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Incorporating Administrative Data in Survey Weights for the Survey of Income and Program Participation

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ABSTRACT: Declining survey response rates in federal surveys have led to concerns of increasing nonresponse bias in key government statistics. A potential solution is to leverage administrative data from federal agencies and third party data when constructing survey weights. This project performs initial research on incorporating administrative data into the weighting algorithm for the Survey of Income and Program Participation (SIPP). Specifically, we match income data from IRS tax forms and demographic data from the Social Security Administration and the Decennial Census to both respondents and nonrespondents. We then use this matched data in the household nonresponse adjustment of the SIPP weighting algorithm, which adjusts the weights of respondents to account for differential nonresponse rates among subpopulations and reduces nonresponse bias in survey estimates. We show how these new experimental weights affect estimates of wealth, income, poverty, health insurance coverage, and participation in government assistance programs and their impact on nonresponse bias compared to the traditional weights. Overall, the new experimental weights are associated with a small increase in estimated economic wellbeing.*

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Introduction

In the survey field, a major concern has been declining unit response rates in surveys. In addition to surveys from academic institutions and the private sector, this trend can be found in a variety of federal surveys (Czajka and Beyler 2016). One particular federal survey which has seen notable drops in response rates has been the Survey of Income and Program Participation (SIPP). At the start of the 2008 Panel, the survey had a response rate of 80.6%.¹ This rate declines to 68.8% for the start of the 2014 Panel, so a 12 percentage point drop in just 6 years. This decrease in response rates might not be concerning if there is no increase in nonresponse bias, as nonresponse rates are weakly associated with nonresponse bias (Groves and Peytcheva 2008). However, as discussed later in this paper, nonresponding 2014 Panel households are likely to have a higher amount of wage and salary income. This difference in characteristics between respondents and the full sample implies that nonresponse bias does exist in SIPP, particularly related to income statistics, a key focus of the survey.

A potential solution to this nonresponse problem is to leverage administrative data from federal agencies when constructing survey weights. In this paper, we propose improvements to the SIPP weighting algorithm in order to address problems with nonresponse bias. Specifically, we match income data from IRS tax forms and demographic data from the Social Security Administration and the Decennial Census to the sampled units – both respondents and non-respondents. We then use this matched data in the household nonresponse adjustment part of the SIPP weighting algorithm, which adjusts the weights of respondents to account for differential nonresponse rates among subpopulations and reduces nonresponse bias in survey estimates.

We find that the new experimental weights are associated with a small increase in estimated economic wellbeing when tested on 2014 SIPP Wave 1 data; the poverty rate decreases from 16.06% to 15.95% and median annual personal income increases from \$22,590 to \$22,800 (Table 4). More notable is the increase in the estimates of household net worth, with the median increasing from \$80,040 to \$82,970 (Table 4). Looking at estimates on nonresponse bias, we do find that overall, the new SIPP weights are associated with a reduction in nonresponse bias. Thus, our work has shown the feasibility of incorporating administrative data into survey weights for SIPP, at least in a research setting. These results should be informative for future planning for SIPP, as well as any other demographic survey considering incorporating administrative data into their weights.

¹This is the RR6 Definition from The American Association for Public Opinion Research (2016).

Background on SIPP and SIPP Weighting

The Survey of Income and Program Participation is a nationally representative panel survey administered by the Census Bureau. It collects information on the short-term dynamics of employment, income, household composition, and eligibility and participation in government assistance programs among the civilian, noninstitutionalized population of the United States. It is a leading source of information on specific topics related to economic well-being, family dynamics, education, wealth and assets, health insurance, child care, and food security. Each SIPP panel follows individuals for several years, in interview cycles called waves, providing monthly data that measures changes in household and family composition and economic circumstances over time. To obtain more precise estimates of participation in government programs, SIPP oversamples households in high-poverty areas.

Since households are sampled with different selection probabilities and because there are varying response rates and coverage rates among subpopulations, survey weights are constructed with the goal of producing unbiased estimates that are representative of the survey population. The basic components of the SIPP weights are:

- A base weight that reflects the probability of selection for a sample unit;
- An adjustment for subsampling within clusters;
- An adjustment for movers (in Waves 2 and beyond);
- A nonresponse adjustment to compensate for sample nonresponse; and
- A poststratification (second-stage calibration) adjustment to correct for departures from known population totals.

Because we are worried about higher nonresponse bias due to lower response rates, our focus is on the nonresponse adjustment component of the weighting procedure. The purpose of the nonresponse adjustment is to compensate for different response rates of households across adjustment cells. For Wave 1 of a SIPP panel, we are limited in the number of variables that can be used to define these cells because they must be characteristics that are known for both responding and nonresponding households. In Waves 2 and beyond of a panel, this is not an issue because we only follow households that responded in Wave 1, and therefore we have SIPP data from a previous wave for all nonrespondents. The current SIPP weighting procedure uses the following six household characteristics for defining the nonresponse adjustment cells in Wave 1: Census Region, Metropolitan Statistical Area (MSA)/Place Status (MSA-central city, MSA-non-central city, other place), poverty stratum (high poverty, low poverty), race of reference person (black, nonblack), household tenure (owner, renter), household

size (1, 2, 3, 4+ people). The first three variables are known from the sampling frame, while the later three are obtained from the survey data for respondents, and the interviewer's guess of these characteristics for nonrespondent households.

Nonresponse Bias in SIPP

As mentioned previously in the introduction, a sizable proportion of households sampled for SIPP do not respond to the survey. For evaluating how respondent and nonrespondent households differ, we match all SIPP non-vacant addresses to various administrative data. Our primary administrative data consists of tax data from the Internal Revenue Service (IRS). We use IRS 1040, W2, 1098, and 1099 data, which give us information on a variety of sources of income. Receipt of a 1098 from a mortgage lender also gives information on whether the household has a mortgage, and thus is a proxy for home ownership. Filing status from the 1040 tax return data also gives us a proxy for marital status.

To match survey and administrative records at the address level, we utilize the linking identifier in the Master Address File (MAF), which is the Census Bureau's frame file of all known living quarters and certain nonresidential addresses in the United States.² The MAF has been used as the sampling frame for SIPP since the 2014 Panel. The IRS data are linked to the MAF using a probabilistic linking algorithm. Looking at the 1040 data, Bee, Gathright, and Meyer (2015) find a match rate of about 90%. Because this match rate is less than 100%, there could be concerns that 1040s linked to the MAF may be different from unlinked 1040s. Bee, Gathright, and Meyer (2015) examine this as well and find that unmatched tax records tend to be in the extreme upper and lower ends of the income distribution. For our analyses, this finding implies that there are two possible reasons for why a household does not match to IRS data. It could be that this household didn't file their taxes or receive any other tax form from an employer or financial institution. However, it could also be the case that they did have one of these tax forms, but had certain characteristics resulting in their tax form failing to match to the MAF.

Linking the IRS data at the address-level to SIPP addresses gives us measures of total income and types of income received for respondents and nonrespondents. But in addition to income, the list of people on these tax forms gives us a proxy for a household roster that is comparable for respondent and nonrespondent households. To obtain additional information on these people listed on the tax forms,

² We link at the address rather than the person-level because the person-level linking identifier used at the U.S. Census Bureau (PIK) is unknown for nonrespondent households.

we also use demographic data from the Social Security Administration's (SSA) Numident file and the 2010 Decennial Census. Both the Social Security and 2010 Census data contain data of an individual's age and race. If race data is available from both sources for a person, we use decennial race. The 2010 Census gives us information on Hispanic origin, while the Social Security data contain information on citizenship and foreign-born status. Both these datasets are linked to the IRS data at the individual level using Census Bureau's Person Identification Validation System (PVS), as described in Wagner and Layne (2014). This procedure matches both survey data and administrative data to a master reference file. Individuals who are matched are given an identifier called a Protected Identification Key (PIK), which acts as an anonymized social security number that can be used to link administrative datasets and surveys. For the 2010 Census, about 90% of individuals are assigned a PIK (Wagner and Layne 2014).³ Once the Social Security and Decennial Census Data are matched at the individual level, the data are then aggregated to the household level to create an address-level measure for comparing respondent and nonrespondent households. For example, our measure of the presence of a household member over age 60 comes from taking the list of people given on the tax forms matched to this address, and then matching these people to the SSA's Numident file to get the year of birth for all household members. To help further explain the matching process, Figure 1 gives a graphical representation of how the data are linked. Table A.1 in the Appendix gives more details on the variables used in this paper, presenting the data source of each variable as well as notes on how some of the variables are constructed.

Using the matched data, SIPP respondent and nonrespondent households can be compared on various characteristics as shown in Table 1. While respondent and nonrespondent households are similar or have small differences for a variety of measures, some notable differences are apparent. Respondent households are more likely to be renters (33.66% vs. 29.13%) and less likely to receive a W2 (70.64% vs. 73.98%). Respondent households are also more likely to have a member who is over 60 years old (37.12% vs. 31.67%) and more likely to have someone receiving a 1099-SSA due to receipt of OASDI income from the SSA (27.28% vs. 21.81%). There is also variation by metropolitan status and region. Overall, these results suggest relevant differences between respondent and nonrespondent households in SIPP, and these differences should be compensated for in the nonresponse weighting adjustment to prevent nonresponse bias in the survey estimates. In particular, the difference in receipt

³ The 2010 Census is also linked to the MAF. But because of mobility, we link decennial data at the person-level instead to make sure we are capturing the characteristics of the current household.

of a W2 is concerning, as SIPP currently does not incorporate any earnings data into its weighting algorithm.

Incorporating Administrative Data in Weighting

Matching SIPP households to administrative data at the address level provides us additional variables to consider when creating the nonresponse adjustment cells. One possible method for creating cells is to cross-tabulate all available items and then collapse cells with similar response propensities together to avoid small sample sizes within cells. This is what is done in the original weighting procedure, where six variables result in a cross-tabulation of about 500 cells. However, because so many items are available with the addition of administrative data, this cross-tabulation results in an extremely large number of cells. Therefore, instead we use a classification tree algorithm, Chi-square Automatic Interaction Detector (CHAID), to discover relationships between the categorical administrative variables and response propensity. CHAID is an algorithm developed by Kass (1980) that explores and models the associations between independent variables and categorical outcomes through a series of Chi-square tests that are used to determine the best split at each stage of the tree. CHAID is an often used method for selecting the variables and forming nonresponse cells in survey weighting; Rizzo, Kalton, and Brick (1994) previously applied CHAID to SIPP panel nonresponse weighting adjustments. Advantages of using such a method are that it is nonparametric and robust to outliers. However, classification trees can be subject to overfitting, so while the model does a good job of describing nonresponse for the SIPP 2014 Panel, caution should be used before generalizing the same model to other SIPP panels, where the characteristics of respondents versus nonrespondents may differ.

The CHAID algorithm resulted in about 350 nonresponse adjustment cells after cell collapsing.⁴ For the original 2014 SIPP Wave 1 data, there were about 450 nonresponse adjustment cells after collapsing. This suggests that the additional administrative variables allow the weighting algorithm to more efficiently separate households into high and low response propensities. The six geographic and demographic variables SIPP traditionally uses to adjust for nonresponse were all important in the CHAID model. However, additional variables such as household age and gender composition, foreign-born and citizen status, wage and salary, social security, and assets were also used to define the cells. The new SIPP 2014 Wave 1 cross-sectional weights were produced using these newly defined nonresponse adjustment cells, leaving all other components of the weighting the same.

⁴ These statistics are the authors' own calculation not shown in any table.

Results on Nonresponse Bias Estimates

By definition 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.

A standardized version of the bias estimate, referred to as relative bias, can be used to compare nonresponse biases across multiple variables. The relative bias for an estimated mean using only the respondent data, \bar{y}_r , is calculated as:

$$RelB(\bar{y}_r) = \frac{B(\bar{y}_r)}{\bar{y}_t}$$

To evaluate the effects on the new administrative data-based weights on SIPP data quality, we first analyze estimates of the administrative data (e.g. percent of households with a W2) using a variety of weights and sample-selection criteria:

1. All non-vacant addresses using the base weight (which only accounts for the probability of selection),
2. Respondent households using the base weight,
3. Respondent households using the original noninterview adjustment weights, and
4. Respondent households using the new noninterview adjustment weights.

Assuming that there is no coverage error due to issues in the sampling frame, an estimate using criteria (1) should be unbiased. The difference between (1) and (2) gives the initial estimates of nonresponse bias in the SIPP sample before any corrections from the weighting algorithm. The difference between (1) and (3) shows the remaining bias after the nonresponse weighting adjustment is applied in the original

weights. If the difference between (1) and (3) is less than the difference between (1) and (2), then the nonresponse adjustment has reduced the nonresponse bias as intended. Finally, the difference between (1) and (4) shows the bias after the new nonresponse weighting adjustment is applied. Not only do we want to see that this difference is less than the difference between (1) and (2), but if it is less than the difference between (1) and (3), then the new nonresponse weighting adjustment is more effective than the old nonresponse weighting adjustment at reducing the bias.

Table 2 presents the SIPP 2014 Wave 1 estimates for these 4 criteria. The first column of numbers presents the estimates from (1) for all non-vacant addresses. The other columns present the estimate and absolute relative bias (percent deviation from (1)), in order to facilitate the presentation of how the bias changes with the various weights.⁵ To summarize the results in Table 2 concisely, we also present Table 3 which gives the mean and median bias from all the variables presented in Table 2, as well as the percent of variables that have a significant bias.

Overall, Tables 2 and 3 show a reduction in nonresponse bias from the new weights. Across all variables, mean absolute relative bias decreases from 1.77% to 0.6%, with a similar decrease for the median (Table 3). The percent of variables that are significantly biased decreases from 64% to 19% (Table 3). Most of the variables in Table 2 are from the administrative data, and the nonresponse adjustment in the original weights did not attempt to correct any of those characteristics beyond the extent to which they are correlated with the original six variables. Therefore, by design, the new weights should do a better job at reducing bias among these variables.

As for some specific variables, the absolute relative bias for rates of home ownership without a mortgage decreases from 2.7% with the old weights (the Absolute Relative Bias column in (3) Original Nonresponse Adjusted Weight) to 1.0% with the new weights (last column in Table 2), and the relative bias for renters decreases from 2.1% to 0.7%. For earnings, the absolute relative bias for household with earnings below \$25,000 decreases in absolute value from 2.6% to 0.8%, and the bias for households with earnings over \$100,000 decreases from 4.0% to 0.2%. However, the improvement is not universal, as the absolute relative bias for the “Used Paid Preparer for Taxes” variable went from insignificance to significance with the new weights. In summary, we find evidence that the new weights improve nonresponse bias estimates for a variety of measures. However, many of the bias estimates remain significantly different from zero, and the bias went from insignificance to significance for a variable.

⁵ This is the absolute value of $RelB(\bar{y}_r)$ described above.

Results of Key SIPP Estimates

Next, we show how the new weights affect some key estimates from SIPP. Table 4 presents estimates on wealth, income, employment, program participation, health insurance coverage, and disability status. Overall, the new weights are associated with a small increase in estimated economic wellbeing. The poverty rate decreases from 16.06% to 15.95%. Given the new weights decreased the percent of household with earnings under \$25,000 (Table 2), the decrease in the poverty rate is consistent with bias estimates from Table 2, as the federal poverty line for a family of 2 adults and 2 children in 2013 was \$23,624. Table 4 shows small increases in estimated wellbeing along other measures. Health insurance coverage increases from 86.91% to 87.06% and employment increases from 62.53% to 62.65%. For health status, disability decreases from 19.64% to 19.52%.

For personal income, household income, and personal earnings, there is an increase in estimates at the 75th and 90th percentile. For example, personal income increases by \$430 at the 75th percentile and by \$990 at the 90th percentile. For these three variables, none of them has a significant increase at the 10th percentile, and the increase at the 25th and 50th percentiles is only significant for some of them. The variable showing the largest across-distribution changes is household wealth, which has a significant increase at the 10th, 25th, 50th, and 75th percentiles. Median household wealth increases from \$80,040 to \$82,970. These changes in wealth estimates are probably largely driven by the inclusion of the 1098 data for having a mortgage in the weighting algorithm. To further show that using the 1098 data in the non-response adjustment may have effected household wealth estimate, Table 4 also presents home ownership rates and rates of having a mortgage. Table 4 shows that the new weights result in a higher estimate of the home ownership rate and a lower estimate for the percent of home owners with a mortgage. Thus, an increase in the estimate of the percent of home ownership who own their home free and clear seems to be a large reason that the net worth estimates have increased.

In addition to affecting point estimates, weighting can also affect standard errors. It is generally understood that increased variability among the survey weights can increase the standard errors, so weighting adjustments aimed at reducing bias are often done at the expense of increasing variance. However, Little and Vartivarian (2005) show that this may not hold true if the variable used to adjust for nonresponse is not only correlated with the propensity to respond to the survey, but also correlated with the survey variable of interest. For example, adding the W2 data to SIPP's weighting algorithm has the potential to reduce the bias and variance of earnings estimates because the W2 earnings amounts are conceptually very similar to survey earnings data, and the W2 earnings are associated with the

propensity to respond, as shown by the differences between respondent and nonrespondents in Table 1.

Table 4 also presents the standard errors of all the estimates. In this table, none of the differences between standard errors from the original to the new weighting are statistically significant. For example, take personal median earnings, which has the same point estimate of \$31,280 with the new and old weights. The estimate of the standard error with the old weights is \$108, and it is \$69 with the new weights, but these are not significantly different. Standard errors are highly associated with sample size, which is not changing from the original to new weighted estimates. In fact, because we have such a large sample size, the coefficient of variation for this median earnings estimate is very small regardless of which weights are used (0.35% with the old weights and 0.22% with the new weights, which are not significantly different).⁶ Therefore, minor changes in the weighting procedure do not have a meaningful impact on the standard error for estimates based on the entire sample.

Conclusion

Declining survey response rates have created the concern that there may be increasing nonresponse bias among key SIPP survey estimates. The nonresponse bias weighting adjustment is the main tool used to correct for any bias that may arise due to differing response rates among subpopulations. To reduce nonresponse bias, it is best if the variables used to form the weighting nonresponse adjustment cells are both associated with response propensity and correlated with the survey variables of interest. Traditionally, for the first wave of a SIPP panel, the number of household characteristics available for nonrespondents is limited, leaving little choice in how the weighting nonresponse adjustment cells are defined. While the SIPP 2014 Wave 1 nonresponse bias analysis report (Treat, 2017) shows that the current weighting adjustment is effective in reducing the bias, we were interested in seeing if additional variables from matched administrative data could be incorporated to further reduce any potential remaining bias.

For SIPP 2014 Wave 1, a CHAID algorithm was used to develop new experimental nonresponse adjustment cells using additional household characteristics from administrative data. As expected, the estimated bias among the additional administrative characteristics does decrease overall with the new noninterview weights compared to with the original noninterview weights. Since the administrative data

⁶ For the first coefficient of variation, this is the standard error for the original weights, \$108, divided by the median estimate for the original weights, \$31,280. The other coefficient of variation is constructed analogously.

comes from IRS and Social Security records, these variables are highly correlated to SIPP estimates of income and economic well-being, and we do see some significant differences in these estimates using the new final person weights compared to the original final person weights. We did not find any significant differences in the standard errors of the key SIPP estimates with the new weights compared to the original weights, but that is not entirely unexpected since the standard errors are highly associated with the sample size, which is unchanged. In fact, the coefficients of variation for the analyzed estimates are well below the Census Bureau quality standard of 30 percent, so reducing the standard errors through the weighting is not a priority for this research. These results should be informative for future planning for SIPP if the weighting algorithm is ever modified in the future for the actual microdata file released to the public. In addition, we believe our proposed methods and results are informative for any other demographic surveys considering incorporating administrative data into their weights.

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Figures and Tables

Figure 1: Diagram Description How Datasets are Linked Together

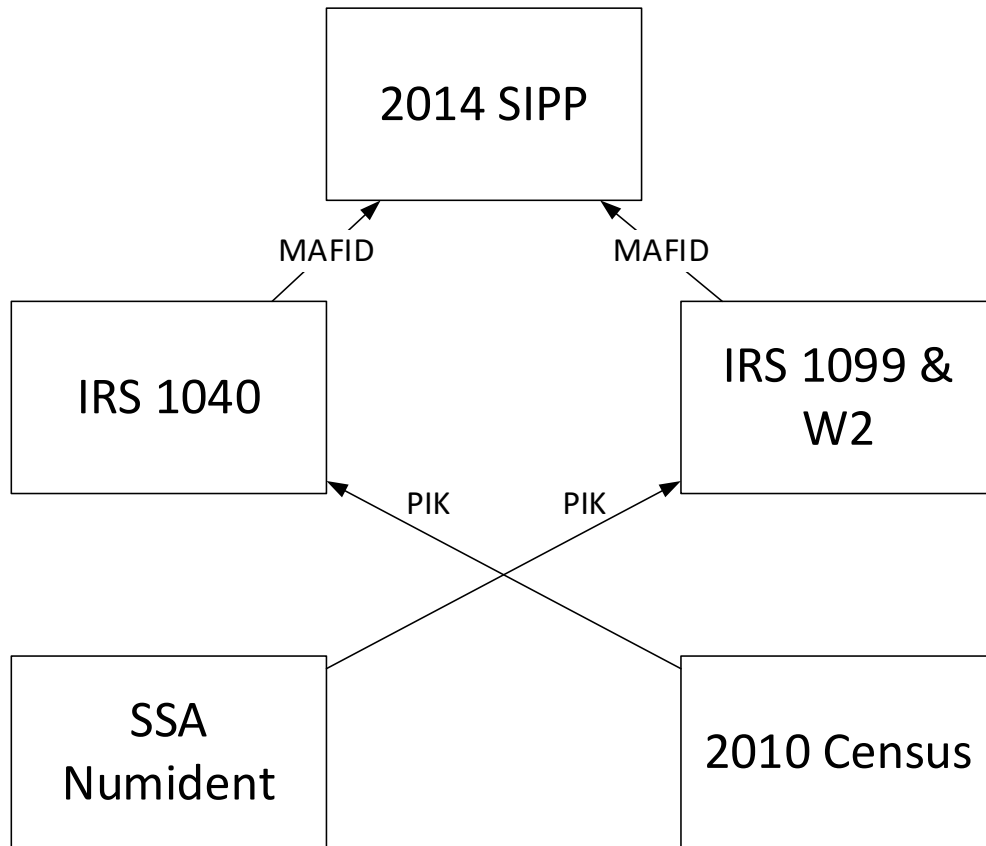


Figure describes how the 2014 SIPP wave 1 data is linked to the administrative data. The IRS data is from tax year 2013, which matches the reference year for wave 1 of 2014 SIPP. The 1099 data includes the indicator of receiving a 1098 from a mortgage lender. See the “Nonresponse Bias in SIPP” section for more details.

Table 1. Distribution of Household Characteristics Among Respondents and Nonrespondents

Characteristic	Respondents		Nonrespondents		Difference
	Percent	Std Error	Percent	Std Error	
Geographic Variables					
Region					
Northeast	16.50	0.17	21.53	0.31	5.03 ***
Midwest	23.53	0.16	20.40	0.29	-3.13 ***
South	37.61	0.2	36.18	0.36	-1.43 ***
West	22.36	0.18	21.89	0.3	-0.47
Low Income Strata	37.79	0.25	32.39	0.38	-5.40 ***
CBSA Type					
Within MSA in Central City	32.52	0.31	34.83	0.46	2.31 ***
Within MSA but not in Central City	51.04	0.44	53.20	0.52	2.16 ***
Not in MSA but in Census Place	8.59	0.29	6.32	0.28	-2.27 ***
Neither in MSA nor Census Place	7.85	0.24	5.65	0.27	-2.20 ***
Hybrid Survey and Administrative Data Variables					
Home Ownership Status					
Own Home, No Mortgage	26.54	0.26	29.33	0.39	2.79 ***
Own Home with a Mortgage	39.81	0.28	41.54	0.39	1.73 ***
Renter	33.66	0.26	29.13	0.35	-4.53 ***
Number of Household Members					
1	23.67	0.3	22.56	0.4	-1.11 **
2	26.76	0.28	27.79	0.44	1.03 **
3	16.85	0.21	17.02	0.37	0.17
4 or more	32.72	0.24	32.63	0.47	-0.09
Match Rates					
Matched to Administrative Data	87.65	0.19	87.37	0.29	-0.28
Have IRS 1040 Tax Return	72.26	0.27	72.85	0.45	0.59
Demographic Variables					
Married Filing Joint	37.84	0.28	39.01	0.45	1.17 **
Any Adult Males in Household	70.77	0.27	70.94	0.42	0.17
Any Adult Females in Household	74.23	0.29	75.22	0.4	0.99 **
Any Foreign Born in Household	30.15	0.29	30.59	0.45	0.44
Any Non-citizen in Household	23.76	0.26	23.48	0.38	-0.28
Households With 1 or More Members Who Are White	73.56	0.25	73.77	0.39	0.21
Households With 1 or More Members Who Are Black	21.37	0.27	20.87	0.39	-0.50
Households With 1 or More Members Who Are Asian, Native American, or Other Race	22.56	0.27	21.25	0.42	-1.31 ***
Households With 1 or More Members Who Are Hispanic	24.93	0.28	23.10	0.38	-1.83 ***

Table 1. Distribution of Household Characteristics Among Respondents and Nonrespondents

Characteristic	Respondents		Nonrespondents		Difference
	Percent	Std Error	Percent	Std Error	
Any Children Under 10 in Household	18.07	0.25	17.69	0.38	-0.38
Any Children Between 10 and 17 in Household	15.00	0.22	15.46	0.35	0.46
Any Adults Between 18 and 39 in Household	47.31	0.29	49.35	0.43	2.04 ***
Any Adults Between 40 and 59 in Household	44.86	0.33	47.32	0.45	2.46 ***
Any Household Member over 60	37.12	0.31	31.67	0.43	-5.45 ***
Income Variables					
Have 1099-MISC	16.00	0.25	16.03	0.36	0.03
Have 1099-R	31.35	0.29	28.57	0.46	-2.78 ***
Have 1099-G	38.44	0.3	39.82	0.48	1.38 **
Have 1099-G and Did Not Itemize on Taxes (Possible Unemployment Income)	21.69	0.26	20.99	0.31	-0.70 *
Have 1099-G and Did Itemize on Taxes (Possible State and Local Tax Refund)	20.93	0.27	23.39	0.42	2.46 ***
Have W2	70.64	0.26	73.98	0.35	3.34 ***
W2 Wages					
Less than \$25,000	15.63	0.25	13.83	0.32	-1.80 ***
Between \$25,000 and \$50,000	14.73	0.22	14.67	0.32	-0.06
Between \$50,000 and \$100,000	21.05	0.23	22.34	0.43	1.29 ***
Over \$100,000	19.22	0.24	23.14	0.44	3.92 ***
Any Non-Wage Money Income Listed on IRS 1040	46.14	0.33	46.23	0.49	0.09
Money Income Other than Wages Less Than \$15,000	21.90	0.26	23.34	0.41	1.44 ***
Money Income Other than Wages Greater Than \$15,000	24.24	0.28	22.89	0.38	-1.35 ***
Have 1099-SSA	27.28	0.26	21.81	0.44	-5.47 ***
Have 1099-SSA for a Household Member Under 60	5.14	0.15	4.12	0.2	-1.01 ***
Have 1099-SSA for a Household Member Over 60	23.50	0.26	18.65	0.41	-4.85 ***
Any Interest Income	39.92	0.34	41.29	0.46	1.37 **
Any Dividend Income	24.83	0.31	25.29	0.47	0.46
Any Rental Income	7.86	0.16	8.29	0.25	0.43
Have 1098 from Mortgage Lender	39.81	0.28	41.54	0.39	1.73 ***
Tax Filing Characteristics					
Filed Schedule A	30.11	0.29	34.29	0.45	4.18 ***
Filed Schedule C	15.11	0.25	16.06	0.4	0.95 **
Filed Schedule D	20.21	0.27	20.99	0.41	0.78
Filed Schedule E	13.04	0.19	14.71	0.34	1.67 ***

Table 1. Distribution of Household Characteristics Among Respondents and Nonrespondents					
	Respondents		Nonrespondents		
Characteristic	Percent	Std Error	Percent	Std Error	Difference
Filed Schedule SE	11.49	0.22	12.79	0.36	1.30 ***
Used Paid Preparer for Taxes (Accountant or Tax Software)	44.83	0.32	45.98	0.51	1.15 *

Table presents the percent of respondent and nonrespondents that fall into each of these categories. Source: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel, Wave 1. All non-vacant non-group quarters sampled address are linked to IRS 1040, W2, 1099, 1098, SSA Numident, and 2010 Census Data. Within each column of estimates, the sample size.

In addition to variable names, this table also gives the data source of each variable. Base weights are used to construct point estimates, and replicate factors are used to construct the standard errors of the estimates and the standard errors of the difference between estimates.

Significance asterisks: *** p<0.01 ** p<0.05 * p<0.10

Table 2. Distribution of Household Characteristics in Full Sample and Respondents, by Different Weights

Characteristic	All Sample Cases		Respondents								
	(1) Base Weight		(2) Base Weight			(3) Original Nonresponse Adjusted Weight			(4) New Nonresponse Adjusted Weight		
	Percent	Std Error	Percent	Std Error	Absolute Relative Bias (%)	Percent	Std Error	Absolute Relative Bias (%)	Percent	Std Error	Absolute Relative Bias (%)
Geographic Variables											
Region											
Northeast	18.08	0.10	16.50	0.17	8.73 ***	18.06	0.10	0.11	18.07	0.09	0.04
Midwest	22.55	0.11	23.53	0.16	4.36 ***	22.54	0.11	0.05	22.54	0.11	0.03
South	37.16	0.13	37.61	0.20	1.21 ***	37.19	0.13	0.10 **	37.36	0.18	0.54
West	22.21	0.10	22.36	0.18	0.66	22.21	0.10	0.02	22.02	0.17	0.85
Low Income Strata	36.09	0.18	37.79	0.25	4.70 ***	35.96	0.18	0.36 ***	36.18	0.21	0.24
CBSA Type											
Within MSA in Central City	33.25	0.27	32.52	0.31	2.18 ***	32.99	0.28	0.79 ***	32.98	0.31	0.80
Within MSA but not in Central City	51.72	0.37	51.04	0.44	1.31 ***	51.86	0.39	0.28	51.71	0.43	0.00
Not in MSA but in Census Place	7.88	0.25	8.59	0.29	9.05 ***	7.90	0.25	0.27	7.96	0.27	1.11
Neither in MSA nor Census Place	7.16	0.21	7.85	0.24	9.63 ***	7.26	0.21	1.38 ***	7.34	0.22	2.53 ***
Hybrid Survey and Administrative Data Variables											
Home Ownership Status											
Own Home, No Mortgage	27.42	0.20	26.54	0.26	3.20 ***	26.68	0.25	2.69 ***	27.15	0.24	0.98 **
Own Home with a Mortgage	40.35	0.21	39.81	0.28	1.35 ***	40.42	0.27	0.18	40.39	0.25	0.11
Renter	32.23	0.20	33.66	0.26	4.41 ***	32.90	0.21	2.07 ***	32.46	0.21	0.70 **
Number of Household Members											
1	23.32	0.23	23.67	0.30	1.49 ***	23.16	0.29	0.68	23.33	0.26	0.06
2	27.08	0.24	26.76	0.28	1.19 ***	27.79	0.29	2.61 ***	26.93	0.28	0.58
3	16.91	0.17	16.85	0.21	0.32	17.06	0.21	0.91	16.88	0.21	0.15
4 or more	32.69	0.21	32.72	0.24	0.09	31.99	0.23	2.15 ***	32.86	0.25	0.52
Match Rates											
Matched to Administrative Data	87.56	0.16	87.65	0.19	0.10	87.88	0.18	0.36 ***	87.45	0.20	0.13
Have IRS 1040 Tax Return	72.44	0.25	72.26	0.27	0.26	72.68	0.26	0.33	72.50	0.28	0.07
Demographic Variables											
Married Filing Joint	38.21	0.24	37.84	0.28	0.97 ***	38.52	0.28	0.81 **	38.21	0.29	0.02

Table 2. Distribution of Household Characteristics in Full Sample and Respondents, by Different Weights

Characteristic	All Sample Cases		Respondents								
	(1) Base Weight		(2) Base Weight			(3) Original Nonresponse Adjusted Weight			(4) New Nonresponse Adjusted Weight		
	Percent	Std Error	Percent	Std Error	Absolute Relative Bias (%)	Percent	Std Error	Absolute Relative Bias (%)	Percent	Std Error	Absolute Relative Bias (%)
Any Adult Males in Household	70.83	0.23	70.77	0.27	0.07	71.25	0.26	0.60 ***	70.83	0.27	0.01
Any Adult Females in Household	74.54	0.23	74.23	0.29	0.42 **	74.70	0.28	0.22	74.21	0.32	0.43
Any Foreign Born in Household	30.29	0.22	30.15	0.29	0.46	29.91	0.29	1.23 **	30.37	0.29	0.28
Any Non-citizen in Household	23.67	0.20	23.76	0.26	0.37	23.39	0.25	1.19 *	23.79	0.27	0.52
Households With 1 or More Members Who Are White	73.63	0.20	73.56	0.25	0.09	73.81	0.25	0.24	73.70	0.25	0.10
Households With 1 or More Members Who Are Black	21.21	0.23	21.37	0.27	0.73	21.30	0.27	0.40	21.27	0.26	0.28
Households With 1 or More Members Who Are Asian, Native American, or Other Race	22.15	0.22	22.56	0.27	1.85 **	22.50	0.26	1.60 **	22.13	0.27	0.08
Households With 1 or More Members Who Are Hispanic	24.35	0.23	24.93	0.28	2.36 ***	24.78	0.27	1.76 ***	24.40	0.27	0.19
Any Children Under 10 in Household	17.95	0.20	18.07	0.25	0.66	17.49	0.23	2.58 ***	18.03	0.24	0.42
Any Children Between 10 and 17 in Household	15.15	0.20	15.00	0.22	0.95	14.57	0.21	3.82 ***	15.09	0.22	0.35
Any Adults Between 18 and 39 in Household	47.95	0.24	47.31	0.29	1.34 ***	47.01	0.29	1.95 ***	47.77	0.29	0.38
Any Adults Between 40 and 59 in Household	45.63	0.27	44.86	0.33	1.70 ***	44.89	0.33	1.62 ***	45.73	0.34	0.21
Any Household Member over 60	35.40	0.24	37.12	0.31	4.83 ***	37.73	0.3	6.56 ***	35.66	0.25	0.73 ***
Income Variables											
Have 1099-MISC	16.01	0.19	16.00	0.25	0.06	16.16	0.26	0.91	16.12	0.25	0.66
Have 1099-R	30.48	0.25	31.35	0.29	2.87 ***	31.98	0.29	4.94 ***	30.80	0.28	1.07 **
Have 1099-G	38.87	0.24	38.44	0.30	1.11 **	38.64	0.29	0.60	38.69	0.28	0.47
Have 1099-G and Did Not Itemize on Taxes (Possible Unemployment Income)	21.47	0.20	21.69	0.26	1.02 *	21.53	0.26	0.28	21.54	0.26	0.33
Have 1099-G and Did Itemize on Taxes	21.70	0.22	20.93	0.27	3.56 ***	21.34	0.27	1.67 **	21.38	0.26	1.49 ***

Table 2. Distribution of Household Characteristics in Full Sample and Respondents, by Different Weights

Characteristic	All Sample Cases		Respondents								
	(1) Base Weight		(2) Base Weight			(3) Original Nonresponse Adjusted Weight			(4) New Nonresponse Adjusted Weight		
	Percent	Std Error	Percent	Std Error	Absolute Relative Bias (%)	Percent	Std Error	Absolute Relative Bias (%)	Percent	Std Error	Absolute Relative Bias (%)
(Possible State and Local Tax Refund)											
Have W2	71.69	0.21	70.64	0.26	1.46 ***	70.76	0.26	1.29 ***	71.47	0.25	0.30
W2 Wages											
Less than \$25,000	15.06	0.20	15.63	0.25	3.75 ***	15.45	0.25	2.56 ***	14.94	0.24	0.81
Between \$25,000 and \$50,000	14.71	0.19	14.73	0.22	0.13	14.58	0.22	0.90	14.60	0.21	0.73
Between \$50,000 and \$100,000	21.45	0.21	21.05	0.23	1.89 ***	21.08	0.24	1.73 **	21.51	0.22	0.25
Over \$100,000	20.45	0.23	19.22	0.24	6.02 ***	19.64	0.26	3.97 ***	20.41	0.23	0.20
Any Non-Wage Money Income Listed on IRS 1040	46.17	0.27	46.14	0.33	0.06	46.99	0.33	1.77 ***	46.21	0.32	0.08
Money Income Other than Wages Less Than \$15,000	22.35	0.22	21.90	0.26	2.02 ***	22.06	0.27	1.30 *	22.41	0.27	0.29
Money Income Other than Wages Greater Than \$15,000	23.82	0.20	24.24	0.28	1.77 ***	24.93	0.28	4.65 ***	23.79	0.26	0.12
Have 1099-SSA	25.56	0.22	27.28	0.26	6.72 ***	27.62	0.26	8.04 ***	25.83	0.24	1.05 **
Have 1099-SSA for a Household Member Under 60	4.82	0.12	5.14	0.15	6.60 ***	5.06	0.14	4.98 ***	5.03	0.15	4.43 ***
Have 1099-SSA for a Household Member Over 60	21.98	0.20	23.50	0.26	6.93 ***	23.91	0.26	8.81 ***	22.06	0.22	0.36
Any Interest Income	40.35	0.26	39.92	0.34	1.07 **	40.87	0.33	1.29 ***	40.31	0.31	0.09
Any Dividend Income	24.98	0.25	24.83	0.31	0.58	25.56	0.3	2.34 ***	25.10	0.28	0.49
Any Rental Income	8.00	0.14	7.86	0.16	1.68	8.06	0.17	0.71	8.04	0.17	0.57
Have 1098 from Mortgage Lender	40.35	0.21	39.81	0.28	1.35 ***	40.42	0.27	0.18	40.39	0.25	0.11
Tax Filing Characteristics											
Filed Schedule A	31.42	0.25	30.11	0.29	4.18 ***	30.88	0.31	1.73 ***	31.10	0.28	1.02 **
Filed Schedule C	15.41	0.22	15.11	0.25	1.95 **	15.23	0.26	1.16	15.22	0.25	1.21
Filed Schedule D	20.46	0.23	20.21	0.27	1.19	20.93	0.27	2.30 ***	20.59	0.26	0.65
Filed Schedule E	13.56	0.17	13.04	0.19	3.87 ***	13.37	0.21	1.45	13.43	0.20	0.96
Filed Schedule SE	11.90	0.18	11.49	0.22	3.41 ***	11.57	0.23	2.75 **	11.60	0.21	2.54 **
Used Paid Preparer for Taxes (Accountant or Tax Software)	45.19	0.26	44.83	0.32	0.80 *	45.01	0.32	0.39	44.81	0.31	0.85 **

Source: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel, Wave 1. All non-vacant non-group quarters sampled addresses are linked to IRS 1040, W2, 1099, 1098, SSA Numident, and 2010 Census Data.

The first column of numbers presents the estimates from all non-vacant addresses, which results in an unbiased estimate in the parameter of interest in the absence of coverage error. The other columns present estimates from using just respondents, and using a variety of different weights. Significance states whether the given estimate of bias is different from zero. Significance asterisks: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

Table 3. Summary of Nonresponse Bias Results			
	Base weight	Original Nonresponse Adjusted Weight	New Nonresponse Adjusted Weight
Mean absolute relative bias	2.36	1.77	0.60
Median absolute relative bias	1.41	1.29	0.4
Percent significantly biased	69%	64%	19%

Source: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel, Wave 1. All non-vacant sampled addresses are linked to IRS 1040, W2, 1099, 1098, SSA Numident, and 2010 Census Data.

Note: The numbers presented are a descriptive summary of the bias results for the 58 characteristics presented in Table 2. This table is only for use in evaluating the weighting methodology; no inferences are being made about the population.

Table 4. Key SIPP Estimates, by Different Weights

Variable	Original Final Weight		New Final Weight		Difference
	Estimate	Std Error	Estimate	Std Error	
Employed	62.53%	0.20%	62.65%	0.21%	0.12% ***
Poverty	16.06%	0.22%	15.95%	0.24%	-0.11% *
SSI	2.67%	0.07%	2.67%	0.07%	0.00%
SNAP	12.97%	0.21%	12.84%	0.22%	-0.13% ***
WIC	2.54%	0.07%	2.53%	0.06%	-0.01%
TANF	0.93%	0.06%	0.91%	0.06%	-0.02%
GA	0.40%	0.04%	0.39%	0.04%	-0.01%
Social Security (OASDI)	20.90%	0.12%	20.70%	0.12%	-0.20% ***
Employer-Sponsored Health Insurance	55.57%	0.31%	55.89%	0.31%	0.32% ***
Medicare	14.78%	0.08%	14.72%	0.08%	-0.06% ***
Medicaid	18.17%	0.22%	18.01%	0.23%	-0.16% ***
Any Health Insurance	86.91%	0.18%	87.06%	0.18%	0.15% ***
Disabled	19.64%	0.18%	19.52%	0.18%	-0.12% ***
Home Owner	63.22%	0.23%	64.05%	0.24%	.83% ***
Have Mortgage (Home Owners Only)	62.16%	.37%	61.69%	0.38%	-.47% ***
Household Net Worth (\$)					
10 th percentile	-6,345	534	-6,000	479	345 **
25 th percentile	3,990	262	4,375	261	385 ***
50 th percentile	80,040	1,610	82,970	1,637	2,930 ***
75 th percentile	318,800	4,041	322,700	4,188	3,900 **
90 th percentile	849,200	12,490	859,000	10,340	9,800
Personal Earnings (\$) (Employed Only)					
10 th percentile	4,431	103	4,492	106	61
25 th percentile	14,730	264	14,950	210	220 *
50 th percentile	31,280	108	31,280	69	0
75 th percentile	57,350	465	58,160	486	810 **
90 th percentile	97,270	1,087	98,240	779	970 *
Personal Income (\$)					
10 th percentile	0	0	0	0	0
25 th percentile	6,947	159	6,990	140	43
50 th percentile	22,590	200	22,800	186	210 **
75 th percentile	47,130	223	47,560	378	430 **
90 th percentile	83,730	656	84,720	851	990 **
Household Income (\$)					
10 th percentile	11,990	186	12,000	168	10
25 th percentile	25,780	254	25,870	244	90
50 th percentile	51,780	432	52,080	299	300
75 th percentile	94,090	734	94,830	669	740 **
90 th percentile	155,000	1,274	156,100	1,351	1,100 **

Source: U.S. Census Bureau, Survey of Income and Program Participation, 2014 Panel, Wave 1. All non-vacant sampled addresses are linked to IRS 1040, W2, 1099, 1098, SSA Numident, and 2010 Census Data.

Final weights are used to construct point estimates, and final replicate weights are used to construct the standard errors of the estimates and the standard errors of the difference between estimates. Significance asterisks: *** p<0.01 ** p<0.05 * p<0.10

Appendix

Table A1: Variable Source and Notes		
Variable	Source	Variable Notes
Geographic Variables		
Region		
Northeast	MAF	
Midwest	MAF	
South	MAF	
West	MAF	
Low Income Strata	MAF	Households are divided into low income and non-low income strata based on poverty data from the American Community Survey (ACS) at the census block level.
CBSA Type		
Within MSA in Central City	MAF	
Within MSA but not in Central City	MAF	
Not in MSA but in Census Place	MAF	
Neither in MSA nor Census Place	MAF	
Hybrid Survey Administrative Data Variables		
Home Ownership Status		The home ownership variable is constructed as a hybrid between survey and administrative variables. If a household is matched to a 1098, then the household is classified as a home owner with a mortgage, even if they are reported as being a renter in the survey. This is done to correct for measurement error in this variable for nonrespondents, in which case the interviewer is asked to guess the home ownership status of nonresponders. If the household is not matched to a 1098, then they are classified as a home owner, no mortgage or renter based on their survey response.
Own Home, No Mortgage	Survey, 1098	
Own Home with a Mortgage	Survey, 1098	
Renter	Survey, 1098	
Number of Household Members		This is the number of household members, capped at 4. If the household match to the administrative data, then use the household size as inferred from administrative data. Else, use the survey variable.
1	Survey, 1040, 1099	
2	Survey, 1040, 1099	
3	Survey, 1040, 1099	
4 or more	Survey, 1040, 1099	
Match Rates		
Matched to Administrative Data	1040, 1099	

Have IRS 1040 Tax Return | 1040

Demographic Variables

For the following demographic variables, the household roster is first inferred from the 1040 and 1099 data. The decennial and Numident data is then merged to this roster to get characteristics of these household members

Married Filing Joint | 1040

Any Adult Males in Household | 1040, 1099,
Numident,
Decennial

Any Adult Females in Household | 1040, 1099,
Numident,
Decennial

Any Foreign Born in Household | 1040, 1099,
Numident

Any Non-citizen in Household | 1040, 1099,
Numident

Households With 1 or More Members Who Are White | 1040, 1099,
Numident,
Decennial

If race data is available from both the Numident and decennial data, then we use the decennial data

Households With 1 or More Members Who Are Black | 1040, 1099,
Numident,
Decennial

Households With 1 or More Members Who Are Asian, Native American, or Other Race | 1040, 1099,
Numident,
Decennial

Households With 1 or More Members Who Are Hispanic | 1040, 1099,
Decennial

Any Children Under 10 in Household | 1040, 1099,
Numident

Any Children Between 10 and 17 in Household | 1040, 1099,
Numident

Any Adults Between 18 and 39 in Household | 1040, 1099,
Numident

Any Adults Between 40 and 59 in Household | 1040, 1099,
Numident

Any Household Member over 60 | 1040, 1099,
Numident

Income Variables

Have 1099-MISC | 1099

Have 1099-R | 1099

Have 1099-G | 1099

Have 1099-G and Did Not Itemize on Taxes (Possible Unemployment Income)	1099, 1040	
Have 1099-G and Did Itemize on Taxes (Possible State and Local Tax Refund)	1099, 1040	
Have W2	W2	
W2 Wages	W2	
Less than \$25,000	W2	
Between \$25,000 and \$50,000	W2	
Between \$50,000 and \$100,000	W2	
Over \$100,000	W2	
Any Non-Wage Money Income Listed on IRS 1040	1040	
Money Income Other than Wages Less Than \$15,000	1040	
Money Income Other than Wages Greater Than \$15,000	1040	
Have 1099-SSA	1099	
Have 1099-SSA for a Household Member Under 60	1099, Numident	
Have 1099-SSA for a Household Member Over 60	1099, Numident	
Any Interest Income	1099, 1040	This is either having a 1099-INT or reporting interest income on a 1040
Any Dividend Income	1099, 1040	This is either having a 1099-DIV or reporting dividend income on a 1040
Any Rental Income	1099, 1040	
Have 1098 from Mortgage Lender	1098	
Tax Filing Forms		
Filed Schedule A	1040	
Filed Schedule C	1040	
Filed Schedule D	1040	
Filed Schedule E	1040	
Filed Schedule SE	1040	
Used Paid Preparer for Taxes (Accountant or Tax Software)	1040	