DISCUSSION

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One of the papers I am going to discuss is concerned with estimation of variance while the other two are concerned with presentation and analysis of sampling errors. These are important topics and have not received as much attention as they deserve. I wish to congratulate the authors of these papers for their contributions. I am also thankful to the chairman for giving me an opportunity to participate in the discussion.

I shall first consider the paper by Lawrence Cahoon. The paper emphasizes rightly the importance of estimating variances for State estimates from the Current Population Survey and discusses several procedures. Since, I am not fully conversant with the design of the survey, my comments may sometimes be in the nature of questions and may be even naive.

i) In regard to the design of the survey, it has been remarked that in the nonself-representing strata, in addition to drawing one PSU from each stratum another PSU was drawn from each pair of grouped strata independent of the first selection. Since the strata are not large, it is likely that the same PSU may get selected in the additional sample resulting in reduced precision. It may be desirable to investigate whether the reduction in precision is appreciable.

ii) It has been mentioned that a control was exercised in the selection of the PSU's to ensure that one PSU was chosen in every state and the district of Columbia. It is not clear whether proper allowance has been made in the estimation procedure.

iii) The author has considered the collapsed strata estimator of variance discussed by Hansen, Hurwitz and Madow (1953). Special cases of this estimator of variance have been considered by Cochran (1953) and Seth (1966). This is a biased estimator of variance. The bias consists of two terms. Assuming that the stratum variance $\sigma^2_{x_{gh}}$ is proportional to its size Agh, one of the bias terms reduces to differences in strata sizes Agh. The other bias term due to differences in strata characteristics is simplified by assuming that the variance for a group of strata is proportional to $X_g = \sum_h X_{gh}$. The two assumptions are clearly not the same. If simplification is the main consideration, several other assumptions are possible. Infact the bias term due to differences in strata sizes vanishes altogether if Agh are not used and we use the estimator suggested by Cochran or Seth. Using the available data, it may be worthwhile to investigate whether any one of the two assumptions made is at all satisfactory.

iv) The problem of estimating the variance with one unit per stratum has also been considered by Hartley, Rao and Kiefer (1969). In certain situations, their method may lead to smaller bias in variance estimation than the method of collapsed strata. It may be desirable to include this method in the investigation.

v) Three different methods of groupings have been considered. These are based on 1970 projected unemployment rate. It may be worthwhile to investigate grouping based on the total number unemployed. This may turn out to be a different grouping and perhaps more efficient. However, the main concern is the use of the 1960 data both for grouping purposes and evaluation of the bias. The results obtained in respect of bias cannot as such be taken at their face value.

vi) On intuitive grounds, it appears that method III should result in minimum bias and this is confirmed by the numerical results given in Tables 2, 4 and 6. This is a positive result and needs further confirmation through numerical investigations of the type carried out in this paper.

vii) To evaluate the three grouping methods in respect of their mean square error, an approximation to the variance of the variance estimator has been obtained by using the formula developed by Hansen, Hurwitz and Madow (1953). This formula is derived under several restrictive assumptions which appear at variance with those made in evaluating the bias. In particular, the derivation is carried out under the assumption of simple random sampling. This is disturbing since in the case considered by the author, the units are selected with probability proportional to size. An additional assumption has also been made that μ_{4h}, the fourth moment about the mean is constant from stratum to stratum. There is no doubt that in spite of all the assumptions made, the Hansen-Hurwitz-Madow formula provides an approximation to the variance of the estimated variance. However, it is a question whether such an approximation can be used without justifying the assumptions made or adequate evidence concerning its reliability. As such the numerical results in respect of mean square error are of limited value.

viii) In evaluating the mean square error of the yearly variance estimate, it has been assumed that the variance of the yearly variance estimate is related to the variance of the monthly variance estimate in the same way as the variance of the yearly estimate is related to the variance of the monthly estimate. Some evidence supporting this assumption would greatly enhance the value of the results obtained.

I shall now discuss the other two papers which deal with presentation and analysis of sampling errors and design effects.

The paper by Krotki, Kish and Groves discusses the results based on eight fertility surveys from five different countries.

i) The authors have computed standard errors for about 40 variables spread over different classes and sub-classes. This is commendable and is likely to be appreciated by survey statisticians engaged in analysis of survey data and designing surveys.

ii) The authors have considered the important problem of presenting design parameters with a view to planning of future surveys. Among the

countries considered, some are highly developed while some are under-developed with high illiteracy rate. As such, the quality of data collected is likely to vary appreciably from one country to another. In the absence of any idea concerning the contribution of non-sampling errors, it is not clear whether the results from different surveys are at all comparable. Portability of such results is questionable. If results from countries with similar cultural background and level of development are available, they could perhaps be pooled together and such results may be useful for planning and designing of surveys of similar nature.

iii) The authors have proposed the use of intra-class correlation coefficients ρ and design effects as tools for designing future surveys. Since both the proposed parameters are functions of the type of stratification used, the selection procedures and sample sizes at different stages, they may not be portable unless the survey is to be repeated with only minor modifications. In fact ρ values obtained from different surveys may not be comparable unless the surveys are essentially designed in a similar manner.

iv) The section on summarizing sampling error results is informative and focuses attention on some important problems that arise and gives some guide lines as to how they can be tackled. The authors recognize the technical and analytical difficulties involved in combining and averaging results over different characteristics in a single survey. All the same, they recommend averaging irrespective of how the characteristics are related. Averaging over a group of related characteristics may be meaningful. If the characteristics are vastly different and ρ values are pooled and averaged, it is not clear what the average represents and whether it can at all be used in designing and planning future surveys.

v) It has been remarked that the ρ value for each characteristic and sub-class combination is subject to high variability but is quite stable when averaged over several sub-classes. This is only to be expected and cannot possibly justify averaging. It seems that by averaging we are giving away information concerning the variation in intra class correlation coefficient over different classes and characteristics. If averaging is considered essential, it may be desirable to give the range of values along with the average.

It is clear that under certain conditions, averaging would be desirable. There are several ways in which it can be carried out. This problem has been examined by Thomas Herzog with reference to 1973 Current Population Survey. He has considered several averaging methods including the one based on James-Stein estimator. The author concludes that the averaging method based on James-Stein estimator is the best among the lot. What is the basis of comparing the different averaging methods? It appears that the optimality criteria is subjective. It may be desirable to evolve suitable criteria consistent with practice and then compare the different methods.

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