

# ASPECTS OF THE $\gamma$ -ORDER NORMAL AND RELATED DISTRIBUTIONS

THOMAS L. TOULIAS

th.toulias@gmail.com

**ABSTRACT.** An exponential-power generalization of the usual multivariate Normal distribution is introduced. The theoretical context, from which this  $\gamma$ -order Generalized Normal ( $\gamma$ -GN) is derived, is roughly presented while the information-theoretic advantages of the  $\gamma$ -GN are also discussed. The generalized Fisher's entropy type information measure as well as the corresponding generalized entropy power for the  $\gamma$ -GN is then computed. Certain entropy measures for the  $\gamma$ -GN are given. The Kullback-Leibler information divergence and the Hellinger distance between two  $\gamma$ -GNs are also studied. Some computational aspects of the  $\gamma$ -GN estimation are discussed. A short risk analysis of the  $\gamma$ -GN is performed. Furthermore, the expected future lifetime of the  $\gamma$ -order half-Normal distribution is calculated. Finally, certain  $\gamma$ -GN based distributions are constructed and discussed, including the generalized  $\gamma$ -order Lognormal distribution, a two-way asymmetric form of the  $\gamma$ -GN as well as a generalization of the Inverse Normal distribution.

**KEYWORDS:**  $\gamma$ -order Normal distribution;  $\gamma$ -order Lognormal distribution;  $\gamma$ -order inverse Normal distribution; Shannon entropy, Rényi entropy; Kullback-Leibler divergence; Hellinger distance; Maximum Likelihood Estimation; hazard rate; cumulative hazard rate; future lifetime; expected future lifetime half-Normal distribution; Lognormal distribution.