

The Power Log-Lindley distribution, with applications to lifetime data modeling

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Abstract: Modeling and analyzing lifetime data represent topics of real concern in many research fields, such as actuarial science, finance, medicine, engineering and many others. The quality and effectiveness of the procedures used in a statistical analysis are determined by the assumed probability distribution. This fact led to the development of large classes of new probability distributions, along with relevant statistical methodologies. Recently, many lifetime distributions for modeling and analyzing data sets have been proposed. Despite this, there still remain many important problems where the real data does not follow any of the existing probability distributions.

In this paper we introduce the new family of the Power Log-Lindley distribution, obtained by compounding the Log-Lindley and power series distributions. The new model constructed represents an extension of the Log-Lindley distribution. Its mathematical properties will be investigated, including moments, quantile and generating functions, order statistics and their moments, Kullback-Leibler divergence and Shannon entropy. The new model will be compared with the Log-Lindley distribution from the point of view of the performance of data modeling, by studying the inference with respect to the initial model. Maximum likelihood estimators for the new model will be derived and compared with the estimators corresponding to the original model or to other related distributions. Some applications to insurance will be developed, regarding stochastic dominance and the Fisher matrix. The results obtained prove that the Power Log-Lindley distribution represents a more flexible family, with powerful statistical performances for modeling and analyzing lifetime data.

Keywords: Power Log-Lindley distribution, insurance, statistical analysis, flexible modeling, lifetime data.

Acknowledgements: This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2012-3-0007.

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