Discussion of "Bayesian Models and Methods in Public Policy and Government Settings" by S. E. Fienberg

Graham Kalton

Steve Fienberg has presented a wide and interesting range of applications of Bayesian methods in public policy and government settings (including election night forecasting which I might prefer to classify as fleeting public entertainment!). The examples exhibit the common feature that they all involve highly complex problems that are difficult to handle in a non-Bayesian framework. Sedransk (2008) has provided some other examples of Bayesian methods in such settings which also share this feature. I am sympathetic to the use of Bayesian methods in such special circumstances, as illustrated below.

My initial comments focus on the choice of modes of inference for large-scale government surveys, particularly surveys of households and persons, that are the backbone for satisfying policy and government data needs. An important feature of these surveys, in common with most surveys, is that they typically collect data on many variables and these data are then used to produce very large numbers of estimates. In this area, I generally favor the frequentist repeated sampling mode of inference, commonly termed design-based inference (Kalton, 2002), and I believe that my views are in line with most other survey statisticians (see, e.g., Rao, 2011, in this issue). However, there are situations in which design-based inference cannot satisfy analytic objectives. Also, limitations in the practical application of design-based inference are becoming increasingly troublesome. To the extent possible, I prefer to minimize the dependence of survey estimates on statistical models. When models are needed, I prefer non-Bayesian models to Bayesian models, but I accept that Bayesian models have major analytic attractions for some complex analytic problems. My chosen focus excludes discussion of applications of what are often termed "the analytic uses of survey data." For example,

Graham Kalton is Senior Vice President, Westat, 1600 Research Blvd, Rockville, Maryland 20850, USA (e-mail: grahamkalton@westat.com).

when a survey collects data for a non-randomized observational study, models are clearly essential to evaluate the effects of different levels of program exposure; this kind of modeling is outside my current scope.

To start, consider the ideal situation of a survey that uses a sampling frame with complete coverage of the finite target population, that achieves complete response from all sampled elements, and that has a sample size chosen to be large enough to produce design-based estimates of adequate precision for prespecified policy needs. In such a case, the design-based approach has major attractions for a typical survey, especially in view of the multipurpose nature of surveys which aim to produce a multitude of descriptive estimates. Under this mode of inference, the survey estimates are not model-dependent. To expand on George Box's often quoted saying "All models are wrong, but some are useful," I would add the caution for the survey context that "Models are not always useful." Models need to be carefully developed and tested if model-dependent inference is to be used, particularly with large-scale surveys. With a small sample, a model-dependent estimate may be preferred because its mean squared error (MSE) is less than the large variance of the design-based estimate; however, with a large sample, the bias associated with the model-dependent estimate becomes the dominant factor in the MSE. Besides the precision of the estimates, another important attribute of quality in government statistics is the timeliness with which the estimates are produced. All the many design-based estimates from a survey can be produced relatively quickly since they do not require the time needed to develop and test many models. Also, the design-based approach has the flexibility of readily permitting the computation of additional estimates if the initial findings indicate they may be of interest.

Although design-based estimates are not dependent on the validity of statistical models, models do play important roles in survey sample design and analysis. Implicit and explicit models have been involved in sample design since the early days including, for instance, in