DISCUSSION

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1. Introduction

The Bureau of the Census is to be commended for presenting papers dealing with proposed methodology during the planning stages of the Survey of Income and Program Participation (SIPP). Presentation of these papers is sure to stimulate constructive suggestions from the scientific community. On the other hand, the SIPP has been in progress since October 1983 and a second panel is to be fielded in January 1985. Hence, it is important for methodological issues that impact directly upon data collection techniques be resolved as quickly as possible.

The first of the three papers being reviewed discusses person-level and household-level cross-sectional weighting procedures for the 1979 Research Panel of the Income Survey Development Program (ISDP), a nationwide field test for the SIPP. The next two papers discuss person-level and household- or family-level longitudinal weighting methods being considered for the SIPP. Each paper will be discussed individually, although it will be noted that some comments pertain to all three papers.

2. Cross-Sectional Estimates for the ISDP by Huang

2.1 Introduction

The following motivational statement is found early in Huang's paper:

> "There is a great deal of interest in developing cross-sectional weights at the time of each interview wave."

Due to the use of three rotation groups with sliding reference periods within each wave, I question the use of wave-specific cross-sectional weights for direct data analysis. The inferential population would be difficult to define because each rotation group has a slightly different reference period. Wave-specific cross-sectional weights are important for defining longitudinal weights, as is apparent from the other two papers being reviewed. Huang presents his weight formulas in the context of weights for cross-sectional estimates that are time-specific rather than wave-specific, which is probably more useful for data analysis. The formulas presented in the paper can actually be considered to be either wave-specific or time-specific weights.

The weighting formulas presented are for cross-sectional household weights applicable as of either time t or wave w. Since all "adult" members of sample households are interviewed, the cross-sectional household weights can be assigned to all household members for cross-sectional person-level analyses.

Cross-sectional household weights are presented for both the area frame and the list frame samples of the 1979 Research Panel. The proposed weighting procedures are discussed below or each sampling frame.

2.2 Area Frame Sample Weights

The population of inferential interest for the 1979 Research Panel was defined to be the 1979 civilian, noninstitutionalized United States adult population. Standard area frame household sampling procedures were used to select a sample of members of this population in the Wave 1 sample, which was fielded early in 1979. However, only adults (aged $\geq$ 16) in the Wave 1 sample were followed when they moved to new addresses during 1979. Thus, "additional" people who entered the target population during 1979 where only interviewed while living in a household that contained at least one Wave 1 sample member. As a result, the sample fails to adequately reflect "additional" people in the target population. This issue will arise again and be discussed more fully with regard to the two SIPP methodology papers.

Two unbiased cross-sectional time t estimators were discussed for estimation of population totals. One estimator is referred to as the multiplicity estimator and the other is referred to as the fair share estimator. In fact, both are multiplicity estimators. The difference is that one is based upon household-level multiplicity and the other is based upon person-level multiplicity. Huang shows that both estimators provide unbiased estimates of population totals, invoking the "fair share assumption." The two weights are actually identical to the initial family weights for the national household survey component of the National Medical Care Utilization and Expenditure Survey (NMCUES) [See Whitmore, et al (1982a)]. In the NMCUES report, it is shown that both weights provide unbiased estimates, even without the "fair share assumption."

2.3 List Frame Sample Weights

Huang's paper defines the population of inferential interest for the sample based upon SSI and BEOG lists as follows:

> "At any time t, the target population consists of the original list frame subpopulation (Groups I and II) and the type of 'additions' defined for the area frame."

Hence, the time t target population is the Wave 1 universe plus "additions." Additions for the area frame sample were civilian, noninstitutionalized United States adults who joined this group by birth, by entering the United States, or by leaving the military or an institution. I expect that the author does not intend to include all such additions in the target population since the Wave 1 universe does not include all civilian, noninstitutionalized United States adults. Maybe only those additions that simultaneously enter the universe and enter a household containing a member of the Wave 1 universe are intended to belong to the target population. In any case, the field procedures did not provide adequate coverage of additional target population members because only adults (aged $\geq$ 16) in the Wave 1 sample were followed when they moved to new addresses during 1979, as was true for the area frame sample.

Two cross-sectional time t estimators of the population totals, were presented. Huang notes that these estimators do not provide unbiased estimates of population totals. Part of the

problem may be that additional (Group III) sample members explicitly enter the weight computations. Since households in the sample must, by definition, contain at least one Group I or II sample member, Group III persons need not explicitly enter the weight computations.

It should be noted that the two weighting procedures do not give positive weights to identically the same households. Time t households that contain Group II people, but no Group I people, are given a weight of zero by the "multiplicity weight," whereas the "fair share weight" is positive for these households.

Consideration should be given to defining the person-level target population as simply the original list frame (Group I) persons. Weights similar in definition to those used for the area frame can then be defined that provide unbiased estimates of population totals for this target population. These weights would be essentially the same as the initial family weights used for defining longitudinal family weights for the state Medicaid household survey component of the NMCUES [See Whitmore et al (1982b)].

3. Person-Level Longitudinal Weights for the SIPP by Judkins, et al

The SIPP universe at any fixed point in time is defined as the persons aged 15 or older who are members of the civilian, noninstitutional United States population, as well as members of the military living on bases with family or living off bases. Dynamic longitudinal features of this universe are:

1. "Additions" - Individuals who were not members of the Wave 1 Universe but became members of the SIPP universe during the panel's 2 2/3 year reference period.
2. "Exits" - Individuals who left the SIPP universe during the 2 2/3 year reference period due to death, moving out of the United States, or going into the military or an institution.

As was true for the ISDP, only Wave 1 sample members are followed to new addresses when they move, and current SIPP survey procedures do not provide adequate coverage of the "additional" target population members. Methods for improving coverage of the "additional" target population members will be discussed later in this section.

The Judkins paper indicates that the ideal annual longitudinal universe is the union of 12 monthly universes. Either this universe or the union of 366 daily universes should be the target population. The problem of analysis of annual statistics when some population members are survey-eligible for less than the full year is noted as one difficulty with this target population definition. I believe that methods exist or can be developed to adequately address this problem. For example, estimation of an annual mean can be based upon the following statistics:

$Y_a(i)$ = Annual income of the i-th sample member while survey-eligible,

$P_a(i)$ = Proportion of the days in the year that the i-th sample member was survey-eligible, and

$W(i)$ = Longitudinal analysis weight for the i-th sample member.

The population totals for Y_a and P_a would be estimated unbiasedly as follows:

$$\hat{N}(a) = \sum_{i=S} W(i)\, Y_a(i), \text{ and} \quad (1)$$

$$\hat{D}(a) = \sum_{i=S} W(i)\, P_a(). \quad (2)$$

These estimators would have the following interpretation:

$\hat{N}(a)$ = Unbiased estimate of total annual personal income for the target population, and

$\hat{D}(a)$ = Unbiased estimate of the average daily number of members in the target population.

Hence, the ratio estimator,

$$\hat{R}(a) = \hat{N}(c) \,/\, \hat{D}(a), \quad (3)$$

would provide a consistent estimate of the average annual personal income.

Estimation of the population distribution of annual statistics, such as total annual personal income, is somewhat more difficult. The income of a sample member who was survey-eligible only part of the year requires special treatment. The NMCUES defined a time-adjusted income defined for each sample member as

$$Y_{adj}(i) = Y_a(i) \,/\, P_a(i), \quad (4)$$

and produced the distribution of these time-adjusted values. Another possibility is to produce separate distributions of annual income for individuals who were survey-eligible for 12 months, 11 months, 10 months, etc. A third possibility might be to simply estimate the annual average monthly income based upon all sample members who were survey-eligible for one month or more, instead of the average annual income.

Four longitudinal weighting procedures are discussed in Judkin's paper. The first procedre defines a longitudinal weight applicable for all longitudinal analyses of an individual's data, irrespective of the analysis time period. A weight of this type is definitely needed for each sample member to facilitate all types of longitudinal analyses. This first procedure gives zero-valued weights to all "associated" sample members. These data are collected mainly to enable family and household analyses. The other procedures attempt to make greater use of the data for "associated" sample members by giving some of them positive weights for particular analysis time periods. Since these "associated" sample members had a chance of inclusion in the Wave 1 sample and were not selected, the bias and variance reduction properties of these procedures would have to be investigated carefully before these procedures could be recommended. Empirical studies based upon the longitudinal data collected by the ISDP, NMCUES, and/or National Medical Care Expenditure Survey (NMCES) could provide a basis for resolving this issue.

A weighting procedure similar to the first procedure in Judkin's paper can provide improved coverage of the target population with some modification of SIPP field procedures. The changes in field procedures would be the following:

1. Each "additional" sample member becomes a "key addition" (i.e., to be followed to the end of the 2 2/3 year panel and receive positive longtudinal weights) if the first household that the person belongs to after entering the universe is a sample household.
2. The Wave 1 sample housing units (and the half-open intervals between sample housing units and next listed housing units) are to be monitored throughout the 2 2/3 year panel for entry of "additional" universe members. If such "additional" people move into one of these housing units and establish their own independent household as their first household after re-entry into the universe, they are also "key additions."

Using this data collection protocol, all longitudinal weights can be based upon selection probabilities for Wave 1 sample households as follows:

1. For each member of a Wave 1 sample household, the longitudinal weight is the reciprocal of the selection probability for that household.
2. Every "key additional" sample member can be linked uniquely to either a Wave 1 sample household or a Time t (time of entry into the universe) sample household. Hence, the longitudinal weight for such a person is either the reciprocal of the selection probability for the uniquely linked Wave 1 household or the Time t cross-sectional weight of the uniquely linked sample household.
3. All "associated" sample members and other "additional" sample members get a weight of zero because they could have been selected into the sample, but were not.
4. Household- and Family-Level Longitudinal Weights for the SIPP by Ernst, et al

Ernst suggests that longitudinal families not be identified as such but rather that longitudinal households be classified as family and non-family households. The desirability of this approach is questionable. Families that exist either long-term or short-term as multi-family households are potentially important for family-level analyses. Based upon the NMCES and NMCUES experience, it is not especially difficult to divide households into family reporting units for data collection.

Consideration should be given to identifying the properties that one would like all longitudinal households or families to satisfy. Such properties might include the following:

1. Since cross-sectional families are well-defined at any fixed point in time, it may be desirable for the longitudinal families in existence at any fixed point in time to be identical to the cross-sectional families in existence at that same point in time.
2. It may be desirable for changes in household composition that strongly affect family income or program participation to trigger the beginning and ending of SIPP longitudinal families.

Some questions like "What longitudinal family definition is most useful for assessing the effect of divorce on family income?" should be addressed in detail before adopting a SIPP longitudinal family definition. In fact, consideration of how to best address analysis issues may suggest that multiple longitudinal family definitions are needed to satisfy multiple analysis objectives.

Use of longitudinal family weights applicable only to specific time periods is discussed as a means for making use of more of the data collected for specific time periods. As noted in the paper, these procedures also tend to require the greatest amount of data for time periods when the family is not in the sample. The variance/bias tradeoff would have to be carefully investigated for these procedures before they could be recommended. Empirical investigations based upon the ISDP, NMCUES, and/or NMCES databases may be useful in this regard. In any case, it is important to have a longitudinal weight applicable for all time periods to enable longitudinal family analyses of all kinds.

One shortcoming of all family weighting procedures suggested by Ernst is that the families spawned by "additional" sample members all get zero weights. The paper states that the first procedure discussed is the procedure used by the NMCUES. This is not exactly true because the NMCUES traced certain types of "key additional" sample members and assigned positive weights to the families spawned by them. The procedures discussed with regard to the Judkins paper are recommended for identifying and tracing "key additional" people. Given these survey procedures, an unbiased "beginning date" type of longitudinal family weightng procedure is presented in Horvitz and Folsom (1980). Review of this paper is highly recommened to everyone interested in longitudinal surveys.

REFERENCES

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