Austrian Journal of Statistics
2024, Volume 53, 43–63.
http://www.ajs.or.at/
doi:10.17713/ajs.v53i4.1818

On Positive Inflated Geometric Distribution: Properties and Applications

Zehra Skinder
Dept. of Mathematical Sciences, IUST

Peer Bilal Ahmad*
Dept. of Mathematical Sciences, IUST

Muneeb Ahmad Wani
Dept. of Statistics, IIT KANPUR

Abstract

One-inflation in zero-truncated count data has recently found considerable attention. In this regard, zero-truncated Geometric distribution and distribution to a point mass at one are used to create a one-inflated model, namely, one-inflated zero-truncated Geometric distribution. Its reliability characteristics, generating functions, and distributional properties are investigated in detail, which includes survival function, hazard rate function, reverse hazard rate function, probability generating function, characteristic function, variance, skewness, and kurtosis. Monte Carlo simulation have been undertaken to evaluate the effectiveness of the maximum likelihood estimators. To test the compatibility of our proposed model, the baseline model and the proposed model are distinguished by using the two different test procedures. The adaptability of the suggested model is demonstrated using two real-life datasets from separate domains by taking various performance measures into consideration.

Keywords: zero-truncation, one-inflation, goodness of fit, simulation, hypothesis testing, geometric distribution.

1. Introduction

In every discipline of knowledge, including epidemiology, engineering, sociology, biological research, insurance, agriculture, and public health, the statistical analysis and modelling of count data is very important. We fit a valid probability model to count data in order to build up decision-making while dealing with count data.

When dealing with positive count data possessing variability, one can model positive data by truncating the distribution at zero, resulting in a zero-truncated distribution. When a specific range of values for the variables is ignored or cannot be seen, the resulting model is said to be truncated. Truncation of probability distributions is an essential statistical feature with several applications in different areas. It is preferable to use a zero-truncated probability distribution instead of any other discrete distribution, when data is to be represented or produced without zeros. Many datasets exclude zero counts, such as the number of siblings in a family, the number of passengers in a car including the driver, the number of articles published in different journals from various disciplines, the number of disturbing events re-