

[DOI: 10.20472/IAC.2025.066.003](https://doi.org/10.20472/IAC.2025.066.003)

SHAO-TUNG CHANG

Department of Mathematics, National Taiwan Normal University Taipei, Taiwan

KANG-PING LU

Department of Applied Statistics, National Taichung University of Science and Technology Taichung, Taiwan

SEGMENTED QUANTILE REGRESSIONS BASED ON THE UNIT-WEIBULL DISTRIBUTION FOR BOUNDED DATA

Abstract:

In this study, we introduce a segmented quantile regression model based on the unit-Weibull distribution. Given that the unit-Weibull random variable is defined on the $(0,1)$ interval, it is particularly suitable for analyzing continuous variables constrained within this range. Such variables, including fractions, indices, ratios, and percentages, are prevalent across various disciplines. Additionally, many bounded variables can be transformed into unit-interval data, further expanding the utility of the unit-Weibull distribution.

The segmented regression model is a widely used technique for identifying structural changes in regression models by detecting turning points, which can provide insights into underlying causal factors. Moreover, compared to ordinary least squares regressions, quantile regressions offer greater robustness against outliers and non-normal error distributions. We incorporate the unit-Weibull distribution with segmented and quantile regressions to develop a flexible and resilient modeling approach applicable across diverse research domains. By using the maximum likelihood estimation with the expectation and maximization algorithm, we investigate model estimations as well as applicable data. This research is novel, highly practical, versatile, relatively easy to use. Besides, we reduce the restriction in using the segmented regression to enlarge the applicability of our method in versatile data and research fields. We demonstrate the efficiency and robustness of our new methods through extensive simulations and experiments. The practicability of the proposed methods is shown by applying the method to various real datasets.

Keywords:

Quantile regressions, Unit-Weibull distribution, Segmented regressions, Segmented quantile Regression models

JEL Classification: C10, C19, C01