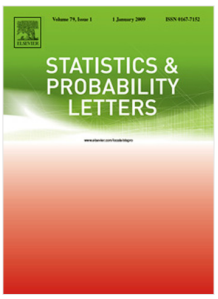

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Christian Genest, Mhamed Mesfioui, Juliana Schulz

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A new bivariate Poisson common shock model covering all possible degrees of dependence

Christian Genest[a,*], Mhamed Mesfioui[b], Juliana Schulz[a]

[a] *Department of Mathematics and Statistics, McGill University, 805, rue Sherbrooke ouest, Montréal (Québec) Canada H3A 0B9*
[b] *Département de mathématiques et d'informatique, Université du Québec à Trois-Rivières, C.P. 500, Trois-Rivières (Québec) Canada G9A 5H7*

Abstract

A variant of the bivariate Poisson common shock model is proposed which, contrary to the original, spans all possible degrees of dependence. Its basic distributional properties are described, moment-based estimation is studied, and its use is illustrated on real data.

Keywords: Bivariate count data; common shock variable; comonotonicity; correlation; counter-monotonicity; positive quadrant dependence.

1. Introduction

Bivariate counts are frequent, notably in quantitative risk management [11], and while many ways of modeling such data have been proposed [1, 2, 7, 12], the bivariate Poisson common shock model is still a benchmark because of its simple form and interpretation. It assumes that Poisson random variables $X_1 \sim \mathcal{P}(\lambda_1)$ and $X_2 \sim \mathcal{P}(\lambda_2)$ with mean λ_1 and λ_2, respectively, are expressible in the form

$$X_1 = Y_1 + Z, \quad X_2 = Y_2 + Z \tag{1}$$

in terms of mutually independent (non-observable) Poisson random variables Y_1, Y_2 and Z. In this setup, the common shock variable Z is the source of correlation between the margins X_1 and X_2.

*Corresponding author