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Microsimulation via Quantiles for Domain Prediction

Domain prediction of complex indicators for example, poverty and inequality indicators typically relies on micro-simulation methods that use regression models with domain random effects. When specific parametric assumptions for the model error terms can be made, Empirical Best Prediction (EBP) is possible and should be preferred. In this talk we explore the use of an alternative micro-simulation methodology when the model assumptions are not met. The method is based on the use of a regression model with random effects for the quantiles of the target distribution. By using the model one can estimate the quantile function of the target distribution, which is then used for micro-simulating samples to be used for domain prediction. The model is fitted by maximum likelihood estimation using the link between quantile regression and the Asymmetric Laplace Distribution. The proposed method can be used both with continuous and discrete (count) outcomes. However, in the case of counts one must impose smoothing for estimating the quantiles.
Using jittering, we transform the count outcome into a continuous one the quantiles of which are modelled by using a linear quantile regression with domain random effects. Utilising the one to one relationship between the quantiles of the jittered and those of the discrete outcome, we estimate the distribution function of the discrete outcome which we use for domain prediction. Estimation of the Mean Squared Error of the domain parameters is discussed. The methods are evaluated in model-based simulations. For continuous outcomes we explore how the proposed method performs in the presence of heteroscedasticity and contamination. For the case of counts we explore how the proposed method performs in the presence of overdispersion