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MEMORANDUM FOR Jason Fields
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Subject: Nonresponse Bias Analysis for Wave 1 2014 Survey of Income and Program Participation (SIPP) (ALYS-16)

This document describes the results of the nonresponse bias analysis for Wave 1 of the 2014 Survey of Income and Program Participation (SIPP).

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Nonresponse Bias Analysis for Wave 1 of the 2014 Survey of Income and Program Participation (SIPP)

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Introduction

Unit nonresponse is the failure to obtain any survey measures on a sample unit (e.g. households in a household survey). Nonresponse rates have been increasing in recent years among large government surveys, creating growing concerns over data quality and loss of valuable information from the nonrespondents. Declining response rates can indicate nonresponse bias, a difference in survey measures between respondents and nonrespondents, which can affect data quality. However, there is not always a direct link between response rates and nonresponse bias. Different statistics within a survey can experience different degrees of nonresponse bias depending on the correlation between each statistic and a unit's likelihood of responding. Low response rates may result in significant nonresponse bias for some statistics but not others [2, 3]. Similarly, high response rates will not lead to a reduction in nonresponse bias if there is no association between response propensities and the variables in question. Therefore, the degree of nonresponse bias is a function of not only the response rate, but also how much the respondents and nonrespondents differ on the survey variables of interest. For a sample mean, an estimate of the bias of the sample respondent mean is given by:

$$B(\bar{y}_r) = \bar{y}_r - \bar{y}_t = \left(\frac{n_{nr}}{n}\right)(\bar{y}_r - \bar{y}_{nr})$$

Where:
$\bar{y}_t$ = the mean based on all sample cases;
$\bar{y}_r$ = the mean based only on respondent cases;
$\bar{y}_{nr}$= the mean based only on the nonrespondent cases;
n = the number of cases in the sample; and
n_{nr}= the number of nonrespondent cases.

Understanding and measuring nonresponse bias for key estimates is an important aspect in determining overall data quality.

Policy makers use estimates from the surveys conducted by the U.S. Census Bureau and other agencies to determine the impact of government programs and evaluate national economic indicators; therefore, the highest data quality is necessary. The Office of Management and Budget (OMB) Standards, released in 2006, require survey programs to implement a nonresponse bias analysis if unit response rates fall below 80% [8]. In addition to the OMB Standards, the Census Bureau's Statistical Quality Standards state that serious data quality issues related to nonsampling error can occur when cumulative response rates for a longitudinal survey fall below 60% and/or when sample attrition from one wave to another wave is greater than 5% [14].

This report documents the nonresponse bias analysis for Wave 1 of the 2014 Survey of Income and Program Participation (SIPP), which had a weighted response rate of 68.8%. The OMB guidelines and Bureau's Quality Standards inform the decision to assess possible data quality issues in the 2014 SIPP by conducting a nonresponse bias analysis. Methods implemented in this study include benchmarking, comparing weighted response rates across subgroups of the sample, examining frame characteristics among full sample, respondents, and nonrespondents, modeling

response propensities with frame variables, and investigating characteristics of late responders. Subsequent analysis on Wave 2 through Wave 4 of the 2014 SIPP Panel will include an in-depth analysis of nonresponse using Wave 1 data available for persons who drop out in later waves and examine the longitudinal aspect of nonresponse.

Data

The SIPP is a longitudinal survey designed to collect detailed information on income, employment, health insurance, and participation in government programs among the civilian noninstitutionalized population residing in the United States. The Census Bureau employed a two-stage sample design to select the 2014 SIPP sample. Housing units were systematically selected from 820 Primary Sampling Units (PSUs) in the Master Address File (MAF), which is created from the decennial censuses and frequently updated by the Census Bureau. In addition, households located in strata with a higher concentration of low-income households were oversampled by 24% to increase the accuracy of the estimates for statistics of low-income households [10].

Prior to the 2014 Panel, the SIPP was administered in panels lasting three to five years with interviews occurring at 4-month intervals. Participants provided information on the previous four months during an interview and each 4-month cycle covering the entire sample comprised a wave. Sampled households in the 2014 SIPP are interviewed annually over a period of four years and data is collected on the 12 months of the preceding calendar year [13]. The SIPP 2014 Wave 1 interviews occurred from February through May of 2014 and obtained data on the reference period covering January 2013 through December 2013.

The sample in Wave 1 of the 2014 SIPP consisted of approximately 53,070 households, of which 42,348 households were eligible for interview. Of the eligible households, 29,685 were interviewed resulting in a weighted response rate of 68.8%. Adults interviewed in Wave 1 were followed in subsequent waves and interviews were attempted for all household members, including new household members who joined a previously interviewed household. Furthermore, when Wave 1 interviewed persons join a new household not originally in the SIPP sample, this new household becomes part of the SIPP sample in later waves.

Because SIPP is a longitudinal survey, single wave response rates do not accurately reflect nonresponse over the course of the survey; the total sample attrition is also examined. The SIPP measures sample attrition using a sample loss rate, which incorporates nonresponse from Wave 1 and later waves. The growth rate of nonrespondents' households is estimated using the growth of respondents' households and included in calculating the sample loss rate for later waves. The sample loss rate for Wave 1 is 31.2%.

Analytic Variables

This analysis aims to examine and measure nonresponse bias associated with SIPP's key estimates, including enrollment in Medicare, Medicaid, Supplement Nutrition and Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), Social Security, and Supplemental Security Income. However, estimates of nonresponse bias can only be produced

for variables whose values are known for both respondents and nonrespondents, i.e. frame variables. Some frame variables are obtained from the MAF, which is updated yearly with the American Community Survey (ACS) data. Other variables, such as those related to householder characteristics, are obtained through interview data for the interviewed households and a Field Representative's (FR) observation for noninterviewed households. Nonresponse bias is specific to a statistic; therefore, frame variables correlated to key estimates of interest are helpful in identifying statistics subject to bias. The examined frame variables include the following:

- *Gender of Householder* (Two Levels: Female, Male)
- *Number of Household Members* (Four Levels:1, 2, 3-4, 5+)
- *Race of Householder* (Two levels: Black, Nonblack)
- *Tenure* (Two levels: Owner, Renter)
- *Urban/Rural* (Two levels: Rural area, Urban area)
- *Region* (Four levels: Midwest, Northeast, South, West)
- *CBSA area* (Four levels: In central city of Metropolitan Statistical Area (MSA), In MSA but not in central city, Not in MSA but in census place, Not in MSA or census place)
- *Within PSU Strata* (Two levels: Low Income household, Non-low Income household)

The relationship between each frame variable above and SIPP indicator variables for participation in Medicare, Medicaid, SNAP, SSI, Social Security and TANF were examined using the Rao-Scott chi-square test of association. All frame variables were significantly associated with each program in the respondent sample.

Previous Research

Previous efforts to examine nonresponse bias and determine its impact on SIPP estimates involved comparing characteristics of respondent households to households who were nonrespondents or dropped out in later waves of the survey. A study on nonresponse in the 1984 SIPP panel showed households who were renters, had persons aged 15-24 as reference persons, or lived in MSAs, were more likely to be nonrespondents [12]. A comparison of SIPP and CPS-ASEC annual poverty rates and health insurance coverage revealed similar poverty estimates at the 100% threshold but not at the 150% or the 200% thresholds [11]. Results from several studies investigating the use of logistic regression and various raking methodologies for nonresponse weighting adjustments in SIPP showed these alternatives did not reduce the bias more than the current adjustment for estimates of income, unemployment, government assistance and poverty [4].

Nonresponse bias analysis on Wave 1 of the 2008 Panel suggests that the SIPP underestimates participation in SNAP, SSI, Medicaid, and Medicare compared to administrative data sources. Comparing different subgroups in the sample further revealed differences in response rates related to race, region, and urban/rural status frame variables. Specifically, black householders had lower response rates than nonblack householders, and households in rural locations had higher response rates than households in urban locations. Comparing estimates of the frame variables between the full sample and respondent sample found differences for region, urban/rural status, CBSA type, and race. These results were supported by odds ratios from a logistic regression analysis indicating region, household size, and age of householder

significantly affected response propensities. However, weighting adjustments resulted in reduction of bias [5].

Analysis on Wave 2 of the 2008 SIPP Panel comparing estimates of the full sample and respondent sample suggests that SIPP may be overestimating household income, household earnings, and participation in Medicare and Social Security. Participation in Medicaid and SNAP may be underestimated in the responding sample compared to administrative data. However, none of the relative differences for these estimates were greater than 5%. Investigating later waves of the 2008 SIPP revealed that the relative differences between full respondent and sample estimates increased in later waves as sample loss increased. However, the representativity indicator (R-indicator), a measure of similarity between sample and population, remained above 70% for each wave, indicating the respondent sample is representative of the full sample and thus the population [6,7].

Methods

Five methods were used to investigate nonresponse bias for key estimates in Wave 1 of the 2014 SIPP, most of which were utilized in the 2008 SIPP panel analysis. These techniques include benchmark analysis, comparison of response rates across subgroups of respondents, comparison of frame characteristics for full sample respondents and nonrespondents, response propensity modeling via logistic regression, and a level of effort analysis to investigate characteristics of late responders. All analyses were conducted using survey procedures in SAS® software, to account for the complex design of the SIPP, and hypothesis testing was carried out at the 90% confidence level.

Benchmarking

Benchmarking involves comparing the survey estimates computed from the respondent sample to an independent source. Administrative records are often used as benchmarks because they are the result of complete records and have good coverage. Wave 1 2014 SIPP total recipient estimates were compared to official counts of federally administered programs recipients published by The Center for Medicare and Medicaid Services (*Medicaid, Medicare*), United States Department of Agriculture (*SNAP*), United States Department of Health and Human Services (*TANF*), and the Social Security Administration (*SSI, Social Security*). Program recipients of SSI and Social Security were further classified by age groups and compared to similar estimates computed from the SIPP data. The SURVEYMEANS procedure in SAS was used to estimate total program participation counts for each of the listed programs and the associated standard errors. SIPP estimated enrollments for each program incorporate final weights that are adjusted for nonresponse, and raked to population control totals. Variance estimates of these counts were calculated using Fay's method of Balanced Repeated Replication (BRR). Finally, a one-sample t-test was used to test for significant differences between SIPP estimates and official program participation counts.

Unit Response Rates in Subgroups of the Sample

Base weighted unit response rates were calculated for different subgroups of the sample and compared to the total weighted unit response rate of 68.8% for Wave 1 of the SIPP 2014 Panel. A unit's base weight is the inverse of its probability of selection and does not contain any adjustments for nonresponse. Dissimilar response rates among the subgroups indicate a potential for nonresponse bias. Subgroups with lower response rates compared to the other subgroups of the same variable are underrepresented in the final sample and subgroups with high response rates compared to the other subgroups of the same variable are overrepresented in the survey [10]. Fay's modified BRR was used to estimate the variance of the difference between weighted unit response rates for each subgroup and the total unit response rates.

Comparing Frame Characteristics Full Sample to that of Respondent Sample

The third approach compared the distribution of frame variables in the full sample (respondents and nonrespondents) to that of the respondent sample using the SAS's SURVEYFREQ procedure. Weighted proportions of the different categories in each frame variable and their corresponding variances were computed using base weights in the full sample. The same statistics were calculated using both base weights and nonresponse adjusted weights in the respondent sample. The difference between the respondent statistic obtained using base weights and the full sample statistic for each variable is an estimate of nonresponse bias. Similarly, the difference between the respondent statistic obtained with nonresponse-adjusted weights and the respondent statistic obtained with base weights indicates a reduction in the bias induced by the nonresponse weighting adjustment.

Comparing Frame Characteristics of Respondents and Nonrespondents

The fourth technique compares the distributions of frame variables between respondents and nonrespondent samples using base weights. Since nonresponse bias occurs when respondent and nonrespondent samples within a survey differ with respect to survey variables, the difference between these estimates is a direct approximation of nonresponse bias.

Model Response Propensities Using Frame Characteristics

Response propensities were modeled using a weighted logistic regression with frame variables as predictors. The model predicts the probability of a household responding in Wave 1 as a function of frame variables and is of the form

$$logit(\pi) = log\left(\frac{\pi}{1-\pi}\right) = \boldsymbol{X\beta}$$

where $\boldsymbol{X}$ is a vector of the frame variables, $\boldsymbol{\pi}$ is the probability of a household responding in Wave 1 and $\boldsymbol{\beta}$ is the vector of slope parameters associated with frame variables**.**

The logistic regression was implemented using the SURVEYLOGISTIC procedure in SAS, and incorporated base weights and replicate base weights to adjust for the SIPP's complex sample design. Odds ratios produced by the model were tested for statistical significance and indicate

which subgroups of the sample are more or less likely to be interviewed. In later waves, the predicted response propensities will be used to classify the sample into mutually exclusive groups and compare estimated key variables across these groups.

The predicted response propensities from the logistic regression model were also used to calculate an R-indicator, which measures how representative a survey's respondents are of the full sample and hence, the population **[**1]. The R-indicator is estimated by the following equation below and its confidence interval is constructed using Fay's BRR.

$$\hat{R} = 1 - 2S_{\hat{p}} = 1 - 2\sqrt{\frac{1}{\sum_{i=1}^{42,364} w_i - 1} \sum_{i=1}^{42,364} w_i \, (\hat{p}_i - \bar{\hat{p}})^2}$$

where w_i is the base weight and $\hat{p}_i$ is the response propensity estimated by the logistic regression model.

The value of the R-indicator approaches 1 when the standard deviation of the response propensities is small, i.e. when the response propensities are similar, indicating the respondents are more likely to be representative of the sample. Conversely, an R-indicator with value close to 0 indicates inadequate representativeness or large differences between the respondents and nonrespondents.

Level of Effort

The final analysis explored characteristics of early and late respondents. Timeliness in responding to the survey was quantified by the number of contacts required to obtain a complete interview in the respondent sample. Households where the number of contacts was greater than or equal the 80th percentile, 7 or more contacts, were designated late respondents. Households requiring less than 7 contacts to complete the interview were classified as early respondents. Participation rates for Social Security, SSI, Medicare, Medicaid, SNAP, and TANF were calculated for both categories of respondents and the difference was tested for statistical significance. Distributions of frame variables were also compared between the late respondents and nonrespondents to investigate if both groups are similar.

Results

Benchmarking

Tables 1 through 4 summarize the results of comparing the SIPP estimates to benchmarks. Program participation for SNAP, Social Security, SSI, Medicaid, Medicare and TANF estimated by SIPP are compared to totals obtained from the program sources. Each table displays SIPP estimated counts of participants and its confidence interval, the benchmark, the difference between the SIPP estimate and the benchmark, and finally the ratio of SIPP estimate to the benchmark.

Table 1 compares enrollment in the aforementioned programs. SIPP estimates for SNAP, Social Security, SSI, and TANF are monthly estimates while those for Medicare and Medicaid are yearly estimates. The monthly estimates indicate the number of persons enrolled in these programs in December 2013. Medicare and Medicaid estimates represent the total number of persons in the respective programs during calendar year 2013[1]. SIPP underestimates participation in all programs except SSI and the differences are statistically significant at the 90% confidence level. The SIPP accurately estimates SSI participation where it accounts for 96% of the Benchmark total. The largest difference occurs in the Medicaid program where the SIPP estimate accounts for 73% of the Benchmark.

Tables 2 through 4 further summarize program participation, categorizing participants by age groups, and resident state. Table 2 classifies participants by age with 62 years as the cutoff separating the two age groups. Although full Social Security retirement benefits begin between ages 65 and 67 depending on the recipient's year of birth, one can begin receiving a percentage of these retirement benefits at age 62. Furthermore, Social Security disability benefits are only available to persons younger than 62 if they are deemed unable to work. The ratio of SIPP estimates to benchmark remains the same for recipients age 62 or older but slightly by 2% in the younger age group. However, the SIPP estimate is still statistically different from the benchmark in both age groups.

Table 1 – Comparison of Overall Total Participation Rates

	SIPP Estimate	SIPP 90% Confidence Interval	Benchmark Total	Difference	Ratio
SNAP	39,624,605	(38,454,705, 40,794,505)	47,078,649[1]	7,454,044*	84%
Social Security	53,612,246	(52,939,123, 54,285,369)	57,978,610[2]	4,366,364*	92%
SSI	8,042,026	(7,699,594, 8,384,457)	8,363,477[3]	321,451	96%
Medicaid	52,923,269	(51,819,181, 54,027,357)	72,800,000[4]	19,876,731*	73%
Medicare	49,600,016	(49,206,899, 49,993,133)	52,506,598[5]	2,906,582*	94%
TANF	3,049,699	(2,687,214, 3,412,185)	3,577,732[6]	528,033*	85%

*indicates difference is statistically significant at the 90% confidence level
Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
1 http://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap
2 https://www.ssa.gov/policy/docs/statcomps/supplement/2014/5a.pdf (Table 5.A1)
3 https://www.ssa.gov/policy/docs/statcomps/supplement/2014/7a.pdf (Table 7.A1)
4 https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMS-Statistics-Reference-Booklet/2014.html (Table I.16)
5 https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMSProgramStatistics/2013/Enrollment.html (MDCR ENROLL AB 1)
6 https://www.acf.hhs.gov/sites/default/files/ofa/2014_monthly_tan.pdf (December 2013)

[1] The CMS program statistics only produces calendar year enrollment in Medicare while the CMS statistics reference booklet published annually in June contains provides average monthly enrollments for Medicare and Medicaid, and unduplicated annual Medicaid enrollment for each fiscal year. Monthly State level Medicaid and Children's Health Insurance Program (CHIP) enrollment are now published by the CMS from January 2014 onwards.

Table 2 – Comparison of Social Security Participation by Age					
	SIPP Estimate	**SIPP 90% Confidence Interval**	**Social Security**	**Difference**	**Ratio**
Less Than 62	11,109,410	(10,485,248, 11,733,572)	11,879,043	769,633*	94%
62+	42,502,836	(42,160,331, 42,845,340)	46,036,401	3,533,565*	92%
Total	53,612,246	(52,939,123, 54,285,369)	57,915,444[1]	4,303,198*	93%

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level
[1] this total excludes 63,166 disabled adult recipients age 60-64

Table 3 displays SSI participants by age group, with ages 18 and 65 used to categorize the three age groups. SIPP significantly underestimates recipients 18 and younger, accounting for 78% of the SSI benchmark totals. In contrast, SIPP accurately estimates SSI recipients in the older age groups accounting for 99% of the benchmark in recipients age 18-64, and 101% of the benchmark in recipients age 65 or older.

Table 3 – Comparisons of Supplemental Security Income Participation by Age					
	SIPP Estimate	**SIPP 90% Confidence Interval**	**SSI**	**Difference**	**Ratio**
Less Than 18	1,036,221	(921,402, 1,151,039)	1,321,681	285,460*	78%
18-64	4,881,547	(4,624,978, 5,138,116)	4,934,272	52,725	99%
65+	2,124,258	(1,962,427, 2,286,090)	2,107,524	-16,734	101%
Total	8,042,026	(7,699,594, 8,384,457)	8,363,477	321,451	96%

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level

Table 4[2] highlights the states where the SIPP estimated SNAP recipient count is significantly different from the benchmark provided by the USDA. The national SIPP estimate of SNAP enrollment constitutes 84% of the benchmark but varies widely at the state level. SIPP significantly overestimates SNAP enrollment in Idaho and Rhode Island where the estimate to benchmark ratios are 184% and 133% respectively. It underestimates SNAP participation rates in the remaining states, where the estimate to ratio ranges from 38% to 88%.

Calculating Weighted Response Rates for Subgroups

Response rates by subgroups of the frame variables, which range from 62.9% in households located in the Northeastern region to 79.3% in households with 5 or more members are presented in Table 5. Most subgroups had significantly higher response rate than the total unit response rate of 68.8% and these response rates differed across subgroups of the same frame variable. Household size had the largest variation in response rates among the subgroups ranging from 64.0% in households with 2 members to 79.3% in households with 5 or more members.

[2] Tables 4, 5, 6a, 6b and 9 are in the appendix section of the document

Response rates in all households with 1, 2, or more than 4 occupants were statistically different from the unit response rate.

Comparing Estimates of the Full Sample to Estimates of the Respondent Sample

Table 6a presents the results of comparing distribution of frame variables in the full sample to that of the respondent sample. The full sample estimates were calculated with base weights and the respondent sample estimates were evaluated using both base weight and nonresponse adjusted weights respectively. Estimated relative differences using base weights can indicate potential for nonresponse bias whereas estimated relative differences using nonresponse adjusted weight indicates whether nonresponse weighting adjustment reduces this bias.

Approximately 36.77% of the entire sampled households are located in low-income PSU strata. This statistic significantly increases to 38.63% when calculated in the respondent sample using base weights but is corrected to the expected proportion in the entire sample, 36.77% when calculated using nonresponse adjusted weights.

Relative percentage differences calculated using base weights in both full and response samples vary from -9.43% to 13.20% and are significantly different from 0% except for proportion of households located in the West region. The percentage of households residing in the Midwest and Southern regions are overestimated by 4.25% and 1.1% respectively. The percentage of householders who own their homes is underestimated by 1.35% and the percentage of householders who rent their current residence is overestimated by 2.32%.

Nonresponse weighting adjustments generally reduced the nonresponse bias in the distribution of the frame variables. The relative differences in estimates were significantly decreased to 0.43% or less in *region, within strata PSU, CBSA type, householder race,* and *tenure* variables when calculated with adjusted weights in the respondent sample. While the differences remained statistically significant in *urban, household size*, and *gender of householder* variables, only the difference for *households with 5 or more members* remained above 3%.

Comparing Frame Characteristics of Respondents and Nonrespondents

Table 6b documents findings from comparing the respondent sample to nonrespondents. Estimated percentages for subgroups of the variables were computed using base weights in both samples. The differences between estimates from both samples were statistically significant across all subgroups and is an estimate of nonresponse bias.

Model Response Propensities Using Frame Characteristics

Odds ratio estimates obtained from the logistic regression model predicting response propensities for all households in Wave 1 as a function of frame variables are displayed in Table 7. All predictors are categorical, and the first level, indicated with odds ratio of 1, is treated as the reference group. Odds ratios greater than 1 indicate other categories of a variable are more likely to be interviewed than the reference category. Conversely, odds ratios less than 1 imply other categories of a variable are less likely to be interviewed than the reference group. Households

with 2 members are 26% less likely to be interviewed, compared to households with 1 member and households with 5 or more members are 55% more likely to be interviewed compared to households with 1 member. Households with male householders are 11% less likely to respond than households with female householders. The estimated R-indicator for this model is 0.872 (0.872, 0.873) suggesting a high likelihood that the respondent sample is representative of the full sample.

Table 7 - Odds Ratios for Logistic Regression of Response

Characteristics	Odds Ratio	90% Confidence Interval
Region		
Midwest	1.00	--
Northeast	0.69*	(0.66, 0.73)
South	0.89*	(0.85, 0.93)
West	0.91*	(0.86, 0.95)
Urban		
Rural	1.00	--
Urban	0.91*	(0.85, 0.97)
Within PSU Strata		
Low Income Strata	1.00	--
Non low Income Strata	0.84*	(0.80, 0.87)
CBSA type		
Located within MSA in principal city	1.00	--
Located within MSA not principal city	1.09*	(1.04, 1.14)
Other	1.42*	(1.27, 1.58)
Place	1.38*	(1.26, 1.50)
Race of Householder		
Black Householder	1.00	--
Non Black Householder	0.92*	(0.87, 0.96)
Number of Household Members		
1	1.00	--
2	0.74*	(0.71, 0.78)
3-4	0.95	(0.90, 1.00)
5+	1.55*	(1.43, 1.68)
Gender of Householder		
Female	1.00	--
Male	0.89*	(0.86, 0.93)
Tenure		
Owner	1.00	--
Renter	1.09*	(1.05, 1.13)

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level

Level of Effort Analysis

Participation rates in early and late respondent samples are compared in Table 8. Proportion of persons receiving Medicaid, Medicare, Social Security and SSI benefits in both respondent groups are statistically different. Early respondents' enrollment rates in Medicare, Social Security, and SSI are much higher than those of late respondents with relative differences of 59%, 55%, and 36% respectively. The difference between participation rates in Medicaid is 6% higher in late respondents compared to earlier respondents. Results comparing distribution of frame variables between late and nonrespondents in Table 9 indicate both samples are different from each other. Households with Black householders represent 16.97% of late respondent sample and 10.85% of the nonrespondents sample. These results are supported by chi-square test of association on the sample consisting of late and nonrespondents, which showed respondent type is related to each of the frame variables.

Table 8 – Comparison of Participation Rates for Early and Late Respondents

	Early Respondents		Late Respondents		
	Participation Rates	**Std Error**	**Participation Rates**	**Std Error**	**Relative Difference**
Medicare	18.56%	0.14%	7.69%	0.23%	59%*
Medicaid	16.05%	0.26%	17.06%	0.45%	-6%*
SNAP	12.87%	0.29%	12.16%	0.46%	5%
Social Security	19.88%	0.19%	8.93%	0.26%	55%*
SSI	2.83%	0.08%	1.80%	0.11%	36%*
TANF	0.91%	0.07%	1.21%	0.19%	-33%

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level

Conclusion

This analysis employed five techniques to investigate the potential for nonresponse bias in SIPP 2014 Wave 1 data: benchmarking, comparing weighted response rates across subgroups of the sample, examining frame characteristics among full sample, respondents, and nonrespondents, modeling response propensity, and a level of effort analysis. Results from all methods are compared to each other to strengthen the conclusions.

The benchmark study suggests SIPP is underestimating recipients enrolled in SNAP, Social Security, Medicaid, Medicare and TANF, which is consistent with results from previous SIPP panels. In some cases, these differences may be due to respondent problems understanding the survey. There is often misunderstanding about Social Security and SSI benefits because the Social Security Administration manages both programs. SSI is a need-based program while Social Security is an entitlement program based on a person's wage contributions over a defined period. One is eligible for Social Security if retired and aged 62 or older, incapable of working

due to disability regardless of age, or the survivor of a deceased Social Security recipient. Eligibility for SSI is determined based on income; persons with limited income that are disabled, blind, or at least 65 years old without any disabilities are eligible for SSI.

The differences between SIPP estimates and corresponding benchmarks can result from differences in survey design, measurement procedures, and coverage between SIPP respondents and the benchmark data. For instance, the Medicaid benchmark covers fiscal year 2013 while the SIPP estimate corresponds to enrollment in calendar year 2013. Therefore, it is inaccurate to ascribe the difference solely to nonresponse.

Weighted response rates among subgroups of the sample vary among different subgroups and are significantly different from the unit response rate. These findings imply there is potential bias due to nonresponse for statistics associated with these variables. The logistic regression parameter estimates substantiate results from the weighted response rates analysis among subgroups. Nonetheless, both techniques do not provide direct estimates of the nonresponse bias and fail to account for the nonresponse weighting adjustments applied during the data editing. Furthermore, the estimated R-indicator of 0.872 suggests that there is a high likelihood that the respondent sample is representative of the full sample.

Frame variable analysis supports evidence of potential nonresponse bias but also shows that the nonresponse weighting adjustment is effective in reducing the bias. Although the distribution of frame variables was significantly different between respondents and nonrespondents, and between full sample and nonrespondents, weighting adjustments mitigate the bias.

Estimates of program participation rates significantly differ between late and early respondents, which would indicate the presence of nonresponse bias if the late respondents turn out to be similar to nonrespondents. But in fact, the frame characteristics of the late responders differed from those of the nonrespondents. Furthermore, the conclusions from the level of effort analysis depend on the definition of late respondents and may change if the late responders are defined by different criteria.

References

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Appendix

Table 4 – Supplemental Nutrition Assistance Program Comparisons by State					
State	**SIPP Estimate**	**SIPP 90% Confidence Interval**	**SNAP**	**Difference**	**Ratio**
Alabama	715,141	(592,828, 837,455)	908,168	193,027*	79%
Colorado	330,279	(216,061, 444,498)	504,612	174,333*	65%
Florida	2,909,859	(2,574,338, 3,245,380)	3,522,173	612,314*	83%
Georgia	1,532,095	(1,313,401, 1,750,788)	2,075,085	542,990*	74%
Idaho	397,036	(303,975, 490,097)	216,218	-180,818*	184%
Illinois	1,515,630	(1,366,914, 1,664,346)	2,016,940	501,310*	75%
Indiana	795,410	(688,756, 902,064)	908,732	113,322*	88%
Kentucky	604,746	(547,954, 661,537)	840,047	235,301*	72%
Louisiana	761,662	(670,158, 853,167)	891,260	129,598*	85%
Maine	88,529	(38,658, 138,400)	235,842	147,313*	38%
Michigan	1,435,561	(1,335,651, 1,535,471)	1,692,720	257,159*	85%
Mississippi	540,488	(472,136, 608,840)	664,936	124,448*	81%
Nebraska	90,076	(50,000, 130,152)	178,631	88,555*	50%
New York	2,587,583	(2,294,989, 2,880,176)	3,158,376	570,793*	82%
North Carolina	1,256,626	(1,064,854, 1,448,398)	1,583,150	326,524*	79%
Oklahoma	336,938	(210,723, 463,154)	624,567	287,629*	54%
Pennsylvania	1,457,558	(1,305,383, 1,609,734)	1,788,668	331,110*	81%
Rhode Island	237,703	(208,456, 266,949)	179,336	-58,367*	133%
South Carolina	697,803	(599,179, 796,426)	855,898	158,095*	82%
South Dakota	38,274	(22,684, 53,863)	101,355	63,081*	38%
Tennessee	1,078,508	(962,134, 1,194,882)	1,318,529	240,021*	82%
Texas	3,219,147	(2,910,056, 3,528,238)	3,916,115	696,968*	82%
Virginia	726,460	(568,339, 884,582)	935,642	209,182*	78%

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level

Table 5 - Response Rates Across Subgroups					
Characteristics	**Unweighted Frequency**	**Weighted Response Rate (%)**	**Std Error**	**90% Confidence Interval**	**Difference from total (%)**
Total	42,348	68.8	0.21	(68.5, 69.2)	-
Region					
Midwest	9,214	71.9	0.43	(71.2, 72.6)	-3.1*
Northeast	6,002	62.9	0.58	(61.9, 63.8)	5.9*
South	18,486	69.6	0.36	(69.0, 70.2)	-0.8*
West	8,646	69.3	0.42	(68.6, 70.0)	-0.5
Urban					
Rural	9,113	72.1	0.60	(71.1, 73.1)	-3.3*
Urban	32,879	68.1	0.24	(67.7, 68.5)	0.7*
Within PSU Strata					
Low Income Strata	20,560	72.3	0.35	(71.7, 72.8)	-3.5*
Nonlow Income Strata	21,788	66.8	0.29	(66.3, 67.3)	2.0*
CBSA type					
Within MSA in Central City	14,148	67.4	0.38	(66.8, 68.1)	1.4*
Within MSA but not in Central City	20,313	67.8	0.33	(67.3, 68.4)	1.0*
Not in MSA but in Census Place	4,113	75.2	0.87	(73.8, 76.6)	-3.3*
Neither in MSA nor Census Place	3,774	75.3	0.92	(73.8, 76.8)	-6.5*
Race					
Black	6,063	71.6	0.58	(70.6, 72.53)	-2.8*
NonBlack	36,285	68.4	0.23	(68.0, 68.8)	0.4*
Number of Household Members					
1	12,198	71.0	0.45	(70.2, 71.7)	-2.2*
2	14,866	64.0	0.39	(63.3, 64.6)	4.8*
3-4	11,633	69.5	0.46	(68.8, 70.3)	-0.7*
5+	3,651	79.3	0.72	(78.1, 80.5)	-10.5*
Gender					
Female	22,158	70.2	0.31	(69.7, 70.7)	-1.4*
Male	20,190	67.3	0.33	(66.8, 67.9)	1.5*
Tenure					
Owner	26,912	67.9	0.26	(67.5, 68.3)	0.9*
Renter	15,436	70.4	0.36	(69.8, 71.0)	-1.6*

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level

Table 6a– Distribution of Frame Variables in Full Sample and Respondents								
	All Sample Cases		Respondents					
			Base Weight			Nonresponse Adjusted Weight		
	Percent	Std Error	Percent	Std Error	Relative Difference (%)	Percent	Std Error	Relative Difference (%)
Region								
Midwest	22.58	0.11	23.58	0.16	4.25*	22.58	0.11	0.00
Northeast	18.13	0.10	16.57	0.18	-9.43*	18.13	0.10	0.00
South	37.04	0.13	37.45	0.19	1.10*	37.04	0.13	0.00
West	22.25	0.11	22.40	0.18	0.66	22.25	0.11	0.00
Urban								
Rural	18.60	0.22	19.48	0.28	4.52*	19.02	0.26	2.21*
Urban	80.57	0.23	79.74	0.29	-1.05*	80.19	0.28	-0.48*
Within PSU Strata								
Low Income Strata	36.77	0.18	38.63	0.24	4.81*	36.77	0.18	0.00
Nonlow Income Strata	63.23	0.18	61.37	0.24	-3.03*	63.23	0.18	0.00
CBSA type								
Within MSA in Central City	33.45	0.27	32.78	0.32	-2.05*	33.22	0.28	-0.67*
Within MSA but not in Central City	51.48	0.38	50.75	0.44	-1.45*	51.59	0.39	0.20
Not in MSA but in Census Place	7.97	0.26	8.71	0.30	8.51*	8.00	0.26	0.43
Neither in MSA nor Census Place	7.10	0.21	7.77	0.24	8.61*	7.19	0.21	1.23*
Race of Householder								
Black	11.90	0.14	12.38	0.18	3.87*	11.90	0.14	0.00
NonBlack	88.10	0.14	87.62	0.18	-0.55*	88.10	0.14	0.00
Number of Household Members								
1	28.46	0.22	29.36	0.30	3.06*	28.51	0.24	0.19
2	35.32	0.24	32.84	0.30	-7.53*	35.13	0.26	-0.54*
3-4	27.77	0.24	28.06	0.30	1.03*	27.19	0.28	-2.14*
5+	8.45	0.15	9.74	0.18	13.20*	9.17	0.17	7.82*
Gender of Householder								
Female	51.72	0.26	52.76	0.33	1.97*	52.59	0.34	1.65*
Male	48.28	0.26	47.24	0.33	-2.20*	47.41	0.34	-1.84*
Tenure								
Owner	64.19	0.21	63.34	0.25	-1.35*	64.19	0.21	0.00
Renter	35.81	0.21	36.66	0.25	2.32*	35.81	0.21	0.00

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level

Table 6b - Distribution of Frame Variables Respondent and Nonrespondent Samples					
	Respondents		Nonrespondents		
Characteristics	**Percent**	**Std Error**	**Percent**	**Std Error**	**Relative Difference (%)**
Region					
Midwest	23.58	0.16	20.37	0.29	-15.78*
Northeast	16.57	0.18	21.58	0.31	23.21*
South	37.45	0.19	36.13	0.36	-3.65*
West	22.40	0.18	21.93	0.30	-2.17
Urban					
Rural	19.63	0.28	16.81	0.39	-16.94*
Urban	80.37	0.28	83.19	0.39	3.25*
Within PSU Strata					
Low Income Strata	38.63	0.24	32.68	0.39	-18.21*
Nonlow Income Strata	61.37	0.24	67.32	0.39	8.84*
CBSA type					
Within MSA in Central City	32.78	0.32	34.93	0.47	6.18*
Within MSA but not in Central City	50.75	0.44	53.11	0.53	4.45*
Not in MSA but in Census Place	8.71	0.30	6.33	0.28	-37.52*
Neither in MSA nor Census Place	7.77	0.24	5.63	0.26	-38.10*
Race of Householder					
Black	12.38	0.18	10.85	0.25	-14.17*
NonBlack	87.62	0.18	89.15	0.25	1.72*
Number of Household Members					
1	29.36	0.30	26.48	0.37	-10.86*
2	32.84	0.30	40.77	0.43	19.43*
3-4	28.06	0.30	27.13	0.43	-3.41*
5+	9.74	0.18	5.62	0.22	-73.36*
Gender of Householder					
Female	52.76	0.33	49.43	0.42	-6.74*
Male	47.24	0.33	50.57	0.42	6.59*
Tenure					
Owner	63.34	0.25	66.07	0.39	4.13*
Renter	36.66	0.25	33.93	0.39	-8.05*

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level

Table 9 - Distribution of Frame Variables among Late Respondents and Nonrespondents					
	Late Respondents		Nonrespondents		
Characteristics	**Percent**	**Std Error**	**Percent**	**Std Error**	**Relative Difference (%)**
Region					
Midwest	24.93	0.61	20.37	0.29	-22.39*
Northeast	16.77	0.38	21.58	0.31	22.28*
South	36.23	0.61	36.13	0.36	-0.28
West	22.07	0.51	21.93	0.30	-0.67
Urban					
Rural	13.24	0.52	16.81	0.39	-20.99*
Urban	86.76	0.52	83.19	0.39	-4.63*
Within PSU Strata					
Low Income Strata	38.92	0.56	32.68	0.39	-19.12*
Nonlow Income Strata	61.08	0.56	67.32	0.39	9.28*
CBSA type					
Within MSA in Central City	38.68	0.66	34.93	0.47	-10.73*
Within MSA but not in Central City	50.06	0.75	53.11	0.53	5.74*
Not in MSA but in Census Place	6.11	0.37	6.33	0.28	3.49
Neither in MSA nor Census Place	5.15	0.38	5.63	0.26	8.52
Race of Householder					
Black	16.97	0.49	10.85	0.25	-56.44*
NonBlack	83.03	0.49	89.15	0.25	6.87*
Number of Household Members					
1	23.57	0.61	26.48	0.37	10.99*
2	28.64	0.65	40.77	0.43	29.75*
3-4	34.13	0.61	27.13	0.43	-25.77*
5+	13.67	0.49	5.62	0.22	-143.29*
Gender of Householder					
Female	53.49	0.66	49.43	0.42	-8.21*
Male	46.51	0.66	50.57	0.42	8.02*
Tenure					
Owner	57.75	0.64	66.07	0.39	12.60*
Renter	42.25	0.64	33.93	0.39	-24.53*

Source: U.S Census Bureau, Survey of Income and Program Participation, 2014 Panel
*indicates difference is statistically significant at the 90% confidence level