MOVER NONRESPONSE ADJUSTMENT RESEARCH FOR THE SURVEY OF INCOME AND PROGRAM PARTICIPATION

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I. INTRODUCTION

A. Motivation for Nonresponse Research

Nonresponse is a particularly critical problem for longitudinal surveys. The Survey of Income and Program Participation (SIPP) is a longitudinal survey that requires a number of interviews over a period of years. Subsequently, nonresponse rates increase with each successive interview. As a result, the sample becomes less representative of the population it is meant to approximate. These issues create concerns about household and person nonresponse bias in the cross-sectional and longitudinal estimates of the SIPP.

In various SIPP panels, Field Representatives (FRs) attempt to interview sample households from six to eight times for up to a two and a half-year period. Cross-sectionally, household nonresponse rates range from 5% to 7.5% at the first interview and increase to a range from 20% to 22% by the last interview. Longitudinally, person nonresponse rates range from 25% to 29% for SIPP panels. Beginning in February 1996, FRs will try to interview each sample household thirteen times over a four year period. Under this new design, household and person nonresponse rates are expected to be even higher for future panels, making nonresponse an even more critical issue for the SIPP. (Weinberg and Petroni, 1992.)

The Census Bureau conducted prior research based on our concern with nonresponse bias in the SIPP. McArthur (1988) compared first interview characteristics of persons who are respondents through all interviews to those who are initial respondents but who become nonrespondents at later interviews. She found differences for characteristics such as marital status, monthly household income, and employment status. In an earlier study, McArthur (1986) also found differences in various characteristics for movers and nonmovers.

McArthur's work lends support to much of our current nonresponse adjustment procedure. However, her results along with work by O'Connell (Jabine, et. al., 1990), DeAre (1990), and Hernandez (1990) suggested we examine nonresponse adjustment by mover status. In addition, exploratory work by analysts showed that estimates such as marriage, migration, and poverty (Hock, 1989) are potentially affected by differential nonresponse among movers and nonmovers.

Results from these research efforts led us to evaluate the effectiveness of the current SIPP cross-sectional nonresponse adjustment cells to reduce bias and to investigate the potential for reducing bias by adjusting for mover nonresponse. (Petroni, 1990.)

Currently, we use weighting class adjustments and raking ratio estimation to reduce nonresponse bias in our cross-sectional and longitudinal estimates. Results from the earlier research and the concern with future increased nonresponse bias in the future SIPP panels have led us to formally research mover adjustment in our longitudinal weighting procedures.

This paper focuses on new compensation approaches to our longitudinal weighting procedures designed to reduce nonresponse bias. We will provide an overview of the content and design of the SIPP, discuss our current longitudinal weights, and then present the research from our mover nonresponse adjustments. We expect that our results will have broad implications for nonresponse adjustment approaches considered for other longitudinal surveys.

B. Content and Design of the SIPP

The SIPP is a nationally representative survey conducted by the Census Bureau. The survey obtains information about the financial situation of persons, families, and households in the noninstitutionalized population of the United States. The information obtained from the survey includes data on cash and noncash income, eligibility and participation in various government transfer programs, labor force status, assets and liabilities, and many other topics (i.e., work history, marital history, and educational attainment).

The SIPP is a continuing survey with new national probability samples of eligible households (panels) introduced each year. FRs interview sample households every four months. Each interview of the entire sample is called a wave. The 1987 SIPP longitudinal panel began with 12,500 households with 30,700 persons interviewed in wave 1. The interview period covered by the 1987 longitudinal panel file consists of 28 months (seven interviews) from February 1987 to May 1989. At each interview, FRs collect data for the four months prior to the interview. For example, data collected in February 1987,

reference the followings months: October, November, December of 1986 and January 1987.

All persons in a sample household at the time of the first interview remain eligible for interviewing even if they move to new addresses. At each interview, we obtain information for each person who is 15 or more years old. In addition, we interview persons aged 15 and over who subsequently share living quarters with original sample persons (individuals who were living in an interviewed sample unit at the time of the first interview) as long as they reside with an original sample person. Such persons are movers into households. (Nelson, et.al., 1985.)

Generally, FRs make no attempt to interview first wave nonrespondent households in subsequent waves. If a household first becomes a nonrespondent at a subsequent interview, FRs attempt to interview it at the next interview. If the household is still a nonresponse, we make no further attempts to interview it at a later wave.

C. Current Longitudinal Weights

Like all other SIPP panels, the 1987 SIPP longitudinal panel file provides weights for each of three longitudinal periods. We developed the following weights for the 1987 panel file: panel, 1987 calendar year (87CY), and 1988 calendar year (88CY). The 87CY data were collected in interview months February 1987 to April 1988 and 88CY data were collected exactly one year later. All persons classified as interviewed for the appropriate longitudinal period received positive longitudinal weights. Persons classified as noninterviews for the appropriate longitudinal period received longitudinal weights of zero.

Interviewed persons are sample persons who were a self or proxy respondent in each month of the appropriate longitudinal period. Noninterviewed persons are all persons on the panel file interviewed in the first month of the appropriate longitudinal period, but who were noninterviews in a subsequent month of the longitudinal period.

Longitudinal weights (panel, 87CY, 88CY) for each sample person are the product of the following components:

1. Initial Weight (IW)

For the panel and 87CY weighting, this component is the first interview cross-sectional baseweight which was adjusted for population sizes by race, Census region, and urbanicity within non/self-representing primary sampling units and for household nonresponse.

For 88CY weighting, IW is the January 1988 reference month cross-sectional baseweight which was adjusted for population sizes by race, Census region,

and urbanicity within non/self-representing primary sampling units and for the first and fourth interview household nonresponse.

2. Nonresponse Adjustment Factor (NAF)

This factor, NAF, calculated for each longitudinal period, accounts for persons classified as noninterviewed in the appropriate longitudinal period and not already accounted for in the nonresponse adjustment component of the initial weight.

Below we summarize the procedures for calculating NAF.

We calculate weighted counts of interviewed and noninterviewed persons for each cell of the nonresponse tables. The following variables define these cells: average monthly household income, employment status, type of income, assets, educational level, race, and labor force status. These variables are based on characteristics obtained at the first interview. We then calculate NAF by dividing the sum of the weighted counts of interviews and noninterviews, in each cell, by the weighted count of interviews for that same cell. If necessary, we collapse cells until the following criteria are met:

1. there are more than 30 unweighted interviewed persons in a cell, and

2. the NAF value of a cell is less than or equal to 2.0.

Finally, we assign each interviewed person the appropriate NAF value.

3. Second-Stage Ratio Adjustment Factor (SS)

We assign interviewed persons in each longitudinal period a second stage ratio adjustment factor. We obtain these factors by raking SIPP estimates to the Current Population Survey's (CPS) age, race, sex, and household relationship status estimates. The benchmark dates used for the three estimated periods are March 1, 1987 for the panel, January 1, 1987 for 87CY, and January 1, 1988 for 88CY.

Weighting components for all other SIPP longitudinal panels are similar to those mentioned above. (King, 1990)

II. MOVER NONRESPONSE ADJUSTMENT RESEARCH

A. Introduction

The Census Bureau is researching mover nonresponse adjustment in an attempt to reduce bias in the SIPP estimates of marriages, divorces, migration, poverty, income, and wealth. We are researching the following two alternative weighting methods:

1. Incorporating a mover interview status variable into the current nonresponse adjustment procedures (SIPP-based estimate), and

2. Incorporating, at the final stage of the SIPP weighting procedure, a mover coverage adjustment based on mover controls from the CPS (CPS-based estimate).

We compare longitudinal estimates resulting from the two alternative methods to each other and to estimates based on the current weighting procedures. In addition, we compare these three sets of estimates to independently produced benchmarks to determine whether either or both of the two alternative weighting methods reduce biases of the key estimates listed above.

B. Methodology

For this research, we used data from the 1987 SIPP longitudinal panel file and used modified longitudinal weighting procedures to produce panel, 87CY, and 88CY weights for the alternative weighting methods. For alternative one, our longitudinal weights are a product of three components: IW, NAF', and SS. For alternative two, they are the product of: IW, NAF, and SS'.

Weights produced for the first alternative method (SIPP-based weight), incorporating a mover interview status variable into the current nonresponse adjustment procedures, require modification to the calculation of NAF. We performed the current nonresponse adjustment procedure separately for movers and nonmovers to obtain NAF'. A person's mover interview status is determined by the following definitions:

1. Movers are persons including children who moved at least once during the reference period covered by the corresponding weight.

2. Nonmovers are persons including children who did not move during the reference period covered by the corresponding weight.

Using NAF', we perform the SS procedure described in I.C. to produce the final set of longitudinal weights.

There is one drawback to this approach. Once a household becomes a nonrespondent we attempt to interview it at one more wave. If we do not obtain a response at that wave, we do not attempt to interview it again. If persons in a nonresponding household have not moved prior to the last attempt to obtain an interview, we classify all persons in the household as nonmover nonrespondents. Of course, some of these persons will have actually moved since their household became nonrespondent and should be classified as mover nonrespondents.

The possible misclassification of mover status for nonrespondents will negatively affect the true potential for reducing nonresponse bias using this approach. Weights produced for the second alternative method

(CPS-based weight), incorporating a mover coverage adjustment at the final stage of the SIPP weighting procedure, require modification to the calculation of SS. The new SS, referred to as SS', is the result of 30 iterations. Each iteration consists of first ratio adjusting the "nonresponse adjusted weight" (i.e. IW x NAF) for movers and nonmovers and then calculating SS. Earlier research suggested we were losing gain by iterating once, therefore we arbitrarily chose 30 iterations. The ratio adjustment involves, dividing the CPS cell control by the SIPP estimate of that cell. CPS controls correspond to the three weights produced for the 1987 panel (panel, 87CY, 88CY) derived from the monthly March 1987, January 1987 and 1988 CPS population estimates, respectively.

To implement this alternative, we matched CPS March data for two years to obtain mover rates for a two year period and adjusted these rates to represent a 28 month period. We then applied these rates to CPS estimates to obtain CPS mover/nonmover controls. This was necessary since the CPS asks questions only about moves occurring in the last year and not moves occurring for a 28 month period.

C. Analysis

We analyzed estimates of the percentages of movers, number of marriages, number of divorces, percent below the poverty level, and median family income based on the SIPP-based and CPS-based alternative weights and the original SIPP weight.

Table 1 compares the calendar year (CY) and panel estimates of the percentage of movers, number of marriages, and number of divorces. The actual SIPP estimate of marriages lies between the two definition values given in the columns labeled "Definition 1" and "Definition 2" in table 1. Since the research file did not contain all of the information to properly calculate the actual SIPP estimate of the number of marriages, analysts used a definition that was expected to result in too low an estimate and a second one that was expected to produce too high an estimate. Results from our comparisons based on CY weights show:

1. Both, 87CY and 88CY, CPS-based estimates of the percentage of movers are not statistically different from the benchmark estimate. The original SIPP estimate is furthest from the benchmark estimate.

2. For both calendar years, marriage "definition 2" for the SIPP-based and CPS-based alternative weights are not statistically different from the benchmark estimates. Both calendar year CPS-based estimates of marriages and divorces are numerically (not statistically) closer to the benchmark

estimates than the SIPP-based and original SIPP estimates.

Since the actual SIPP marriage estimate lies between "definition 1" and "definition 2" and "definition 1" differs statistically from the benchmark, it is possible that the actual SIPP estimate differs statistically from the benchmark estimate for all CY weights.

Panel estimates for 1987 and 1988 were produced from panel weights and data from the appropriate year. Results from estimates based on panel weights show:

1. The 1987 CPS-based estimate of the percentage of movers is not statistically different from the benchmark estimate. Of the three estimates, the original SIPP estimate is furthest from the benchmark.

2. All three of the 1988 estimates of the percentage of movers are statistically different from the benchmark. Again, the original SIPP estimate is furthest from the benchmark estimate.

3. All CPS-based marriage estimates except the 1988 marriage "definition 1" estimate are not statistically different from the benchmark estimates, while only the 1987 SIPP-based marriage "definition 2" estimate is not statistically different from the benchmark.

Tables 2A and 2B show that the use of the two alternative weights virtually have no impact on the percent below the poverty level estimates. The two sets of estimates from the alternative weights test the same against the benchmark estimate. In general, the alternative estimates are numerically (not statistically) closer to the benchmark estimate than the original SIPP estimate.

Overall, the alternative estimates for median family income did not adversely affect the SIPP estimates. In general, the alternative estimates were numerically (not statistically) closer to the benchmark estimates than the original SIPP panel estimates for 1988.

D.   Conclusions

Both sets of weights from the alternative weighting methods produced estimates numerically, although not always statistically, closer to the benchmark estimates than the original SIPP weights. The estimates from "definition 2" of the number of marriages are statistically closer to the benchmark estimates for the two alternative weighting methods. However, we must be cautious in supporting results from these estimates since they are not based on the true definition of marriages.

In general, however, all three weights produce estimates that are either all statistically different or all not statistically different from the benchmark

estimates. Thus, we have no strong evidence that either alternative reduces biases. Hence, we recommend that before pursuing implementation of either procedure, this research be conducted on more panels. If replications provide the same general outcome, that both alternative weighting procedures produce estimates numerically and/or statistically closer to the benchmark estimates than the current alternative, only then consider implementing one of the two alternatives.

If SIPP adopts either method in the future, some modifications should be made. First, as noted in section II.B., SIPP's current following rules do not allow us to determine if persons in a nonresponding household move after the household becomes a nonrespondent. Hence, we cannot always determine the correct nonresponse cell for a person. The problem could be handled in the future by changing the following rules so that SIPP attempts to interview nonrespondent households at every wave after they initially become nonrespondents or by following a sample of such households to determine mover/nonmover status of persons in the households, using this information to determine the propensity of similar persons to move, and incorporating this into the nonresponse adjustment procedure.

Second, because we cannot match CPS cases for more than two years due to the design of the CPS, it is not possible to use the current set of CPS questions to obtain mover rates for a four-year period as would be required for the 1996 SIPP design. Hence, to implement the CPS-based alternative for the 1996 SIPP design, we would need to add questions regarding moves in the past four years to the CPS questionnaire. Thus, before deciding whether or not to implement this alternative, we need to weigh the cost of making this change in the CPS against the small potential for reducing bias in the SIPP.

If a decision is made to pursue one of the alternatives, it would be useful to compare variances of selected estimates to assist in choosing between the approaches. In addition, files used in research should contain data to enable analyst to estimate the number of marriages based on the true definition of marriage.

Finally, the SIPP staff may find that the research now underway to increase efforts to track movers proves more beneficial in reducing bias than pursuing either of the two weighting alternatives further. (Petroni, 1994)

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Table 1. Comparison of Estimates Derived from Alternative SIPP Weights
        (Numbers in Thousands)

Weight	Percentage of Movers	Number of Marriages		Number of Divorces
		Definition 1	Definition 2	
1987				
Original CY Weight	13.6*	1,718*	1,913*	734*
SIPP-based CY Weight	15.6*	1,791*	1,996	762*
CPS-based CY Weight	17.7	1,893*	2,114	803*
Original Panel Weight	13.6*	1,749*	1,935*	704*
SIPP-based Panel Weight	14.8*	1,823*	2,015	738*
CPS-based Panel Weight	18.1	2,054	2,272	828*
Benchmark[1]	17.8	2,400	2,400	1,668
1988				
Original CY Weight	15.4*	1,661*	1,939*	733*
SIPP-based CY Weight	16.9*	1,742*	2,032	750*
CPS-based CY Weight	17.3	1,795*	2,088	768*
Original Panel Weight	14.9*	1,505*	1,768*	699*
SIPP-based Panel Weight	16.3*	1,565*	1,848*	756*
CPS-based Panel Weight	20.0*	1,836*	2,174	866*
Benchmark[1]	17.8	2,400	2,400	1,668

Table 2A. Comparison of Poverty Rates from Alternative SIPP Panel Weights, by Selected Characteristics: 1987

Characteristics	Percent Below the Poverty Level			
	Benchmark[2]	Original Panel Weight	SIPP-based Panel Weight	CPS-based Panel Weight
AGE				
Total	13.4	10.8*	11.1*	11.1*
Under 18 years	20.3	17.7*	18.7*	18.6*
18 to 64 years	10.6	8.3*	8.4*	8.5*
65 years and over	12.5	8.9*	8.7*	8.8*
SEX				
Male	11.8	9.5*	9.7*	9.8*
Female	14.9	11.9*	12.4*	12.3*
RACE AND HISPANIC ORIGIN				
White	10.4	7.9*	8.1*	8.2*
Black	32.4	30.2	30.7	30.5
Hispanic Origin	28.0	22.8*	22.9*	23.2*
REGIONS				
Northeast	11.0	8.5*	8.6*	8.6*
Midwest	12.7	9.5*	9.8*	9.9*
West	12.6	10.0*	10.3*	10.4*
South	16.1	13.6*	13.9*	13.9*
TYPE OF RESIDENCE				
Metropolitan Area	12.5	9.4*	9.7*	9.7*
Inside Central City	18.6	15.0*	15.4*	15.2*
Outside Central City	8.5	5.8*	6.0*	6.1*
Outside Metropolitan Area	16.9	15.1*	15.3*	15.5

Table 2B. Comparison of Poverty Rates from Alternative SIPP Panel Weights, by Selected Characteristics: 1988

Characteristics	Percent Below the Poverty Level			
	Benchmark[2]	Original Panel Weight	SIPP-based Panel Weight	CPS-based Panel Weight
AGE				
Total	13.0	10.0*	10.4*	10.3*
Under 18 years	19.5	16.4*	17.5*	17.1*
18 to 64 years	10.5	7.6*	7.9*	7.8*
65 years and over	12.0	8.7*	8.5*	8.5*
SEX				
Male	11.5	8.8*	9.0*	9.0*
Female	14.5	11.2*	11.8*	11.5*
RACE AND HISPANIC ORIGIN				
White	10.1	7.3*	7.4*	7.5*
Black	31.3	28.8	30.7	29.3
Hispanic Origin	26.7	21.9*	22.1*	22.4*
REGIONS				
Northeast	10.1	9.0	9.1	9.2
Midwest	11.4	8.5*	8.7*	8.8*
West	12.7	8.6*	8.8*	9.0*
South	16.1	12.7*	13.4*	12.9*
TYPE OF RESIDENCE				
Metropolitan Area	12.2	8.8*	9.3*	9.1*
Inside Central City	18.1	13.5*	13.9*	13.7*
Outside Central City	8.3	5.7*	6.3*	6.1*
Outside Metropolitan Area	16.0	13.9*	13.8*	13.9*

1   Marriage and Divorce benchmark estimates are from the National Center for Health Statistics. Mover benchmark estimates are from the March 1988 and March 1989 Current Population Survey.

2   Poverty and Median Family Income

*   The estimate is statistically different from the benchmark estimate at the .10 significance level.