Comment

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The main point of the paper by Freedman and Navidi seems to be that statistical models and inferences derived from them cannot be trusted, and indeed might be misleading, unless the underlying assumptions are made explicit and are shown to be appropriate after careful testing and verification. The paper illustrates the general point with an analysis of some data concerning coverage errors in the 1980 Decennial Census.

Who among us would disagree with the general point? I certainly would not. The stating and checking of assumptions should be an integral part of any scientific investigation conducted by competent professionals. This is so particularly for the modeling of statistical data.

But assumptions always fail to some degree, and when they do, I wish to reserve the right to consider a statistical model useful if it can be demonstrated that decisions made on the basis of the model are better in some sense than the decisions that would be made in the absence of the model. In other words, I believe the notion of model robustness is of central importance. Would Freedman and Navidi go so far as to disagree with this general philosophy? I doubt it. Indeed, I suppose most statisticians would tend to agree with the general philosophy. At the margin, however, there will always be disagreements between statisticians about the acceptability or usefulness of any given model in any specific application.

Now I turn to the analysis of the 1980 data by Freedman and Navidi. These data are concerned generally with the completeness of the 1980 Decennial Census in respect to the population count, and specifically with issues that arose in U. S. district court in *Cuomo v. Baldrige.* Much has already appeared in the statistical literature about this celebrated case, and as background information for new readers I summarize some of the salient features.

In this lawsuit the State and City of New York complained they had been undercounted in the 1980 Census disproportionately to the balance of the nation, and therefore their voting strength was diluted and they were denied their fair share of federal grants to local areas. As a remedy, New York asked the court to compel the Census Bureau to adjust the census population counts for the estimated undercount. The lawsuit first went to trial in 1980. It was decided in favor of New York but was later remanded for a new trial by the Second Circuit because of an improper order entered in the original trial precluding the Census Bureau from introducing evidence in its defense and also because the lower court failed to recognize and consider the important competing interests of other jurisdictions in the census process. The new trial commenced in January 1984 and proceeded in three parts. In part one, Barbara Bailar, Vincent Barabba, Ansley Coale, Charles Cowan, Leon Gilford, Nathan Keyfitz, Richard Nathan, Jeffrey Passel, Jacob Siegel, Michael Stoto, James Trussell, Kenneth Wachter, and Kirk Wolter presented expert testimony on behalf of the Census Bureau (defendants) and Eugene Ericksen, Philip Hauser, Charles Keeley, Samuel Preston, Karl Taeuber, and John Tukey presented expert testimony on behalf of New York (plaintiffs). This initial phase of the trial discussed the 1980 undercount estimates themselves, of which there were 12 sets derived from the Census Bureau's Post Enumeration Program (PEP) for the nation and for each of 66 geographic areas, and a 13th set derived by demographic analysis and available only at the national level. Also discussed was the applicability of statistical loss functions to the census adjustment problem and the precise meaning of the term "better than the census."

Plaintiffs' rebuttal, phase 2 of the trial, commenced in February 1984 and expert testimony was offered by Eugene Ericksen, Franklin Fisher, and Joseph Kadane. The regression analysis discussed by Freedman and Navidi was first presented during this phase of the trial, with the plaintiffs' experts asserting that the models were successful in removing problems from the PEP data and that the resulting regression or Bayes estimates were more accurate than the census, and thus should replace the census. The proposal, in brief, was to replace the census population count of each small area, j, by

$$\text{Adjusted Census}_j = \frac{\text{Census}_j}{1 - \hat{y}_j/100},$$

where $\hat{y}_j = \hat{a} + \hat{b}\ \text{min}_j + \hat{c}\ \text{crime}_j + \hat{d}\ \text{conv}_j$ is a prediction of the percentage of undercount in area j; the generalized least squares estimator (GLS) $\hat{\beta}$ of $\beta = (a, b, c, d)$ is given in equation (12); min_j, crime_j, and conv_j are values of the predictor variables specific to the small area j; and the data used in obtaining $\hat{\beta}$ are at the 66-point level of aggregation.

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