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The role of adjusted maximum likelihood estimation in small area estimation

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Abstract: We first introduce the concept of adjusted maximum likelihood estimation using the well-known Fay-Herriot linear mixed model that is frequently used to improve on direct survey estimates for small geographic areas. We then explain how the adjustment factor in the adjusted residual maximum likelihood method can be suitably chosen for producing a class of strictly positive consistent estimates of the unknown variance component, constructing simple second-order unbiased mean square error estimates, improving parametric bootstrap methods, and constructing simple second-order efficient Cox type empirical Bayes confidence intervals for small area means. We discuss various higher-order asymptotic properties of the proposed methods and assess their finite sample properties using Monte Carlo simulations. Finally, the utility of the proposed methodology is illustrated using a real life dataset.