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CONTRIBUTIONS TO ESTIMATION AND MODELING USING QUANTILES

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It is well known that classical moment-based methods may not be reliable in the presence of skew and outliers. However, estimators based on quantiles are more robust in such instances and can provide more reliable inferences. Owing to advances in computing, quantile-based estimators have become more accessible and significant for researchers.

In the light of this progress, the aim of this thesis was to contribute to the existing body of knowledge on quantile-based methods in modeling and estimation, while providing simulation studies and real data applications to support the new contributions. These measures and their estimates have applications in fields including economics and the health sciences, and also address significant issues relevant to the wider scientific research community. The results discussed in the thesis include original papers that have been either published, accepted for publication or submitted for peer review.

In the first part of the thesis, we propose a new approach based on the probability density quantile (pdQ) for parameter estimation of the generalised lambda distribution (GLD). Defined by a location parameter, scale parameter and two shape parameters, the GLD is widely used for modeling in various fields because of its flexibility in mimicking many other distributions. However, as there are four parameters, choosing optimal parameters and/or estimating those parameters is not straightforward. We compare our pdQ approach with existing methods in regard to time efficiency and performance. Further, we extend the method for the generalised beta distribution, illustrating the applicability of the method beyond the GLD.

In the second part of the thesis, we introduce several methods, including a GLD-based method, to obtain confidence intervals for quantiles when only a frequency

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distribution or histogram is available. These methods are extended to measuring inequality in grouped income data, where data are often provided in a summary format to protect the confidentiality of individuals. We show that interval estimators for quantile-based inequality measures are suited to this type of data. The thesis also includes two web-based Shiny applications to enable end-users to apply these methods in their research.

Some of this research has been published in [1–4].

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