A Unit-level Quantile Nested Error Regression Model for Domain Prediction with Continuous and Discrete Outcomes

Nikos Tzavidis*
University of Southampton, Southampton, UK - n.tzavidis@soton.ac.uk

Beate Weidenhammer
Freie Universität Berlin, Berlin, Germany - beate.weidenhammer@fu-berlin.de

Timo Schmid
Freie Universität Berlin, Berlin, Germany - timo.schmid@fu-berlin.de

Nicola Salvati
University of Pisa, Pisa, Italy - nicola.salvati@unipi.it

In this talk we will present recent work on a new unit-level small area methodology that can be used with continuous and discrete outcomes. The proposed method is based on constructing a model-based estimator of the distribution function by using a nested-error regression model for the quantiles of the target outcome. A general set of domain-specific parameters that extends beyond averages is then estimated by sampling from the estimated distribution function. For fitting the model we exploit the link between the Asymmetric Laplace Distribution and maximum likelihood estimation for quantile regression. The specification of the distribution of the random effects is considered in some detail by exploring the use of parametric and non-parametric alternatives. The use of the proposed methodology with discrete (count) outcomes requires appropriate transformations, in particular jittering. For the case of discrete outcomes the methodology relaxes the restrictive assumptions of the Poisson generalised linear mixed model and allows for what is potentially a more flexible mean-variance relationship. Mean Squared Error estimation is discussed. Extensive model-based simulations are used for comparing the proposed methodology to alternative unit-level methodologies for estimating a broad range of complex parameters.

Keywords: Asymmetric Laplace Distribution; Generalized linear mixed model; Jittering; Non-parametric estimation.