When Do Model-Based Methods Work?

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The prevailing philosophy of official statistics is a design/model compromise (DMC) -- design-based for descriptive inferences from large samples, and model-based for small area estimation, nonsampling errors such as nonresponse or measurement error, and some other subfields like ARIMA modeling of time series. I suggest that DMC involves a form of "inferential schizophrenia", and is inadequate for the complex web of problems presented by modern official statistics, involving data from multiple sources and serious deviations from probability sampling. An alternative philosophy for survey inference is the form of model-based inference known as calibrated Bayes (CB), where inferences for a particular data set are Bayesian, but models are chosen to yield inferences that have good design-based properties. I argue that CB resolves DMC conflicts, and capitalizes on the strengths of both frequentist and Bayesian approaches. For the CB approach to work, survey design features like clustering, stratification and weighting need to be incorporated in the model, and models with weak prior distributions that avoid strong parametric assumptions are generally favored. I describe examples of CB approaches that combine robust modeling with good frequentist properties.

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