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MEMORANDUM FOR Carolyn M. Pickering
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Subject: Nonresponse Bias Analysis for Wave 4 of the Survey of Income
and Program Participation 2014 Panel (ALYS-19)

This memorandum includes the documentation of the nonresponse bias analysis for Wave 4 of the 2014 Survey of Income and Program Participation (SIPP).

The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY20-POP001-0181.

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**Demographic Statistical Methods Division
Sample Design and Estimation**

Nonresponse Bias Analysis for Wave 4 of the 2014 Survey of Income and Program Participation (SIPP)

**Version 1.0
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Executive Summary

The Office of Management and Budget (OMB) Standards and Guidelines for Statistical Surveys and The U.S. Census Bureau's Statistical Quality Standards require surveys to conduct a nonresponse bias analysis if unit response rates are below 80 percent (OMB, 2006; U.S. Census Bureau, 2013). This report documents the nonresponse bias analysis for Wave 4 of the 2014 Panel of the Survey of Income and Program Participation (SIPP), which covered the reference period from January to December 2016 and had a cumulative response rate of 36.9 percent. The methods implemented in this study include: comparing cross-sectional weighted response rates across several demographics of the SIPP sample; examining key estimates and characteristics of the full sample, responders, and nonresponders using data from Wave 1 of the 2014 Panel; and benchmarking SIPP 2014 Wave 4 estimates. Our findings are as follows:

- Weighted response rates for various subgroups differed from the Wave 4 cross-sectional unit response rate among households that were interviewed in Wave 1 and eligible for interview in Wave 4 (55.23 percent). The response rates also differed significantly across subgroups of the same characteristic. Consistent with previous waves, the largest response rate differences occurred in the householder age and household type characteristics.
- Wave 1 demographics, frame characteristics and SIPP key estimates significantly differed between Wave 4 respondent and nonrespondent households suggesting a high potential for nonresponse bias in Wave 4. Similar to nonresponding households in previous waves, Wave 4 nonrespondents were more likely to be located outside principal cities of Core Based Statistical Areas (CBSAs), less likely participate in Supplemental Nutritional Assistance Program (SNAP) and Supplemental Security Income (SSI), and more likely to reside in the Northeast.
- Relative differences between some full sample and respondent only statistics computed using data from Wave 1 of the SIPP were significantly reduced when respondent statistics were calculated using the Wave 4 noninterview adjusted weight, demonstrating the noninterview adjustment was effective in reducing nonresponse bias associated with some key estimates and demographic groups.
- The SIPP estimated median income in calendar year 2016 computed with Wave 4 final weights was 3.72 percent lower than the value published in the 2017 Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC) Current Population Reports but estimated poverty rates were not significantly different between the two surveys. Although the SIPP's estimated Medicare enrollees in December 2016 was not significantly different from administrative sources, SIPP may underestimate participation in Social Security, Medicaid, Supplemental Nutritional Assistance Program (SNAP), and Temporary Assistance for Needy Families (TANF), and overestimate participation in Supplemental Security Income (SSI) in Wave 4.

1. Introduction

Unit nonresponse occurs when sample units – for example households in a household survey – do not respond to a survey. Nonresponse rates have been increasing in recent years among large government surveys, creating growing concerns over data quality and the loss of valuable information from the nonrespondents. Declining response rates can indicate *nonresponse bias*, differences in survey measure estimates from the actual population values due to inherent dissimilarities between respondents and nonrespondents in the sample. 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 (Groves, 2006; Groves & Peytcheva, 2008). 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.

Policymakers 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, understanding and measuring nonresponse bias associated with these key estimates 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 percent (OMB, 2006). 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 percent and/or when sample attrition from one wave to the next is greater than 5 percent (U.S. Census Bureau, 2013).

1.1 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 units¹ in the Master Address File (MAF), which is created from the decennial censuses and frequently updated by the Census Bureau, were systematically selected from 820 Primary Sampling Units (PSUs). Selected housing units were partitioned into two strata with one containing a higher concentration of low income households than the other. Households located in the low income stratum were oversampled by 24 percent to increase the accuracy of the estimates of low income households.

Sampled households in the 2014 SIPP were interviewed annually over a period of four years and data was collected on the 12 months of the preceding calendar year. Each cycle of interviewing is called a *wave*. 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. Interviews for Waves 2, 3, and 4 were conducted in years 2015, 2016, and 2017 respectively, providing data on the calendar year before the year of interview. During each interview, Field Representatives (FRs) identify an adult² reference person, also called the *householder*, in each household. The householder is often the owner or renter of the residence.

The designated sample in Wave 1 of the 2014 SIPP consisted of approximately 53,000³ housing units, of which 42,500 households were eligible for interview. Of the eligible households, 29,500 households were interviewed resulting in a weighted response rate of 69.8 percent. Adults in *original sample* households – households that were 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 persons from original sample households join a new household that was not originally in the SIPP sample, the new household – referred to as a *spawned household* – also becomes part of the SIPP sample in subsequent waves.

Table A shows the counts of eligible, interviewed, and noninterviewed households, and response rates in all four waves of the SIPP. In Wave 4 – the final wave of the 2014 SIPP – FRs obtained interviews from about 17,000 of the 31,500 eligible households, resulting in a weighted wave response rate of 53.7⁴ percent. Cross-sectional single wave response rates do

¹ The SIPP selects housing units which may be occupied or vacant; households are occupied housing units.

² The SIPP defines adults as all household members age 15 or older.

³ Unweighted housing unit and household counts throughout this report are rounded to the nearest hundred or thousand and may not sum up to totals or match proportions that are computed from unrounded counts.

⁴ The response rate of 53.7 percent is the weighted response rate among all eligible households – i.e. original sample and spawned households – in Wave 4 while the response rate of 55.23 percent in the executive summary on page 1 and used throughout the report is the weighted response rate among original sample households who

not accurately reflect nonresponse over the course of the SIPP because it is a longitudinal survey. The SIPP measures cumulative sample attrition at the end of each wave using a sample loss rate given in formula 1.

Cumulative sample loss incorporates nonresponse⁵ from the beginning of the panel in Wave 1 to the end of the current wave and accounts for the unobservable loss of nonrespondent spawned households using an estimated growth factor computed from interviewed households. The cumulative sample loss rate was 31.2 percent in Wave 1, 47.7 percent in Wave 2, 57.8 percent in Wave 3, and 63.1 percent in Wave 4.

$$\text{Sample Loss} = \frac{(A_1 \times GF_c) + A_c + D_c}{I_c + (A_1 \times GF_c) + A_c + D_c} \quad 1$$

where:

A_1 = weighted number of Type A noninterviewed households in Wave 1

A_c = weighted number of Type A noninterviewed households in the current wave

D_c = weighted number of Type D noninterviewed households in the current wave

I_c = weighted number of interviewed households in the current wave

GF_c = growth factor associated with the current wave

Table A. 2014 Panel Household Total Counts, Sample Loss and Weighted Unit Response Rates

Wave	Eligible Households ¹	Interviewed Households	Type A Households	Type D Households	Growth Factor	Weighted Cross-sectional Response Rate (percent)	Weighted Cumulative Response Rates (percent)	Weighted Cumulative Sample Loss (percent)
1	42,500	29,500	12,500	-		69.8	69.8	31.2
2	30,000	23,000	6,400	700	1.0	76.7	52.3	47.7
3	31,000	19,000	10,000	1,500	1.0	61.3	42.2	57.8
4	31,500	17,000	12,500	1,900	1.1	53.7	36.9	63.1

Source: U.S. Census Bureau, 2014 Survey of Income and Program Participation.

¹ Interviewed and noninterviewed households may not sum up to eligible households due to rounding.

were eligible for interview in Wave 4.

⁵ There are two types of unit nonresponse in the SIPP: Type A and Type D nonresponse. Type A nonrespondent households are eligible households where the interviewer obtains no interviews while Type D nonrespondents are previously interviewed households who move to an unknown address or moved more than 100 miles from a SIPP interviewer and no telephone interview could be conducted. As a result, Type D noninterviews only occur after Wave 1.

This report analyzes nonresponse bias in original sample households that are eligible for interview in Wave 4⁶ – hereafter referred to as original sample households or full sample households throughout the report – which were categorized as respondents or nonrespondents depending on whether FRs interviewed them in the fourth wave. If an original sample household is associated with one or more spawned households in Wave 4, the address where the Wave 1 reference person resides – or whose householder is a Wave 1 interviewed adult if the Wave 1 reference person is not listed on any of the household rosters in Wave 4 – is used to determine the original household’s response status⁷. Approximately 28,500 of the 29,500 original sample households interviewed in Wave 1 were eligible for interview in Wave 4; 16,000 were classified as respondents and the remaining 12,500 household were considered nonrespondents.

1.2 Nonresponse Bias in Previous Waves of the 2014 Panel

Previous efforts to examine nonresponse bias and determine its impact on SIPP estimates involved comparing frame variables and data available from previous interviews between respondent households and households who were nonrespondents in the first or later waves of the survey. SIPP estimates were also compared to benchmarks – official statistics computed from administrative records or surveys and available to the public – to assess the likelihood of nonresponse bias.

The SIPP 2014 Wave 1 nonresponse bias analysis results indicate the SIPP underestimated participation in government programs, consistent with nonresponse bias reports from previous panels. The study also found that response rates differed between various subgroups of the selected sample. FRs were most likely to interview households located in the Midwest compared to other regions and households in the low income stratum were more likely to be respondents than those in the non-low income stratum. Furthermore, the distribution of household size, householder race, and sex differed between all selected eligible households and Wave 1 respondents, but the bias was mitigated when nonresponse adjusted weights were used in computing these statistics (Treat, 2017a).

Analysis on Waves 2 and 3 of the 2014 SIPP found that weighted cross-sectional response rates significantly decreased as the panel progressed and also differed across various subgroups of the original sample households eligible for interview in each wave. Households with older reference persons or whose members participated in government programs were more likely to respond to the survey. Wave 1 key estimates including household income and net worth also significantly varied between responding and nonresponding households in both waves.

⁶ A previously interviewed SIPP household may become ineligible in later waves of the survey if (a) the household unit becomes vacant, demolished or otherwise unfit for residence or (b) all sample members of the household are no longer part of the SIPP sample universe, for example they become institutionalized, active military personnel, or move abroad.

⁷ All Wave 1 householders – including those that were not interviewed in Wave 4 – were listed in Wave 4 household rosters.

Nonetheless, some of the relative differences between full sample and respondent-only statistics computed using Wave 1 data were significantly reduced when respondent statistics were calculated using the Wave 2 and Wave 3 noninterview adjusted weights respectively, demonstrating noninterview adjustments were effective in reducing nonresponse bias associated with some key estimates.

Benchmark analyses from Waves 2 and 3 showed the SIPP estimated poverty rates in 2014 and 2015 were not significantly different from corresponding published values in the Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC) Current Population Reports. The 2014 median household income in both surveys also were not significantly different but the SIPP estimated 2015 median annual income was 2.42 percent lower than that of the CPS ASEC. Although the SIPP underestimated counts of enrollees in Social Security, Medicaid, Supplemental Nutritional Assistance Program (SNAP), and Temporary Assistance for Needy Families (TANF) compared to administrative sources in both years, the survey's population universe differs from that of the population represented by the government program benchmarks (Tersine, 2020b; Tersine, 2020c).

2. Methodology

Four methods were used to investigate nonresponse bias in Wave 4 of the 2014 SIPP, all of which were used to assess nonresponse bias in earlier waves of the panel. The techniques analyze a combination of geographic frame variables, Wave 1 data available for both respondents and nonrespondents, Wave 4 data available for respondents only, and external benchmarks. They include:

1. Comparing cross-sectional response rates for subgroups of the sample to that of the original sample households eligible for interview in Wave 4.
2. Comparing Wave 1 household characteristics and SIPP key estimates between Wave 4 respondent and nonrespondent households.
3. Comparing Wave 1 household characteristics and SIPP key estimates between the original sample households and the Wave 4 respondent sample.
4. Benchmark analysis comparing SIPP Wave 4 key estimates to available corresponding administrative data statistics and estimates from other surveys.

2.1 Weighting Procedure

SIPP sample households – and therefore sample persons – are selected with unequal probabilities. Appropriate weights, estimates of the number of households (persons) each sample household (person) represents in the population, should be used when computing SIPP estimates to account for the survey's sample design.

All sampled households were assigned base weights (*BW*) equal to the inverse of their selection probabilities at the beginning of the panel. Base weights were adjusted for additional

subsampling done in the field and nonresponse during Wave 1 interviews using Weighting Control Factors (WCF) and Wave 1 noninterview adjustment factors ($W1_{af}$) respectively, to create Wave 1 household noninterview adjusted weights ($W1_{NIwgt}$). The household noninterview weights were then assigned to each member of the household, and raked to independent population controls for each month in the wave to determine monthly final person weights ($PFINWGT$) in Wave 1.

Each eligible household in subsequent waves, #, was assigned an initial weight ($W\#_{INITwgt}$) equal to its Wave 1 noninterview adjusted weight. Initial weights are multiplied by movers' adjustment factors ($W\#_{MF}$) to account for multiple chances of selection of movers⁸. The resulting movers' weights are multiplied by a noninterview adjustment factor $W\#_{af}$ to obtain household noninterview adjusted weights for the current wave. Finally, the household noninterview weights are assigned to all occupants of the household and raked to monthly population controls to determine the final person weights for each month. Details of the SIPP cross-sectional weighting procedure are outlined in Treat (2017b) and Tersine (2020a).

Wave 4 household initial weights ($W4_{INITwgt}$)⁹, household noninterview adjusted weights ($W4_{NIwgt}$), and final person weights ($W4PFINWGT$) are used for the analyses in this report and computed as follows:

$$\begin{aligned} W4_{INITwgt} &= W1_{NIwgt} = BW * WCF * W1_{af} \\ W4_{NIwgt} &= W4_{INITwgt} * W4_{MF} * W4_{af} \\ W4PFINWGT^{10} &= W4_{NIwgt} * W4SS_{af} \end{aligned}$$

$W4SS_{af}$ are second stage adjustment factors computed during the raking to population control step of the weighting procedure. All analyses were conducted using survey procedures in SAS[®] software and hypothesis testing was carried out at the 90 percent confidence level.

2.2 Analytic Variables

We evaluated nonresponse bias associated with SIPP key estimates including household earned income, total income, net worth, poverty rates, and participation in government programs. Estimates of nonresponse bias can only be produced for variables that are available for both respondents and nonrespondents. Due to the longitudinal structure of the SIPP, calendar year

⁸ Movers – persons who move into SIPP sample households after Wave 1 interviews – have two chances to become SIPP sample persons: (a) selection into original SIPP sample households in Wave 1 or (b) selection by moving into a sample household after Wave 1.

⁹ A household's Wave 4 initial weight is equal to its Wave 1 noninterview adjusted weight. As a result, statistics that are computed with the Wave 4 initial weight have already been adjusted for Wave 1 nonresponse.

¹⁰ Previous SIPP Panels published person, family, and household level final weights with cross-sectional public use files. The SIPP 2014 Panel however, only published final person weights. Household weights can be created by either using the final weights of the householder or averaging the final weights of all persons in the households; we use the first method to compute all final weighted household level estimates in Section 4.4 of this report.

2013 data obtained during Wave 1 interviews is available for Wave 4 respondents and nonrespondents, and is used to assess the potential for nonresponse bias.

The SIPP key estimates¹¹ examined in this analysis include:

- *Median annual household earnings*
- *Median annual household total income*
- *Median household net worth*
- *Household annual poverty rates*
- *Percent of households where at least one household member was covered by Medicaid*
- *Percent of households where at least one household member was covered by Medicare*
- *Percent of households where at least one household member received Social Security income*
- *Percent of households where at least one household member received Supplemental Security Income (SSI)*
- *Percent of households where at least one household member received Supplemental Nutrition Assistance Program (SNAP) benefits*
- *Percent of households where at least one household member received Temporary Assistance for Needy Families (TANF) benefits*
- *Percent of households receiving welfare income i.e., households where at least one household member participated in or received income from one of the following sources: Medicaid, SNAP, SSI, General Assistance, TANF, or Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)*

Table 1 lists Wave 1 demographic variables and geographic sampling frame variables that are also available for both respondents and nonrespondents and are included in our analyses. Some of these variables were used in Wave 1 and/or Wave 4 household noninterview adjustment.

Table 1. Characteristics and Geographic Frame Variables Used to Assess Nonresponse Bias

Variable/Characteristics	Level Definitions
<i>Age of Householder</i>	Under 25 years
	25 to 34 years
	35 to 44 years
	45 to 54 years
	55 to 64 years
	65 years or older [†]

¹¹ The SIPP cross-sectional data files contain monthly and annual coverage indicator variables for most programs and topics collected during interview. We use the annual coverage indicators to determine programs' recipients in this report unless otherwise noted.

Variable/Characteristics	Level Definitions
<i>Assets[^]</i>	<p>Bonds – at least one household member possessed one of the following assets: U.S. Government savings bonds or securities, money market deposit accounts, certificates of deposit, mutual funds, stocks, rental properties, municipal or corporate bonds, other investments.</p> <p>Minimal – No one in household possessed any of the above assets.</p>
<i>Core Based Statistical Area (CBSA) status[^]</i>	<p>In principal city of a Core Based Statistical Area (CBSA)</p> <p>In CBSA but not in principal city</p> <p>Outside a CBSA or principal city</p>
<i>Census Region[^]</i>	<p>Northeast</p> <p>Midwest</p> <p>South</p> <p>West</p>
<i>Educational Attainment of Householder[*]</i>	<p>Up to high school diploma</p> <p>Some college, no bachelor's degree</p> <p>Bachelor's degree or higher</p>
<i>Hispanic Origin of Householder[*]</i>	<p>Hispanic,</p> <p>Non-Hispanic</p>
<i>Household Income to Poverty Ratio[*]</i>	<p>Less than 1.75</p> <p>1.75 to 4.5</p> <p>Greater than 4.5</p>
<i>Household Size^{^*}</i>	<p>1 person household</p> <p>2 person household</p> <p>3 person household</p> <p>4 or more person household</p>
<i>Household Type[*]</i>	<p>Female householder with biological child and no spouse present.</p> <p>Householder age 65 years or older[‡]</p> <p>Other</p>
<i>Marital Status of Householder[*]</i>	<p>Married, spouse present</p> <p>Married, spouse absent</p> <p>Widowed</p> <p>Divorced</p> <p>Separated</p> <p>Never married</p>
<i>Race of Householder^{^*}</i>	<p>White only</p> <p>Black only</p> <p>Asian only</p> <p>Other</p>

Variable/Characteristics	Level Definitions
<i>Sex of Householder</i>	Male Female
<i>Tenure^{^*}</i>	Owner Renter, no government subsidy Renter, receives government subsidy
<i>Urban/Rural Status</i>	Household located in urban area Household located in rural area
<i>Within PSU Strata[^]</i>	Low income stratum Non-low income stratum

Source: U.S. Census Bureau, Survey of Income and Program Participation (SIPP), 2014 Panel. For more information on sampling and nonsampling error see the SIPP 2014 User's Guide.

[^] Variables were used in computing Wave 1 noninterview adjustment factors.

* Variables were used in computing Wave 4 noninterview adjustment factors.

‡ Estimates of the last category of the *Age of Householder* variable and the second category of the *Household Type* variable represent the same statistic: households whose householders were age 65 years or older.

The relationship between the demographic and sampling frame variables above and SIPP key estimates were examined using the Rao-Scott chi-square test of association. Most of the demographic and geographic variables were significantly associated with the key estimates.

2.3 Examining Weighted Unit Response Rates for Subgroups of the Original Sample Households Eligible for Interview in Wave 4

Weighted unit response rates were calculated using Wave 4 initial weights for different subgroups of the original sample households that were eligible for interview in Wave 4 and compared to the total weighted cross-sectional unit response rate of 55.23 percent for Wave 4 of the SIPP 2014 Panel. Pairwise comparisons of response rates across subgroups within the same demographic or geographic characteristic were also done and Bonferroni correction was used to adjust for the multiple comparisons. Response rates were calculated using formula 2 below.

$$Response\ Rate = \frac{\sum_{i \in S} w_i R_i D_i}{\sum_{i \in S} w_i D_i} \quad 2$$

where:

i = indicator for each original sample household

S = set of all original sample households

w_i = Wave 4 initial weight of the i^{th} household

R_i = response indicator

D_i = domain indicator

Dissimilar response rates among subgroups within the same characteristics indicate a potential for nonresponse bias. Subgroups with lower response rates compared to the other subgroups of the same variable may be underrepresented in the final sample and subgroups with high response rates compared to the other subgroups of the same variable may be overrepresented in the survey. Fay's modified Balanced Repeated Replication (BRR) was used to estimate the standard error of the difference between weighted unit response rates for each subgroup and the total unit response rate (Fay, 1984).

2.4 Comparing Key Estimates, Demographic Characteristics, and Frame Variables Between Wave 4 Respondent and Nonrespondent Households

SIPP calendar year 2013 key estimates described in Section 2.2, including household earned income, total income, net worth, poverty rates, and program participation rates, were computed from Wave 1 data and compared between Wave 4 respondent and nonrespondent households. We also examined the distribution of demographic and geographic variables between the two respondent groups using Rao-Scott chi-squared test of association. All estimates and their standard errors were calculated using Wave 4 initial weights and replicate weights respectively. While differing response rates indicate which demographic variables may be associated with nonresponse bias, the difference between estimates computed from respondents and nonrespondents is a direct approximation of nonresponse bias which occurs when respondent and nonrespondent sample units within a survey differ with respect to survey variables (Groves, 2006).

2.5 Comparing Key Estimates and Characteristics of the Full Sample to the Respondent Sample

We examined calendar year 2013 SIPP key estimates, as well as the distribution of geographic and householder demographic variables among original sample households eligible for interview in Wave 4, and among the Wave 4 respondent sample. The estimates derived from the full sample were weighted using Wave 4 initial weights, which incorporate unit nonresponse from Wave 1 while the respondent sample estimates were computed using both Wave 4 initial and noninterview adjusted weights respectively. Fay's modified BRR was used to estimate the standard error of the differences between full sample and respondent estimates.

The difference between the respondent statistics obtained using the initial weights and the full sample statistic for each variable is an estimate of nonresponse bias. Whereas the difference between the respondent statistics obtained with nonresponse adjusted weights and the respondent statistics obtained with initial weights is reflective of the effects of nonresponse weighting adjustments on the bias.

2.6 Benchmarking

We computed person and household level monthly, average monthly, and calendar year estimates using Wave 4 data for all households that were interviewed in Wave 4 – including original sample households and all spawned households – and compared them to corresponding benchmark values. The methods and key estimates discussed in Sections 2.3 to 2.5 were calculated from original sample households and only included spawned households containing an original sample householder as described in Section 1.1. The benchmarking analysis includes data from all households interviewed in Wave 4 regardless of whether they were interviewed in previous waves. It also accounts for item level nonresponse in Wave 4 by incorporating post-interview item imputed responses for survey measures that interviewed persons did not provide¹² and give an insight to the effect of combining the nonresponse adjustments and post stratification adjustments on SIPP estimates.

SIPP estimates of monthly program participation counts in December 2016 were compared to monthly counts of programs' enrollees published by The Centers for Medicare and Medicaid Services (*Medicaid, Medicare*¹³), United States Department of Agriculture (*SNAP*), United States Department of Health and Human Services (*TANF*), and the Social Security Administration (*SSI, Social Security*). Average monthly Social Security and SSI income in December 2016 were computed from the SIPP and compared to those published in the 2017 Social Security Annual Statistical Supplement. Annual median income and poverty rates computed from all Wave 4 interviewed households were compared to 2016 annual median income and poverty rates from the 2017 Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC), the official source of poverty estimates for the United States.

The SIPP estimates were calculated using final weights that are adjusted for nonresponse and raked to population control totals. Standard errors of the estimates were calculated using Fay's method of BRR and t-tests were used to test for significant differences between SIPP estimates and benchmark statistics. Significant differences between the two values for any statistic may suggest that the SIPP underestimates or overestimates that statistic.

3. Assumptions and Limitations

Most of the methods in our analysis exclude spawned households without an original sample household reference person. As a result, the Wave 4 noninterview adjusted weights for these households and persons residing in them are not accounted for. We also do not account for changes in household composition between interview periods. The demographic variables used, including age, sex, Hispanic origin, educational level, householder type, race, and marital status belong to the household reference person in the first wave, but household compositions

¹² Chapter 6 of the SIPP Users' Guide provides more details on the imputation methods for item nonresponse in the SIPP.

¹³ Medicare SIPP estimate and benchmarks were average monthly enrollments over the course of calendar year 2016.

and reference persons may change between waves. As a result, the actual difference between full sample and respondent estimates may slightly differ from the values we computed. The benchmark analysis attempts to compensate for this, as it includes all households interviewed in the current wave and also utilizes demographic variables and key estimates from the current wave.

4. Results

4.1 Weighted Unit Response Rates for Subgroups of the Original Sample Households Eligible for Interview in Wave 4

Table 2 summarizes the results of comparing Wave 4 cross-sectional response rates across different subgroups of the sample. The second through fifth columns show the unweighted and weighted household counts in each subgroup, weighted response rates, and their corresponding standard errors respectively. The sixth column displays results of multiple pairwise comparisons across subgroups within the same characteristics; response rates from subgroups with the same letters are not significantly different from each other. The last column indicates whether a subgroup's response rate is significantly different from the overall response rate of 55.23 percent.

Response rates in most subgroups differed from the overall cross-sectional unit response rate. Similar to response rates in previous waves, Wave 4 original sample households who: had reference persons age 54 or younger; were located in the Northeast; consisted of three or more persons; or had female householders with biological children, had response rates lower than the overall cross-sectional response rate among original sample households.

Households with reference persons age 55 or older had higher response rates than that of the overall original sample, suggesting they may be overrepresented in Wave 4 of the SIPP. Households that: were located outside CBSAs; consisted of at most two persons; owned their homes or rented their homes and received government subsidies; or belonged to the low income stratum also had response rates significantly higher than 55.23 percent and may also be overrepresented in the final wave of the 2014 SIPP.

Results of comparing response rates between multiple pairs of subgroups within the same characteristic were also comparable to those of earlier waves of the 2014 SIPP panel. Although response rates among households with reference persons in the lower three age groups did not differ from each other (significance grouping A), response rates increased with the age of the householder in the remaining three age groups. Response rates also differed across households based on their householder's highest level schooling completed. Households whose reference person belonged to the second group – some college, no Bachelor's degree – had the lowest response rate which was 2.88 percentage points lower than households whose householder had a high school diploma and 4.8 percentage points lower than households whose reference person attained at least a Bachelor's degree.

Table 2. SIPP 2014 Wave 4 Weighted Response Rates for Different Subgroups of the Original Sample Households

Characteristic	Unweighted ¹ Households	Weighted ¹ Households (in thousands)	Weighted Response Rate (percent)	Standard Error (percent)	Significance Grouping [†]	
Total	28,500	107,900	55.23	0.35	-	
Age of Householder						
Under 25 years	1,500	5,016	45.64	1.48	A	*
25 to 34 years	4,100	15,580	48.52	0.81	A	*
35 to 44 years	4,800	18,070	48.26	0.84	A	*
45 to 54 years	5,600	21,340	52.29	0.74	B	*
55 to 64 years	5,600	21,650	58.84	0.70	C	*
65 years or older	6,700	26,250	65.27	0.69	D	*
Census Region						
Northeast	3,700	19,580	51.82	0.85	A	*
Midwest	6,300	24,330	57.40	0.68	B	*
South	12,500	39,950	55.89	0.53	B,C	
West	5,800	24,040	54.75	0.83	C	
Core Based Statistical Area (CBSA)						
Status						
Inside principal city of a CBSA	9,200	35,680	55.64	0.68	A	
In CBSA but not principal city	13,500	55,200	53.64	0.41	B	*
Not in a CBSA	5,700	16,270	59.63	0.96	C	*
Educational Attainment of Householder						
Up to high school diploma	12,000	41,210	55.44	0.54	A	
Some college, no bachelor's degree	8,400	31,300	52.56	0.62	B	*
Bachelor's degree or higher	8,100	35,390	57.36	0.55	C	*
Sex of Householder						
Male	13,500	51,280	55.06	0.49	A	
Female	15,000	56,620	55.40	0.48	A	
Hispanic Origin of Householder						
Hispanic	3,600	13,350	52.61	0.97	A	*
Non-Hispanic	25,000	94,550	55.61	0.34	B	*
Household Size						
1 person household	8,000	28,790	60.69	0.63	A	*
2 person household	9,400	38,690	56.38	0.60	B	*
3 person household	4,400	16,510	51.63	0.86	C	*
4 or more person household	6,500	23,900	49.30	0.83	C	*
Household Type						
Female householder with biological child and no spouse present	1,900	6,462	45.56	1.20	A	*

Characteristic	Unweighted ¹ Households	Weighted ¹ Households (in thousands)	Weighted Response Rate (percent)	Standard Error (percent)	Significance Grouping [‡]	
Householder 65 years or older	6,700	26,250	65.27	0.69	B	*
Other	20,000	75,190	52.56	0.44	C	*
Marital Status of Householder						
Married, spouse present	13,500	53,050	54.33	0.55	A	*
Married, spouse absent	500	1,867	54.49	2.50	A,B,D	
Widowed	2,700	9,603	66.73	1.03	C	*
Divorced	5,000	18,340	57.26	0.90	D	*
Separated	850	2,965	50.99	2.22	A,B,D	*
Never married	6,100	22,080	51.35	0.63	B	*
Race of Householder						
White Only	22,500	87,250	55.74	0.39	A	*
Black Only	4,300	12,910	52.10	0.80	B	*
Asian Only	1,000	4,794	54.62	1.52	A,B	
Other	850	2,945	55.05	1.84	A,B	
Tenure						
Owner	18,000	70,090	57.26	0.40	A	*
Renter, no government subsidy	9,000	33,020	50.09	0.58	B	*
Renter, receives government subsidy	1,400	4,796	61.04	1.37	C	*
Urban/Rural Status						
Urban	22,000	86,420	54.35	0.38	A	*
Rural	6,400	20,620	58.82	0.83	B	*
Within PSU Strata						
Low income	14,500	39,430	56.79	0.41	A	*
Non-low income	14,000	68,470	54.34	0.45	B	*

Source: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel.

¹ Sums may not add up to total due to rounding.

[‡] Response rates of subgroups within the same characteristic with same letters are not significantly different from each other at the $\alpha=0.10$ level.

* Indicates subgroup response rate is significantly different from overall response rate at the $\alpha=0.10$ level.

4.2 Comparing Key Estimates and Characteristics Between Wave 4 Respondent and Nonrespondent Households

Table 3 shows results of comparing calendar year 2013 key estimates and the distribution of demographic and frame variables derived from SIPP 2014 Wave 1 data using Wave 4 initial weights between Wave 4 respondent and nonrespondent households. Median annual earned income and total income among nonresponding households in 2013 were \$9,390 and \$3,670 higher respectively, than those of responding households. However, household net worth among respondent households was \$16,950 higher than that of nonrespondent households, suggesting that the SIPP may underestimate household earnings and income, but overestimate household net worth in Wave 4.

Unlike in previous waves where poverty rates were not significantly different by response status, Wave 4 nonresponding households had a higher household poverty rate compared to responding households but household income to poverty ratio was not significantly different by response status. Additionally, respondent households had higher participation rates in Medicare and Social Security – programs typically associated with persons age 65 or older – compared to nonresponding households, consistent with the significantly higher response rates among households with reference persons age 65 or older in Table 2.

The distribution of demographic and geographic variables also differed significantly between the two groups except for the householder’s sex. Householders in respondent households were more likely to own their homes, bonds, and other investments compared to those in nonresponding households. Nonresponding households were more likely to reside in urban areas and in the Northeast.

Table 3: Comparison of Estimates between Wave 4 Respondents and Nonrespondents

Characteristics and Key Estimates	Respondents		Nonrespondents		Chi-Square Statistic (df)	
	Percent/Median in Dollars	Standard Error	Percent/Median in Dollars	Standard Error		
Annual household earnings	31,910	647	41,300	658	-	*
Annual household income	50,550	510	54,220	709	-	*
Household net worth	95,010	2,186	78,060	2,719	-	*
Households in poverty	13.07	0.29	14.06	0.34	-	*
Households receiving income from welfare programs	24.24	0.33	23.42	0.37	-	
Program Participation						
Medicaid	19.35	0.30	18.93	0.32	0.9600(1)	
Medicare	35.17	0.42	24.64	0.47	230.3(1)	*
Supplemental Nutritional Assistance Program (SNAP)	13.84	0.26	12.81	0.26	7.721(1)	*
Social Security	35.86	0.41	25.07	0.42	283.0(1)	*

Characteristics and Key Estimates	Respondents		Nonrespondents		Chi-Square Statistic (df)	*
	Percent/ Median in Dollars	Standard Error	Percent/ Median in Dollars	Standard Error		
Supplemental Security Income (SSI)	6.08	0.21	4.50	0.21	23.93(1)	*
Temporary Assistance for Needy Families (TANF)	0.86	0.08	1.09	0.09	3.930(1)	*
Asset Ownership						
Bonds	37.23	0.39	33.26	0.55	31.67(1)	*
Minimal	62.77	0.39	66.74	0.55		
Age of Householder						
Under 25 years	3.84	0.17	5.65	0.24	457.4(5)	*
25 to 34 years	12.68	0.27	16.60	0.38		
35 to 44 years	14.63	0.32	19.35	0.33		
45 to 54 years	18.73	0.32	21.08	0.38		
55 to 64 years	21.38	0.32	18.45	0.40		
65 years or older	28.75	0.38	18.87	0.44		
Census Region						
Northeast	17.03	0.29	19.53	0.32	26.89(3)	*
Midwest	23.43	0.27	21.46	0.33		
South	37.46	0.33	36.49	0.39		
West	22.08	0.28	22.52	0.40		
Core Based Statistical Area (CBSA) Status						
Inside principal city of a CBSA	33.55	0.44	32.98	0.47	32.06(2)	*
In CBSA but not principal city	50.04	0.52	53.33	0.56		
Not in a CBSA	16.40	0.48	13.69	0.46		
Educational Attainment of Householder						
Up to high school diploma	38.33	0.39	38.01	0.49	35.30(2)	*
Some college, no bachelor's degree	27.60	0.40	30.74	0.42		
Bachelor's degree or higher	34.06	0.37	31.24	0.46		
Hispanic Origin of Householder						
Hispanic	11.79	0.29	13.10	0.26	9.807(1)	*
Non-Hispanic	88.21	0.29	86.90	0.26		
Household Income to Poverty Ratio						
Less than 1.75	26.53	0.33	26.30	0.40	1.305(2)	
1.75 to 4.5	39.96	0.46	39.51	0.44		
Greater than 4.5	33.50	0.42	34.20	0.46		
Household Size						
1 person household	29.32	0.40	23.43	0.40	142.9(3)	*
2 person household	36.60	0.40	34.95	0.45		
3 person household	14.31	0.28	16.53	0.39		
4 or more person household	19.77	0.37	25.09	0.41		

Characteristics and Key Estimates	Respondents		Nonrespondents		Chi-Square Statistic (df)	
	Percent/ Median in Dollars	Standard Error	Percent/ Median in Dollars	Standard Error		
Household Type						
Female householder with biological child and no spouse present	4.94	0.17	7.28	0.21	318.4(2)	*
Householder 65 years or older	28.75	0.38	18.87	0.44		
Other	66.31	0.38	73.84	0.47		
Marital Status of Householder						
Married, spouse present	48.36	0.45	50.15	0.48	140.6(5)	*
Married, spouse absent	1.71	0.11	1.76	0.11		
Widowed	10.75	0.25	6.61	0.26		
Divorced	17.62	0.36	16.23	0.43		
Separated	2.54	0.13	3.01	0.19		
Never married	19.02	0.33	22.24	0.39		
Race of Householder						
White Only	81.60	0.27	79.96	0.36	15.28(3)	*
Black Only	11.28	0.21	12.80	0.25		
Asian Only	4.39	0.16	4.50	0.22		
Other	2.72	0.14	2.74	0.17		
Sex of Householder						
Male	47.37	0.47	47.71	0.52	0.2440(1)	
Female	52.63	0.47	52.29	0.52		
Tenure						
Owner	67.34	0.32	62.02	0.44	138.6(2)	*
Renter, no government subsidy	27.75	0.34	34.12	0.41		
Renter, receives government subsidy	4.91	0.15	3.87	0.17		
Urban/Rural Status						
Urban	79.48	0.38	82.29	0.42	22.41(1)	*
Rural	20.52	0.38	17.71	0.42		
Within PSU Strata						
Low income	37.57	0.30	35.27	0.34	18.95(1)	*
Non-low income	62.43	0.30	64.73	0.34		

Source: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel.

* Indicates respondent and nonrespondent estimates are significantly different at the $\alpha=0.10$ level.

4.3 Comparing Key Estimates and Characteristics between the Full Sample and the Respondent Sample

Relative differences between calendar year 2013 estimates computed from all original sample households interviewed Wave 1 and from original sample households that responded to the survey in Wave 4 are presented in Table 4. All estimates from the full sample were computed using Wave 4 initial weights while the estimates for the respondent sample were weighted using both Wave 4 initial weights, as well as, nonresponse adjusted weights.

The relative difference for an estimate i , is calculated as $100 * (R_i - F_i)/F_i$ where F_i is the value of estimate obtained from the full sample and R_i is the value of the estimate obtained from the respondent sample. Relative differences between the initial weighted estimates from both samples – column six – are estimates of nonresponse bias. Comparing them with relative differences computed from Wave 4 noninterview weighted respondent estimates – the ninth column – gives insight on the effect of the adjustments on the bias.

Most of the respondent-only estimates computed using initial weights significantly differ from the corresponding full sample estimates. Median household earnings and income among respondents in 2013 were 12.55 percent and 3.05 percent lower than those of the full sample respectively, when computed using Wave 4 initial weights. All respondent initial weighted program participation rates – except participation in Medicaid – also differed from those of the full sample. The largest relative difference occurred in the householder marital status characteristic where the initial weighted estimate of households who had widowed householders was 20.79 percent higher than the full sample estimate.

Examining the differences between the relative differences calculated from initial weights and noninterview adjusted weights in the respondent sample shows that Wave 4 noninterview adjustment significantly reduced the bias associated with some estimates. The percent of respondent households where at least one member received income from government programs computed using initial weights was 1.55 percent higher than the same estimate computed from the full sample. The difference between the full sample estimate and respondent sample estimate is no longer significant when the latter is computed using Wave 4 noninterview adjusted weights. Relative differences for households where at least one member: participated in SNAP; participated in SSI; had bonds or other assets decreased from 3.44 percent to 2.02 percent; 13.22 percent to 10.61 percent; and 4.99 percent to 3.98 percent respectively.

Nonresponse adjustment significantly increased the bias associated with some estimates in a few cases. Household poverty rate in the respondent sample calculated using the initial weights was 3.26 percent lower than that of the full sample estimate, but becomes 6.37 percent lower than the full sample estimate when computed using Wave 4 noninterview adjusted weights. Relative differences between full sample and respondent sample estimated percentage of

households with reference persons age 25 or under further increased from -17.42 to -24.95 percent when noninterview adjusted weights were incorporated.

Table 4. Comparison of Estimates between the Full Sample and the Wave 4 Respondent Sample

Characteristics and Key Estimates	All Sample Cases		Respondents					
	Initial Weight		Initial Weight			Nonresponse Adjusted Weight		
	Percent/ Median	Std Error	Percent/ Median	Std Error	Relative Difference	Percent/ Median	Std Error	Relative Difference
Annual household earnings	36,490	454	31,910	647	-12.55*	32,460	561	-11.04*
Annual household income	52,140	423	50,550	510	-3.05*	51,000	378	-2.19*^
Household net worth	88,380	1,769	95,010	2,186	7.5*	93,930	2,099	6.28*
Households in poverty	13.51	0.23	13.07	0.29	-3.26*	12.65	0.31	-6.37*
Households receiving income from welfare programs	23.87	0.25	24.24	0.33	1.55*	24.15	0.33	1.17^
Program Participation								
Medicaid	19.16	0.22	19.35	0.30	0.99	19.20	0.30	0.21
Medicare	30.46	0.28	35.17	0.42	15.46*	35.06	0.42	15.1*
Supplemental Nutritional Assistance Program (SNAP)	13.38	0.18	13.84	0.26	3.44*	13.65	0.25	2.02*^
Social Security	31.03	0.27	35.86	0.41	15.57*	35.79	0.42	15.34*
Supplemental Security Income (SSI)	5.37	0.13	6.08	0.21	13.22*	5.94	0.21	10.61*^
Temporary Assistance for Needy Families (TANF)	0.96	0.06	0.86	0.08	-10.42*	0.83	0.08	-13.54*
Age of Householder								
Under 25 years	4.65	0.15	3.84	0.17	-17.42*	3.49	0.16	-24.95*
25 to 34 years	14.44	0.24	12.68	0.27	-12.19*	12.85	0.28	-11.01*^
35 to 44 years	16.74	0.23	14.63	0.32	-12.6*	14.89	0.33	-11.05*^
45 to 54 years	19.78	0.23	18.73	0.32	-5.31*	18.73	0.33	-5.31*
55 to 64 years	20.07	0.25	21.38	0.32	6.53*	21.44	0.35	6.83*
65 years or older	24.33	0.27	28.75	0.38	18.17*	28.59	0.38	17.51*
Asset Ownership								
Bonds	35.46	0.31	37.23	0.39	4.99*	36.87	0.36	3.98*^
Minimal	64.54	0.31	62.77	0.39	-2.74*	63.13	0.36	-2.18*^
Census Region								
Northeast	18.15	0.10	17.03	0.29	-6.17*	16.88	0.26	-7.00*
Midwest	22.55	0.12	23.43	0.27	3.9*	23.32	0.26	3.41*
South	37.02	0.14	37.46	0.33	1.19	37.73	0.34	1.92*
West	22.28	0.12	22.08	0.28	-0.9	22.07	0.28	-0.94

Characteristics and Key Estimates	All Sample Cases		Respondents					
	Initial Weight		Initial Weight			Nonresponse Adjusted Weight		
	Percent/ Median	Std Error	Percent/ Median	Std Error	Relative Difference	Percent/ Median	Std Error	Relative Difference
Core Based Statistical Area (CBSA) Status								
Inside principal city of a CBSA	33.30	0.30	33.55	0.44	0.75	33.52	0.43	0.66
In CBSA but not principal city	51.52	0.40	50.04	0.52	-2.87*	50.14	0.52	-2.68*
Not in a CBSA	15.19	0.38	16.40	0.48	7.97*	16.34	0.47	7.57*
Educational Attainment of Householder								
Up to high school diploma	38.19	0.28	38.33	0.39	0.37	38.82	0.36	1.65*
Some college, no bachelor's degree	29.01	0.30	27.60	0.40	-4.86*	27.89	0.38	-3.86*
Bachelor's degree or higher	32.80	0.30	34.06	0.37	3.84*	33.29	0.33	1.49*^
Hispanic Origin of Householder								
Hispanic	12.38	0.18	11.79	0.29	-4.77*	12.16	0.28	-1.78^
Non-Hispanic	87.62	0.18	88.21	0.29	0.67*	87.84	0.28	0.25^
Household Income to Poverty Ratio								
Less than 1.75	26.43	0.25	26.53	0.33	0.38	26.17	0.35	-0.98
1.75 to 4.5	39.76	0.30	39.96	0.46	0.5	40.64	0.47	2.21*
Greater than 4.5	33.81	0.31	33.50	0.42	-0.92	33.19	0.43	-1.83*
Household Size								
1 person household	26.68	0.24	29.32	0.40	9.9*	28.50	0.40	6.82*^
2 person household	35.86	0.27	36.60	0.40	2.06*	36.42	0.42	1.56*
3 person household	15.30	0.21	14.31	0.28	-6.47*	14.51	0.28	-5.16*^
4 or more person household	22.15	0.24	19.77	0.37	-10.74*	20.56	0.39	-7.18*^
Household Type								
Female householder with biological child and no spouse present	5.99	0.13	4.94	0.17	-17.53*	4.92	0.17	-17.86*
Householder 65 years or older	24.33	0.27	28.75	0.38	18.17*	28.59	0.38	17.51*
Other	69.68	0.29	66.31	0.38	-4.84*	66.49	0.39	-4.58*
Marital Status of Householder								
Married, spouse present	49.16	0.28	48.36	0.45	-1.63*	49.52	0.46	0.73^
Married, spouse absent	1.73	0.07	1.71	0.11	-1.16	1.56	0.11	-9.83*
Widowed	8.90	0.18	10.75	0.25	20.79*	10.63	0.25	19.44*
Divorced	17.00	0.28	17.62	0.36	3.65*	17.31	0.37	1.82^

Characteristics and Key Estimates	All Sample Cases		Respondents					
	Initial Weight		Initial Weight			Nonresponse Adjusted Weight		
	Percent/ Median	Std Error	Percent/ Median	Std Error	Relative Difference	Percent/ Median	Std Error	Relative Difference
Separated	2.75	0.10	2.54	0.13	-7.64*	2.48	0.13	-9.82*
Never married	20.46	0.26	19.02	0.33	-7.04*	18.49	0.34	-9.63*
Race of Householder								
White Only	80.87	0.21	81.60	0.27	0.9*	80.68	0.29	-0.23^
Black Only	11.96	0.14	11.28	0.21	-5.69*	11.73	0.22	-1.92^
Asian Only	4.44	0.13	4.39	0.16	-1.13	4.79	0.18	7.88*
Other	2.73	0.11	2.72	0.14	-0.37	2.80	0.15	2.56
Sex of Householder								
Male	47.53	0.35	47.37	0.47	-0.34	47.47	0.47	-0.13
Female	52.47	0.35	52.63	0.47	0.3	52.53	0.47	0.11
Tenure								
Owner	64.96	0.23	67.34	0.32	3.66*	66.68	0.28	2.65*^
Renter, no government subsidy	30.60	0.24	27.75	0.34	-9.31*	28.64	0.29	-6.41*^
Renter, receives government subsidy	4.44	0.11	4.91	0.15	10.59*	4.68	0.14	5.41*^
Urban/Rural Status								
Urban	80.74	0.27	79.48	0.38	-1.56*	79.54	0.37	-1.49*
Rural	19.26	0.27	20.52	0.38	6.54*	20.46	0.37	6.23*
Within PSU Strata								
Low income	36.54	0.18	37.57	0.30	2.82*	37.55	0.33	2.76*
Non-low income	63.46	0.18	62.43	0.30	-1.62*	62.45	0.33	-1.59*

Source: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel.

* Indicates full sample and respondent estimates are significantly different at the $\alpha=0.10$ level.

^ Indicates nonresponse adjustments helped to reduce the bias. The relative difference for the nonresponse adjusted estimate is either no longer significant (relative difference was significant for the initial weighted estimate) or the difference is smaller than the relative difference using only the initial weight at the 90 percent confidence level.

4.4 Comparing Estimates to Benchmarks

Findings from comparing various SIPP person and household level final weighted estimates – computed from all original and spawned households that were interviewed in Wave 4 – to corresponding administrative data sources and estimates from the Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC) are summarized in Table 5. The statistics examined include: annual median household income by race and Hispanic origin of the householder; percent of persons in poverty by race and Hispanic origin, sex, and age; number of persons enrolled in Medicaid, Medicare, SNAP, Social Security, SSI, and TANF; and average

monthly Social Security and SSI income among respective program recipients. The table displays benchmarks and their margins of error when available, SIPP estimates and their standard errors, and relative differences between the benchmark and SIPP estimates.

The reference period – duration for which an estimate is computed – depends on the benchmarks available. Median household income and poverty rates are annual estimates for the entire 2016 calendar year. Medicaid, SNAP, Social Security, and SSI statistics are monthly counts of persons who received benefits from these programs in December 2016. The Medicare statistic is the average monthly number of persons that participated in the program during the 2016 calendar year.

SIPP estimated annual median household income in 2016 was 3.72 percent lower than the CPS ASEC median annual income of \$59,039 and 5.41 percent lower among White, non-Hispanic householders compared to the CPS ASEC benchmark. While the SIPP estimated percentage of persons in poverty during calendar year 2016, 12.29 percent, was not statistically different from CPS ASEC estimate of 12.7 percent, SIPP poverty rate among persons 65 years or older in the same reference period was 35.16 percent lower than that of the CPS ASEC.

The SIPP estimated count of Medicare recipients in December 2016 did not differ from the value published by the Centers for Medicare and Medicaid Services. However, SIPP underestimated overall participation in Medicaid, SNAP, Social Security, and TANF during the same month compared to the programs' data by 10.99 percent, 19.13 percent, 3.71 percent, and 16.25 percent respectively.

The number of Social Security beneficiaries in December 2016 computed from the SIPP also differed from benchmarks published in the 2017 Social Security statistical supplement by sex and age¹⁴. SIPP estimates were 6.84 percent higher, 5.99 percent lower, and 5.21 percent lower than benchmarks among recipients under 62 years, 62 years or older, and female recipients respectively. The SIPP estimated average monthly Social Security income in the same month was 17.98 percent higher than the benchmark among all recipients, 17.48 percent higher among males, and 18.35 percent higher among females.

SIPP estimated SSI enrollees 26.53 percent higher than the counts produced by the Social Security Administration and also differed from the benchmarks by age group. SIPP estimated average monthly SSI income among all recipients was not significantly different from the benchmark, but 5.54 percent lower among recipients under 18 years, and 3.2 percent lower among recipients 18 to 64 years.

The SIPP sample universe is the same as that of the CPS ASEC, but different from the population enrolled in the various government programs. The SIPP and CPS ASEC sample universes are restricted to civilian noninstitutionalized persons residing in the United States. While program participation benchmark counts for Medicaid and Medicare are also restricted to persons

¹⁴ The earliest age persons can begin receiving social security retirement benefits is age 62.

residing in the U.S.,¹⁵ they include institutionalized persons. Social Security and SSI participation benchmark counts and average monthly benefits include all persons in the United States and in eligible U.S. territories, as well as, institutionalized persons.

Table 5. Comparing SIPP 2016 Key Estimates to Benchmarks from Administrative Data and Estimates from the 2017 Current Population Survey (CPS) Annual Social and Economic Supplement (ASEC)

Characteristic and Subgroups	Benchmark	Benchmark Margin of Error	SIPP Estimate	SIPP Standard Errors	Relative Difference (percent)
Annual Median Income (in Dollars)					
All households	59,039	717	56,840	601	-3.72*
Race and Hispanic Origin					
White Only	65,041	839	61,520	672	-5.41*
Black Only	39,490	1,187	40,380	1,260	2.25
Asian Only	81,431	1,917	82,900	5,057	1.8
Hispanic of any race	47,675	1,113	48,170	1,477	1.04
Poverty Rates (Percentages)					
All persons	12.70	0.20	12.29	0.31	-3.23
Age					
Under 18 years	18.00	0.50	18.23	0.73	1.28
18 to 64 years	11.60	0.20	11.82	0.30	1.9
65 years or older	9.30	0.40	6.03	0.34	-35.16*
Race and Hispanic Origin					
White Only	8.80	0.30	9.08	0.34	3.18
Black Only	22.00	0.90	20.26	1.06	-7.91
Asian Only	10.10	0.90	10.21	1.83	1.09
Hispanic of any race	19.40	0.70	17.22	1.13	-11.24*
Sex					
Male	11.30	0.30	11.12	0.37	-1.59
Female	14.00	0.30	13.40	0.37	-4.29
Social Security Participation					
All Recipients	60,907,307	.	58,650,000	537,600	-3.71*
Age ¹					
Under 62 years	11,307,026	.	12,080,000	425,600	6.84*
62 years or older	49,528,604	.	46,560,000	277,500	-5.99*

¹⁵ The Centers for Medicare and Medicaid also produce counts of [Medicare](#) and [Medicaid](#) participants that include recipients residing in U.S Territories.

Sex					
Male	27,624,279	.	27,090,000	327,200	-1.93
Female	33,283,028	.	31,550,000	347,100	-5.21*
Average Monthly Social Security Income (in Dollars)					
All Recipients	1,246	.	1,470	7.46	17.98*
Sex					
Male	1,402	.	1,647	12.82	17.48*
Female	1,117	.	1,322	9.53	18.35*
Supplemental Security Income (SSI) Participation					
All Recipients	8,251,161	.	10,440,000	345,700	26.53*
Age					
Under 18 years	1,213,079	.	1,282,000	130,000	5.68
18 to 64 years	4,845,735	.	6,603,000	253,600	36.26*
65 years or older	2,192,347	.	2,552,000	162,200	16.4*
Average Monthly Supplemental Security Income (in Dollars)					
All Recipients	542	.	529	8.45	-2.4
Age					
Under 18 years	650	.	614	17.28	-5.54*
18 to 64 years	563	.	545	9.40	-3.2*
65 years or older	437	.	444	17.79	1.6
Participation in Other Programs					
Medicaid	74,995,234	.	66,750,000	1,179,000	-10.99*
Medicare	55,758,132	.	56,410,000	408,600	1.17
Supplemental Nutrition Assistance Program (SNAP)	42,972,692	.	34,750,000	822,800	-19.13*
Temporary Assistance for Needy Families (TANF)	2,587,570	.	2,167,000	233,900	-16.25*

Sources: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel.

U.S. Census Bureau Current Population Survey 2017 Annual Social and Economic Supplements.

The Centers for Medicaid & Medicare Services (CMS) Program Statistics, 2016 Medicare Enrollment Section.

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¹ Social Security participation by age benchmarks obtained from Tables 5A.1 to 5A.11 of the 2017 Social Security Annual Statistical Supplements exclude disabled persons age 60 to 64 years.

* Indicates SIPP estimates are significantly different from benchmarks at the $\alpha=0.10$ level.

Note regarding benchmark analysis in Wave 1 of the SIPP 2014 Panel: *The SIPP re-released Wave 1 files in September 2017 which included changes to beginning and ending months of SNAP and TANF receipt spells. However, all estimates in the Wave 1 nonresponse bias analysis were computed using the original SIPP Wave 1 data published in March 2017 and hence contain incorrect estimates of SNAP and TANF participation. The correct estimates for the number of persons who receive SNAP and TANF in December 2013 are 36,540,000 and 2,543,000 respectively. Both numbers are still significantly lower than the benchmarks and hence do not alter the conclusions of the report.*

The Wave 1 SIPP Medicaid estimates and benchmarks represent different statistics than those computed in the nonresponse bias analysis report for subsequent waves of the 2014 SIPP. The Wave 1 statistic corresponds to the unduplicated number of persons who were enrolled in Medicaid in the 2013 fiscal year and the benchmark was obtained from the 2014 edition of the Center of Medicaid and Medicare Statistics Reference Booklet which was discontinued in 2016 and replaced with the Center of Medicaid and Medicare Program Statistics. The Wave 2 and later wave Medicaid statistic is the number of persons enrolled in Medicaid at any point in December of the specified year and the benchmark was obtained from Center for Medicaid and CHIP Services.

5. Discussion and Conclusions

This analysis employed different techniques to investigate the potential for nonresponse bias in Wave 4 – the final wave – of the 2014 SIPP including: comparing weighted response rates across subgroups of the sample; examining key estimates, frame and demographic characteristics among full sample, respondents, and nonrespondents, and benchmarking. Some of the methods identified variables correlated with nonresponse while others provided estimates of nonresponse bias for specific estimates and the effect of noninterview adjustment on these statistics.

Weighted response rates in most subgroups were significantly different from the Wave 4 cross-sectional unit response rate among original sample households. Response rates also differed across subgroups of the same characteristics with some subgroups overrepresented or

underrepresented compared to others, implying there is potential bias due to nonresponse for statistics associated with these characteristics. Particularly, response rates were significantly higher among households with reference persons age 55 and older compared to households with younger reference persons. Response rates were also higher among households whose members participated in government programs but lower among households in the Northeast compared to other regions.

These findings were supported by comparisons between nonrespondent and respondent household calendar year 2013 estimates in Section 4.2 and are also in line with results from nonresponse bias analysis in previous SIPP panels and in earlier waves of the 2014 SIPP. SIPP key estimates, including household income, poverty rates, and program participation rates, also differed significantly between the two respondent groups. The distribution of households in both respondent categories also differed by householder demographic characteristics and frame variables including CBSA status, urban/rural status and within PSU strata.

Relative differences between initial weighted full sample estimates and respondent-only estimates computed using Wave 4 initial weights were generally higher than those of the earlier waves: 18¹⁶ of the 60 estimates had relative differences larger than five percent in contrast to Wave 2, where only eight¹⁷ estimates had relative differences larger than five percent. Noninterview adjusted weights significantly reduced the relative differences between some of the full sample and Wave 4 respondent sample estimates including median household total income and participation in SNAP and SSI.

Although some estimates remain biased after incorporating the noninterview adjustment, the actual differences between the full sample and respondent sample estimates may not be practically significant – particularly for estimates with small relative differences, as only six¹⁸ of the 60 estimates displayed in Table 4 had relative differences greater than 10 percent when

¹⁶ The magnitude of Wave 4 initial weighted relative differences associated with the following estimates were not significantly different from 5 percent: households whose householders were age 45 to 54 years (-5.31 percent); households who owned bonds or other assets (4.99 percent); households located in the Northeast (-6.17 percent); households consisting of three persons (-6.47 percent); households whose householders were separated from their spouse (-7.64 percent); households who had Black householders (-5.69 percent); households located in rural areas (6.54 percent), and households who received TANF (-10.42 percent).

¹⁷ The magnitude of Wave 2 initial weighted relative difference associated with the estimated percentage of households whose householders were age 25 to 34 years old (-5.84 percent) was not significantly different from five percent.

¹⁸ The magnitude of Wave 4 noninterview weighted relative differences associated with the following estimates were not significantly different from 10 percent: households whose householders were age 25 to 34 years (-11.01 percent); households whose householders were age 35 to 44 years (-11.05 percent); households who received SSI income (-10.61 percent); households who received TANF benefits (-13.54 percent).

respondent sample estimates were computed with noninterview adjusted weights. Furthermore, some of these estimates that remained biased are correlated with variables used in the second stage adjustment step of the SIPP weighting procedure¹⁹ described in Section 2.1. Therefore, the bias may further be reduced following the second stage adjustment.

Comparing SIPP estimates to benchmarks in Section 4.4 showed that some SIPP estimates like household total income were biased compared to benchmarks, while others like poverty rates and Medicare participation were not significantly different from benchmarks. While we cannot infer that nonresponse is solely responsible for biased estimates, we can surmise that the combination of nonresponse and second stage weighting adjustments mitigates some of the bias associated with nonresponse since the analyses in Sections 4.2 and 4.3 had suggested the SIPP may underestimate poverty rates and overestimate Medicare participation in Wave 4.

While there isn't strong evidence of nonresponse bias in the Wave 4 estimates, there is a noticeable trend towards the presence of nonresponse bias in Wave 4. Response rates among original sample eligible households have decreased from 75.68 percent in Wave 2 to 55.23 percent in Wave 4 and the number of the significant relative differences between full sample and respondent only estimates have increased. Nonetheless, the combination of noninterview and second stage adjustments are effective in reducing the biases associated with some of the estimates.

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¹⁹ Second stage adjustment uses *race, Hispanic origin, sex, state, and age* to adjust subgroups of the sample to population controls.

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