DISCUSSION

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I welcome the opportunity to discuss these papers; first, because I value the existence of an ASA session devoted to survey costs, and, second, because the papers themselves stimulate new thoughts about cost modeling in surveys.

Costs are half of the optimization problem in survey design, but have received scant attention from survey statisticians (see Groves, 1989, Chapter 2). I suspect this is because they have been parameterized as deterministic models **and** they are typically not a part of the post-survey work of the designer. The papers in this session partially rectify this. Let me review cross-cutting issues in the papers.

In all modeling, including cost modeling, the researcher faces a tension between parsimony and realism. In this regard, McCarthy's paper classifies components of costs, prior to a necessary stage of aggregation and parameterization of models. The Bienias **et al.** work is a simulation of a rather complex system of models, heavy on realism, light on parsimony. Judkins and Waksberg try more traditional and simpler models.

Clearly, parsimony must be valued relative to the intended uses of the model. Bienias **et al.** are attempting to measure cost changes in reaction to design changes. Complex interactions are being explored because of the suspicion that they can have large impacts. This work, using a simulation evaluation, is important and deserves support.

Another problem of modeling arises when models meet data, and in this field, too many models meet too little useful data. Judkins and Waksberg lament this fact because it greatly affected their ability to address sampling design optimization. They suspect that interviewers are bad recordkeepers, but the authors could have been more positive in suggesting administrative mechanisms to improve the motivation of interviewers to perform this function better. I suspect that designers have only poorly communicated the utility of these data to interviewers (and indeed to field administrators!). The weakness of available data goes to the heart of the Bienias **et al.** work because various side equations in their simulation were specified with imperfect knowledge about interviewer behavior. The papers in this session might have their largest effect in directing the field to build more useful cost data bases.

A related theme is a distinction between administrative cost models and design-oriented cost models. This is a point observed earlier in Lepkowski and Groves (1986), but pervades the cost modeling enterprise. At this time, what the survey field knows about costs comes from field administrative systems that are used to pay the bills of the field work. The accounting components useful for paying the bills are not necessarily useful for

evaluating the impact of cost constraints on survey designs. Cost models for the latter purpose must have parameters related to major error components of the design. These may or may not be relevant to field administrators. Moving cost accounting to design-relevant structures requires new work and wisdom in reaching compromises.

Another theme is related to the Judkins and Waksberg finding of linear models giving poor fit. Given the Bienias **et al.** work this is symptomatic of the behavior being modeled -- interviewer strategies heavily dependent on various field situations. Traditional sample design optimization models are linear in form, but there are reasons to suspect those are misspecified. Discontinuities arise when a new administrative unit (e.g., a supervisor, a regional office) needs to be added. Nonlinearities arise when matches between supervisory resources and needs vary with design changes.

The overall principle that links the observations above is that the modeler must be intimately familiar with the process he/she is modeling. For example, a common assumption that within segment travel is negligible masks the real behavior of interviewers who drive to the nearest fast food establishment to wait for an appropriate time before calling back on sample units after an unsuccessful call. Another example is the common assumption of trip costs being constant over repeated calls to the segment. It is often the case that first visits occur during the day and experience many noncontacts, making for short visits. Second trips are often made in the evening and are limited by the time of the day. Cost modeling cannot be successfully accomplished only by sitting in a statistician's office but is advanced by awareness of the influences that cause interviewers and other staff members to make their decisions about ways to do their work.

A few final comments toward stimulating new work are in order:

a) Advances in knowledge come from observation **and** experimentation. The work reviewed in the papers should suggest interventions in the design to affect costs. This will improve our understanding of costs and may yield improvements in quality.

b) Data collection for costs should be integrated with data collection for substantive information. New CATI/CAPI systems offer the promise of better monitoring of costs, but design work is required to achieve the promise.

c) The uncertainty in cost model parameter estimates should be explicitly acknowledged. For example, although average interviewer travel costs are sufficient for some modeling purposes, they mask the fact that there may be large variation across interviewers in their cost-related activities. There are stochastic components of cost, out of the control of the designer. These could be reflected in cost models. The effect of this change would be a flattening of the loss function for departing from optimal design features. This is important for designers to know.

References

Groves, R.M., **Survey Errors and Survey Costs**, Wiley, 1989.

Lepkowski, J.M. and Groves, R.M., "A Mean Square Error Model for Dual Frame, Mixed Mode Surveys," **Journal of the American Statistical Association**, 1986, 81, p. 396.