

# Smoothing, Clustering, and Benchmarking for Small Area Estimation: An Application to Household Rental Prices in Berlin

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## Abstract

We develop constrained Bayesian estimation methods for small area problems: those requiring smoothness with respect to similarity across areas, such as geographic proximity or clustering by covariates; and benchmarking constraints, requiring (weighted) means of estimates to agree across levels of aggregation. We develop methods for constrained estimation decision-theoretically and discuss their geometric interpretation. Our constrained estimators are the solutions to tractable optimization problems and have closed-form solutions. Mean squared errors of the constrained estimators are calculated via bootstrapping. Our techniques are free of distributional assumptions and apply whether the estimator is linear or non-linear, univariate or multivariate. We illustrate our methods to the estimation of house rental prices from the Empirica-Systeme GmbH database in Berlin.