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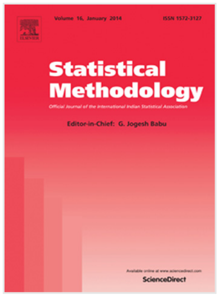

Some new results on the Rényi quantile entropy Ordering

Lei Yan, Dian-tong Kang

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Some new results on the Rényi quantile entropy Ordering

Lei Yan*
School of Economics and Management, Lanzhou University of Technology,
Lanzhou, Gansu 730050, People's Republic of China
E-mail: 13516316758@163.com

Dian-tong Kang
School of Mathematics and Statistics, Hexi University,
Zhangye, Gansu 734000, People's Republic of China
E-mail: kdt20042@126.com

Abstract

Rényi (1961) proposed the Rényi entropy. Ebrahimi and Pellerey (1995) and Ebrahimi (1996) proposed the residual entropy. Recently, Nanda et al. (2014) obtained a quantile version of the Rényi residual entropy, the Rényi residual quantile entropy (RRQE). Base on the RRQE function, they defined a new stochastic order, the Rényi quantile entropy (RQE) order, and studied some properties of this order. In this paper, we focus on further properties of this new order. Some characterizations of the RQE order are investigated, closure and reversed closure properties are obtained, meanwhile, some illustrative examples are shown. As applications of a main result, the preservation of the RQE order in several stochastic models are discussed.

Keywords: Rényi's residual quantile entropy, Rényi residual quantile entropy order, closure property, proportional odds model, record valus model

MSC: 60E15, 62N05, 62E10

1. Introduction

The notion of entropy, originated from thermodynamics and statistical mechanics, is of importance in some scientific and technological areas such as communication theory, physics, probability, statistics and economics. It measures uncertainty of a physical system. The Shannon entropy plays a central role in information theory since it was introduced mathematically by Shannon (1948). Let X be a nonnegative random variable (rv) representing the lifetime of a device or a living thing with absolutely continuous cumulative distribution function $F_X(x)$, survival function $\overline{F}_X(x) = 1 - F_X(x)$ and probability density function $f_X(x)$. The Shannon entropy of X is defined by

$$H_X = -\mathrm{E}[\ln f_X(X)] = -\int_0^{+\infty} f_X(x) \ln f_X(x) \mathrm{d}x. \tag{1.1}$$

H_X measures the uncertainty contained in $f_X(x)$ about the predictability of an outcome of X. In continuous case, H_X is also referred to as the Shannon differential entropy. In recent years, the literature on information theory has grown quite voluminous. It has been found that the Shannon entropy has lot of applications in different areas such as physics, probability and statistics, communication theory and economics. (see, for instance, Taneja (1990, 2001), Kumar and Taneja (2011), Nanda et al. (2014), and Kayal (2015).)

* Corresponding author.