Parametric Analysis of Tampered Random Variable Model for Multiple Step-Stress Life Test

Tamalika Koley

Centre for Quantitative Economics and Data Science, Birla Institute of Technology, Mesra, Ranchi 835215, India.

Abstract

The Tampered Random Variable (TRV) model for multiple step-stress life testing experiment is present in the literature for more than two stress levels. However, the work emphasizes on the TRV modeling of data from multiple step-stress life test. As per our knowledge, no inferential work in this setup is present in the literature. In this paper, we focus on the parametric inference for this multiple step-stress TRV model based on random right censored lifetime data. The methodology is developed for a general parametric family of distributions. In the special case, we assume the baseline lifetime of the experimental units under normal stress condition to follow exponential distribution with mean θ. We consider both unconstrained and order-restricted maximum likelihood estimation (MLE) of the model parameters. For unconstrained optimization, the closed form solutions of the estimators are derived assuming exponential baseline lifetime distribution. Extensive simulation studies are performed to investigate the finite sample properties of the proposed estimators. Finally, the proposed methods are illustrated with two real data sets.

Keywords: Baseline lifetime, Tampering times, Tampering coefficients, Identifiability, Re-parametrization, Isotonic constraints, Pool adjacent violators algorithm.