Simplifying the Noninterview Adjustment Used in Weighting the American Community Survey Housing Unit Sample*

Evan B. Gutentag, Edward C. Castro Jr., Mark E. Asiala
U.S. Census Bureau, 4600 Silver Hill Road, Washington, DC 20233

Abstract
The American Community Survey (ACS) weighting methodology uses three noninterview adjustment factors. The first and second factors are defined by building type, data collection month, and census tract. Two factors are used instead of one to reduce variance due to small cell sizes. Since the ACS is a multimode survey with most noninterviews occurring in the final mode, the third factor adjusts for mode bias that the first two factors may introduce since they are applied to interviews in all modes. The three factors are expected to reduce nonresponse bias without notably increasing variance, thereby reducing mean square error (MSE). The purpose of this research is to simplify the adjustment without impacting ACS estimate quality. MSEs of ACS estimates were computed and compared when formed using 1) current methodology, or 2) the first noninterview adjustment factor only, defined by building type and census tract. The simplified method used to compute estimates did not notably affect the MSEs of those estimates, suggesting that building type and small, local geography sufficiently account for the nonresponse bias of survey estimates without significantly increasing their variances.

Key Words: weighting, nonresponse, mean square error, American Community Survey

1. Introduction

The ACS housing unit (HU) weighting has used the same noninterview adjustment ever since the first ACS was conducted in 1996. Currently, the noninterview adjustment uses three factors. A fourth factor that is not directly applied to the weights must also be computed. This process seems rather complicated for a noninterview adjustment, especially since the noninterview rate for the ACS is very low (it was only 4.2% in 2015 and 5.3% in 2016 (U.S. Census Bureau, 2017)).

The purpose of this research is to determine whether the noninterview adjustment used in the ACS HU weighting can be simplified without notably affecting the overall quality of survey estimates. A simpler noninterview adjustment would help shorten the lengthy ACS HU weighting methodology and would be easier for data users with a background in statistics to understand compared to the current noninterview adjustment. Also, if weights using a simpler noninterview adjustment produce estimates of similar overall quality as weights using the current noninterview adjustment, that would suggest that the additional factors are not improving the overall quality of the estimates and should be removed from the weighting methodology.

* Any views expressed are those of the authors and not necessarily those of the U.S. Census Bureau. This paper meets all of the U.S. Census Bureau's Disclosure Review Board (DRB) standards and has been assigned DRB approval number DRB-B0001-DSSD-20180912.

1.1 Research Questions

After conducting this research, we should be able to answer the following questions regarding the noninterview adjustment and ACS survey estimates:

- How does each factor in the noninterview adjustment that is applied to the HU weights affect survey estimates, their variances, and weight variation?
- How would simplifying the noninterview adjustment affect the MSE of estimates?
- How much of the MSE of estimates is composed of bias vs variance?
- How much will simplifying the noninterview adjustment cause final estimates to change?

2. Background

This section gives a summary of the current ACS HU weighting methodology and discusses previous research regarding the noninterview adjustment.

The summary information regarding the current HU weighting methodology is based on the 2015 1-year and 2015 5-year ACS accuracy documents (U.S. Census Bureau, 2016a and 2016b), Chapter 11 of the ACS Design and Methodology Report (U.S. Census Bureau, 2014), and the 2015 ACS HU weighting specification (Castro, 2016).

2.1 Overview of Current Housing Unit Weighting Methodology

ACS HU weighting is performed within independent weighting areas. A weighting area is composed of one or more counties, but each county can only be in one weighting area (see Powers and Navarro (2006) for more information regarding how weighting areas are formed).

The current ACS HU weighting methodology that is used within each weighting area to create the HU weights and household population (person) weights can be summarized in the following steps:

1. A base weight equal to the inverse of an HU's probability of selection in the first phase of sampling is computed for each sample HU.

2. A Computer-Assisted Personal Interview (CAPI) subsampling factor (SSF) is applied to the base weights to account for a unit's probability of selection in the second phase of sampling.[1] HUs that were selected for the second phase of sampling receive an SSF equal to the inverse of their probability of selection during the second phase of sampling, HUs that responded in the first phase of sampling receive an SSF equal to 1, and HUs that did not respond in the first phase of sampling, but were not selected for the second phase receive an SSF equal to 0. Applying SSF to the base weights creates the WSSF weights.[2]

[1] The ACS uses a two-phase sample design for HU data collection. Data from the first phase sample is collected over the first two months of data collection by mail and internet (Month 1), and by Computer-Assisted Telephone Interview (Month 2). The second phase sample consists of a subsample of the HUs that did not respond during the first two months of data collection. Data from the second phase sample is collected during the final month of data collection (Month 3) by CAPI.

[2] In the ACS HU weighting, the W<FCTR> weights are the weights where <FCTR> was the last adjustment factor applied.

3. A variation in monthly sample (VMS) factor is applied to the WSSF weights. An HU has up to three months to respond to the ACS, so some months may be overrepresented or underrepresented compared to other months in ACS estimates. VMS makes the sum of the weights of HUs tabulated in each month equal to the sum of the base weights of HUs sampled in that month, giving each month approximately equal representation in ACS estimates. This creates the WVMS weights.

4. A noninterview adjustment is applied to the WVMS weights using three factors: the first noninterview adjustment factor (NIF1), the second noninterview adjustment factor (NIF2), and the mode bias factor (MBF). Vacant HUs are not used to compute the noninterview adjustment, so NIF1, NIF2, and MBF all equal 1 for vacant HUs. The noninterview adjustment shifts all the weight from the noninterviews to the interviews. NIF1 is applied to the WVMS weights, creating the WNIF1 weights. NIF2 is applied to the WNIF1 weights, creating the WNIF2 weights. MBF is applied to the WNIF2 weights, creating the WMBF weights. After the noninterview adjustment, all the noninterviews are dropped from the HU weighting process.

5. Administrative data are linked to ACS data and then used in a generalized regression with the WMBF weights to create g-factors, which are applied to the WMBF weights to create the g-weights. This process is done in order to lower the variances of tract-level estimates, so it is only performed in the 5-year HU weighting process.

6. An HU post-stratification factor (HPF) is applied to the g-weights in order to control the weights to HU totals provided by the Population Estimates Program (PEP). This creates the WHPF weights.

7. Raking is used to create a person post-stratification factor (PPSF) that is applied to the WHPF weights, creating the WPPSF weights. The raking has three purposes: 1) control the person weights to subcounty totals created using PEP totals, 2) control the person weights so that the number of householders matches the number of occupied HUs, the sum of the number of married spouses and unmarried partners matches the sum of the number of married-couple households and the number of unmarried partner households, and 3) control the person weights to PEP age/sex/race/ethnicity totals.

8. A householder factor (HHF) that equals the PPSF of the householder is applied to the WHPF weights in order to make the HU weight equal to the WPPSF weight of the householder. This creates the WHHF weights.

9. The WHHF and WPPSF weights are rounded to a whole number in order to create the final HU weights (WHRF) and the final person weights (WPRF).

2.2 Current Noninterview Adjustment

The noninterview adjustment currently used in the ACS HU weighting has two parts that are carried out using three factors that are directly applied to the weights and one factor that is indirectly applied to the weights.

The first part of the current noninterview adjustment adjusts the weights for nonresponse bias that noninterviews may introduce. Building type (single-unit or multi-unit), data collection month, and census tract are used to adjust for nonresponse bias because census tract has been used to adjust for nonresponse bias in census long form surveys, units in

structure (similar to building type) has been used to adjust for nonresponse bias in other household surveys, and data collection month is believed to be related to HU response due to seasonal populations existing in some geographic areas (Weidman, Alexander, Diffendal, & Love, 1995). One adjustment factor with cells defined by building type, data collection month, and census tract could be used to adjust for nonresponse bias, but many of the cells would have a very small number of records. Therefore, in order to limit the number of small cells and to prevent estimates from having large variances, the adjustment for nonresponse bias is carried out using two adjustment factors: one defined by building type and census tract (NIF1), and one defined by building type and data collection month (NIF2).

The second part of the current noninterview adjustment adjusts the weights for mode bias that the first two noninterview adjustment factors may introduce. We compute NIF1 and NIF2 using interviews from all modes. However, most noninterviews occur in the CAPI mode and research using census data has found that mail-interviewed housing units tend to be different from housing units that need to be interviewed in person (Weidman et al., 1995). Since NIF1 and NIF2 don't take interview mode into account, applying these factors to the weights may introduce bias into survey estimates. We refer to this bias as "mode bias." Therefore, a factor that adjusts for mode bias (MBF) is computed and applied to the weights.

In order to compute MBF, the mode noninterview adjustment factor (NIFM) needs to be computed. NIFM is applied to the WVMS weights to create the WNIFM weights, which are independent of NIF1 and NIF2. These weights are only used to compute MBF. NIFM is computed using adjustment cells defined by building type and data collection month, which is similar to NIF2. However, NIFM is computed using only noninterviews and CAPI interviews, so the weights of non-CAPI interviews remain unchanged after applying NIFM to the WVMS weights (NIFM equals one for non-CAPI interviews). NIFM may reduce nonresponse bias more than the current noninterview adjustment since only noninterviews and CAPI interviews are used to compute it. However, previous research found that, for tract-level estimates, using NIFM as the noninterview adjustment would usually cause larger relative variances and larger relative MSEs than using the current noninterview adjustment (Adeshiyan, 1998), so NIFM is only used to compute MBF.

After creating the WNIFM weights, MBF is computed and applied to the WNIF2 weights to create the WMBF weights and complete the current noninterview adjustment. MBF uses adjustment cells defined by household tenure (owned or rented), data collection month, and marital status (single or married/widowed). Only interviewed HUs are used to compute MBF. After applying MBF, the weighted total within each adjustment cell will be the same as if NIFM had been used as the noninterview adjustment, but the weight of the noninterviews will be shifted to all of the interviews instead of just the CAPI interviews. This reduces mode bias without causing large variance increases, so using the current noninterview adjustment results in estimates with lower MSEs than if NIFM had been used as the noninterview adjustment.

2.3 Previous Research

Previous research has found that simplifying the noninterview adjustment would not notably affect county-level estimates. Weidman (2006) uses data from the 2000 ACS to compare county-level estimates formed with five different sets of weights. The five sets

of weights used different noninterview adjustments: 1) NIF1 x NIF2 x MBF (the current noninterview adjustment), 2) NIF2 x MBF, 3) NIF1 x MBF, 4) NIF2, and 5) NIF1. He found that there was not much difference between estimates formed using the five different noninterview adjustments, suggesting that the noninterview adjustment could be simplified without notably affecting county-level estimates. The main limitations of Weidman (2006) are that 1) it only examines county-level estimates, so it is unclear how simplifying the noninterview adjustment would affect small area estimates, such as tract-level estimates, and 2) it was based on data from only 36 counties. Also, Sirkis (2008) used 2006 ACS data to examine the five noninterview adjustments that were examined in Weidman (2006), NIF1 x NIF2, and three noninterview adjustments that involved using propensity scores obtained from logistic regression models. She compared estimates that were formed with weights using these nine different noninterview adjustments. She found that at the county level, using either the current noninterview adjustment or NIF1 in the weighting produced estimates of similar quality, suggesting that the noninterview adjustment could be simplified to just NIF1. However, Sirkis (2008) could not examine small area estimates since no ACS 5-year datasets existed at the time,[3] so the noninterview adjustment used in the ACS HU weighting methodology was not changed.

Little research has been done to determine how different noninterview adjustments affect small area estimates. Adeshiyan (1998) compared the relative MSEs of estimates formed using WMBF weights, estimates formed using WNIFM weights, and estimates formed using WNIF2 weights. He found that for tract-level estimates, the relative MSEs of estimates formed using the WNIF2 weights and the WMBF weights were both generally lower than the relative MSEs of estimates formed using the WNIFM weights because the WNIFM estimates had larger relative variances. When comparing the relative MSEs of WNIF2 and WMBF tract-level estimates, he found that the WNIF2 weights generally performed better for large estimates, while the WMBF weights generally performed better for small estimates. The main limitations of Adeshiyan (1998) are that 1) it was based on data from only three counties, 2) only 17 estimated totals (15 person-level and 2 HU-level) were examined within each geographic area, and 3) it examines WNIF2, WMBF, and WNIFM weights, but does not examine WNIF1 weights, which may form estimates with lower variances and lower MSEs than the other sets of weights.

3. Methodology

Three sets of analyses were performed in order to examine whether simplifying the noninterview adjustment used in the ACS HU weighting would notably affect overall estimate quality:

1. We analyzed the impact that each noninterview adjustment factor has on survey estimates by examining the change in the estimates, the change in the coefficients of variation (CVs) of the estimates, and the change in weight variation (the CV of the weights) after applying each noninterview adjustment factor to the weights. This was done in order to determine how the noninterview adjustment could be simplified without notably affecting overall estimate quality. The simplified noninterview adjustment was used instead of the current noninterview adjustment when forming the experimental methodology weights used in the second and third sets of analyses.

[3] The ACS does not publish 1-year estimates for small areas. The 1-year estimates are limited to geographies with populations of at least 65,000, but 5-year estimates are published for "all legal, administrative, and statistical geographic areas down to the tract and block group level" (U.S. Census Bureau, 2014). The first 5-year ACS was the 2005-2009 ACS and the weights for this ACS were not created until 2010.

2. We analyzed the MSE, variance, and bias of the estimates formed using the current methodology noninterview-adjusted weights and of the estimates formed using the experimental methodology noninterview-adjusted weights. We defined noninterview-adjusted weights as weights where the last adjustment applied is their noninterview adjustment.

3. We analyzed the change in the estimates when they are formed using the experimental methodology final weights compared to when they are formed using the current methodology final weights. We defined final weights as the WHRF weights for HU-level estimates and the WPRF weights for person-level estimates.

3.1 Survey Estimates Used in Analyses

3.1.1 Data

Most of the estimates in these analyses were formed using data from the 2011-2015 ACS. The third set of analyses used data from the 2010-2014 ACS in addition to the 2011-2015 ACS. Group quarters (GQ) person data were excluded when forming the person-level estimates because the GQ weighting methodology is independent of the HU weighting methodology.

3.1.2 Variables and Characteristics

We used eight HU-level variables and seven person-level variables to create 40 HU-level characteristics and 13 person-level characteristics for our analyses. Some of these variables, such as race, ethnicity, and household poverty status, were selected because we believed that they are of high interest to the general public. Other variables, such as the utility variables and household tenure, were chosen because they were related or believed to be related to the variables used to define the adjustment cells of one or more of the noninterview adjustment factors. The first set of analyses were preliminary analyses, so it was limited to the variables that we thought would be most affected by simplifying the noninterview adjustment. The second and third sets of analyses included all of the variables and characteristics since the decision to simplify the noninterview adjustment would mostly be based on those analyses.

We examined estimated proportions instead of estimated totals because estimated proportions for a given geographic area can be easily interpreted without knowing the total population size.

Table 1 lists each variable, the characteristics formed from the variable, and the definition of each characteristic.

3.1.3 Geographic Areas

The analyses presented here examine only tract-level estimates unless other geographic levels are explicitly mentioned. We focused on tract-level estimates because we believed that simplifying the noninterview adjustment would have the largest impact on small area estimates. Also, previous research described in Section 2.3 has already adequately studied the impact of simplifying the noninterview adjustment on estimates for larger areas of geography, such as counties, but little research has been done on the impact that simplifying the noninterview adjustment would have on small area estimates.

3.1.4 Rules for Excluding Estimates

Since the results of these analyses were used to determine if the noninterview adjustment in the HU weighting should be simplified, we wanted to remove estimates that were very low quality regardless of whether the current weights or experimental weights were used. Therefore, if an estimate had a CV greater than 61 percent when formed using the current weights and when formed using the experimental weights, it was excluded from our analyses. A CV of 61 percent was chosen because if an estimate has a CV greater than 61 percent, it is not significantly different from zero at the 10 percent significance level.

Estimated proportions that were equal to zero or one were excluded from the analyses because they had variances equal to zero when using the successive differences replication variance estimator, which was used to calculate the variances of all estimates in this study and is used to calculate the variances of nearly all published ACS estimates (U.S. Census Bureau, 2014). The actual variances of these types of proportion estimates are greater than zero and are computed using a different method when publishing ACS estimates (Starsinic, 2016), but we believed that including these proportions in our analyses would make them more complicated without notably changing the results, so we excluded them. Also, using the experimental weights instead of the current weights will not change the values of these types of estimated proportions.

3.1.5 Examining Results

In nearly every analysis, we examined select percentiles of the distributions of the computed tract-level quantities. Over 73,000 estimates of each quantity could be computed for each characteristic, so it would not be feasible to examine the estimates individually. The selected percentiles included the 1st, 5th, 25th, 50th, 75th, 95th, and 99th percentiles, as well as the minimum (0th percentile) and maximum (100th percentile), of each distribution.

3.2 Examining the Effects of each Noninterview Adjustment Factor

3.2.1 Changes in Estimates and CVs of Estimates

In order to determine the impact that each noninterview adjustment has on survey estimates and the CVs of those estimates, the change in the estimate and the change in the CV of the estimate was computed for tract-level estimates after applying each noninterview adjustment factor to the weights. This was done for the characteristics formed using the following variables: household type, household poverty status, household tenure, vacancy status, monthly HU electricity cost, monthly HU gas cost, ethnicity, employment status, and race.

The change in the estimate was computed as:

$$\Delta\left[\hat{Y}_i(wgt1_i \rightarrow wgt2_i)\right] = \frac{\hat{Y}_{ij'} - \hat{Y}_{ij}}{\hat{Y}_{ij}},$$

where:

- $\hat{Y}_{ij}$ is the estimate for Y_i when weight j is used to form the estimate.
- $\hat{Y}_{ij'}$ is the estimate for Y_i when weight j' is used to form the estimate.

- $\hat{Y}_i$ is the estimated value of characteristic Y in tract i.
- $wgt1_i$ is WVMS, WNIF1, or WNIF2 among HUs in tract i.
- $wgt2_i$ is WNIF1, WNIF2, or WMBF among HUs in tract i.
- $j = wgt1_i$.
- $j' = wgt2_i$.

The change in the CV of the estimate was computed as:

$$\Delta\left[cv\left(\hat{Y}_i\right)(wgt1_i \rightarrow wgt2_i)\right] = \frac{cv\left(\hat{Y}_{ij'}\right) - cv\left(\hat{Y}_{ij}\right)}{cv\left(\hat{Y}_{ij}\right)},$$

where:

- $cv\left(\hat{Y}_{ij}\right) = \frac{se\left(\hat{Y}_{ij}\right)}{\hat{Y}_{ij}}$.
- $cv\left(\hat{Y}_{ij'}\right) = \frac{se\left(\hat{Y}_{ij'}\right)}{\hat{Y}_{ij'}}$.
- $se\left(\hat{Y}_{ij}\right)$ is the estimated standard error of $\hat{Y}_{ij}$.
- $se\left(\hat{Y}_{ij'}\right)$ is the estimated standard error of $\hat{Y}_{ij'}$.

The change in the estimate and the change in the CV of the estimate were calculated for the following weight pairs (listed as *weight j → weight j′*): WVMS → WNIF1, WNIF1 → WNIF2, and WNIF2 → WMBF.

3.2.2 Change in Weight Variation

The change in the tract-level weight variation after applying each noninterview adjustment was calculated within each tract. Only interviewed HUs that were occupied or temporarily occupied[4] were included in this analysis because the noninterview adjustment is only applied to the weights of these HUs. The CV of the weights within a tract was used to measure the weight variation within that tract. Therefore, the change in the tract-level weight variation was computed as:

$$\Delta[CV(wgt1_i \rightarrow wgt2_i)] = \frac{CV(wgt2_i) - CV(wgt1_i)}{CV(wgt1_i)},$$

where:

- $CV(wgt1_i) = \frac{SD(wgt1_i)}{MEAN(wgt1_i)}$.
- $CV(wgt2_i) = \frac{SD(wgt2_i)}{MEAN(wgt2_i)}$.
- $SD(wgt1_i)$ is the standard deviation of $wgt1_i$.
- $SD(wgt2_i)$ is the standard deviation of $wgt2_i$.
- $MEAN(wgt1_i)$ is the mean value of $wgt1_i$.
- $MEAN(wgt2_i)$ is the mean value of $wgt2_i$.

The change in the weight variation was calculated for the same weight pairs as the change in the estimate and the change in the CV of the estimate.

[4] Temporarily occupied HUs are defined as "HUs which are occupied but whose occupants do not meet the ACS residency criteria" (U.S. Census Bureau, 2014).

The estimate exclusion rule based on CVs that was used in most of this paper's analyses was not used in this section because we were examining weight variation instead of the variances of survey estimates. The only requirements were that the sum of the weights among the interviewed HUs that were occupied or temporarily occupied within a tract was greater than zero and that the CV of the weights within a tract did not equal 0%.

3.3 Mean Square Error, Variance, and Bias Analyses

3.3.1 Relative Mean Square Error

We computed the relative MSEs of the estimates formed using the current noninterview-adjusted weights and the experimental noninterview-adjusted weights using an estimator similar to the one used in Adeshiyan (1998). We chose to examine relative MSEs instead of MSEs because MSEs do not account for the size of the estimate. In order to calculate the relative MSEs of estimates formed using different sets of noninterview-adjusted weights, Adeshiyan (1998) uses estimates formed using the WNIFM weights as benchmarks to compute the bias of the estimates formed using the noninterview-adjusted weights. We also chose to use the WNIFM weights as benchmarks for bias computation because NIFM may be better for reducing nonresponse bias than the current noninterview adjustment since NIFM is computed using only noninterviews and CAPI interviews. The MSE of characteristic *Y* in tract *i* using the noninterview-adjusted weights was computed as:

$$\widehat{MSE}\left(\hat{Y}^i_{NI-ADJ}\right) = \widehat{Var}\left(\hat{Y}^i_{NI-ADJ}\right) + \hat{B}^2_{NI-ADJ},$$

where:

- $\hat{Y}^i_{NI-ADJ}$ is the estimate of characteristic Y in tract i using either the current or experimental versions of the noninterview-adjusted weights.
- $\hat{B}_{NI-ADJ} = \hat{Y}^i_{NI-ADJ} - \hat{Y}^i_{NIFM}$ is the estimated bias in $\hat{Y}^i_{NI-ADJ}$ due to using either the current or experimental versions of the noninterview-adjusted weights instead of the WNIFM weights (it is assumed that estimates formed using the WNIFM weights are unbiased).
- $\hat{Y}^i_{NIFM}$ is the estimate of characteristic Y in tract i using the WNIFM weights.
- $\widehat{Var}\left(\hat{Y}^i_{NI-ADJ}\right)$ is the estimated variance of $\hat{Y}^i_{NI-ADJ}$.

Therefore, the relative MSE was computed as:

$$\widehat{relMSE}\left(\hat{Y}^i_{NI-ADJ}\right) = \frac{\widehat{MSE}\left(\hat{Y}^i_{NI-ADJ}\right)}{\left[\hat{Y}^i_{NI-ADJ}\right]^2}.$$

The relative MSE was relative to the square estimate so that it would be unitless (similar to a CV).

3.3.2 Relative Change in Relative Mean Square Error

In order to determine whether the current or experimental weights produced higher quality estimates, the relative change in the relative MSE when using the experimental noninterview-adjusted weights compared to the current noninterview-adjusted weights was computed. This quantity was computed as:

$$\Delta\left[\widehat{relMSE}\left(\hat{Y}^i_{NI-ADJ}\right)\right] = \frac{\widehat{relMSE}_{EXP}\left(\hat{Y}^i_{NI-ADJ}\right) - \widehat{relMSE}_{CUR}\left(\hat{Y}^i_{NI-ADJ}\right)}{\widehat{relMSE}_{CUR}\left(\hat{Y}^i_{NI-ADJ}\right)},$$

where:

- $\widehat{relMSE}_{EXP}\left(\hat{Y}^i_{NI-ADJ}\right)$ is $\widehat{relMSE}\left(\hat{Y}^i_{NI-ADJ}\right)$ using the experimental noninterview-adjusted weights.
- $\widehat{relMSE}_{CUR}\left(\hat{Y}^i_{NI-ADJ}\right)$ is $\widehat{relMSE}\left(\hat{Y}^i_{NI-ADJ}\right)$ using the current noninterview-adjusted weights.

3.3.3 Relative Variance and Relative Square Bias

The relative variance and relative square bias were computed so that they would be unitless quantities. Therefore, the relative variance was computed as:

$$\widehat{relvar}\left(\hat{Y}^i_{NI-ADJ}\right) = \frac{\widehat{Var}\left(\hat{Y}^i_{NI-ADJ}\right)}{\left[\hat{Y}^i_{NI-ADJ}\right]^2}.$$

The relative square bias was computed as:

$$\widehat{rel\_sq\_bias}\left(\hat{Y}^i_{NI-ADJ}\right) = \frac{\hat{B}^2_{NI-ADJ}}{\left[\hat{Y}^i_{NI-ADJ}\right]^2}.$$

3.4 Change in Final Estimate Analyses

3.4.1 Percentage Point Change in Final Estimate

The percentage point change in the estimate when using the experimental version of the final weights to form the estimate instead of the current version of the final weights was obtained for each estimate in order to determine the impact that simplifying the noninterview adjustment would have on the estimates when using the weights that are applied to published estimates. The percentage point change in the estimate in tract *i* was computed as:

$$\Delta\left[\hat{Y}^i_{FINAL}(CUR \rightarrow EXP)\right] = \hat{Y}^i_{FINAL,EXP} - \hat{Y}^i_{FINAL,CUR},$$

where:

- $\hat{Y}^i_{FINAL,EXP}$ is the estimate of characteristic Y in tract *i* when using the experimental version of the final HU-level or person-level weights to form the estimates.
- $\hat{Y}^i_{FINAL,CUR}$ is the estimate of characteristic Y in tract *i* when using the current version of the final HU-level or person-level weights to form the estimates.

3.4.2 Significant Changes in Estimates from 2014 to 2015

The percent of 5-year estimates that significantly changed from 2014 to 2015 was computed when the 2015 5-year estimates were formed using the current version of the final HU-level or person-level weights and when they were formed using the experimental version of the final HU-level or person-level weights (2014 5-year estimates were always formed using the current version of the final HU-level or person-

level weights). This was done in order to determine if simplifying the noninterview adjustment would cause the estimates to change any more than they normally do because of the year-to-year changes that estimates experience. *Z*-tests were conducted at the 10 percent significance level and used to decide whether an estimate significantly changed from 2014 to 2015. For a given estimate and weight in state, county, or tract *i*, the *z*-statistic was computed using the following equation:

$$z\left(\hat{Y}^i_{2015,WGT} - \hat{Y}^i_{2014,CUR}\right) = \frac{\hat{Y}^i_{2015,WGT} - \hat{Y}^i_{2014,CUR}}{se\left(\hat{Y}^i_{2015,WGT} - \hat{Y}^i_{2014,CUR}\right)},$$

where:

- $se\left(\hat{Y}^i_{2015,WGT} - \hat{Y}^i_{2014,CUR}\right) = \sqrt{\frac{1}{5}\left(\widehat{Var}\left(\hat{Y}^i_{2015,WGT}\right) + \widehat{Var}\left(\hat{Y}^i_{2014,CUR}\right)\right)}$ is the estimated standard error of $\hat{Y}^i_{2015,WGT} - \hat{Y}^i_{2014,CUR}$.
- $\widehat{Var}\left(\hat{Y}^i_{2015,WGT}\right)$ is the estimated variance of $\hat{Y}^i_{2015,WGT}$.
- $\widehat{Var}\left(\hat{Y}^i_{2014,CUR}\right)$ is the estimated variance of $\hat{Y}^i_{2014,CUR}$.
- $\hat{Y}^i_{2015,WGT}$ is the 2015 5-year estimate of characteristic Y in state, county, or tract *i* when using either the current version (CUR) or experimental version (EXP) of the final HU-level or person-level weights to form the estimates.
- $\hat{Y}^i_{2014,CUR}$ is the 2014 5-year estimate of characteristic Y in state, county, or tract *i* when using the current version of the final HU-level or person-level weights to form the estimates.
- $WGT =$ CUR or EXP.

If the absolute value of the *z*-statistic was greater than 1.645, then the change was considered significant. Otherwise, it was not considered significant.

After computing whether the change in each estimate from 2014 to 2015 was significant, the percent of changes that were significant for a given characteristic and geographic area was obtained for both $WGT =$ CUR and $WGT =$ EXP.

3.5 Limitations

The following limitations apply to all three sets of analyses:

- The number of characteristics that were examined was relatively small compared to the number of characteristics for which the ACS publishes estimates.
- The analyses mainly focus on tract-level estimates because we were interested in the impact that simplifying the noninterview adjustment would have on small area estimates, but there are also other small area geographies, such as places, that may show different results.
- Although the HU nonresponse rate for the ACS is currently low, it has been increasing over the past couple of years (U.S. Census Bureau, 2017) and could continue to increase, making nonresponse bias a larger issue.
- Since the change distributions examined are for tract-level estimates, nonparametric tests, such as the sign test, that could determine whether the distributions are significantly skewed in one direction are not useful because they will nearly always have a significant result due to the large number of tract-level estimates. As an alternative to nonparametric tests, we compared mirror

percentiles of the distributions (25th and 75th percentiles, 5th and 95th percentiles, etc.) to each other in most of the change distribution analyses.
- Estimated proportions equal to zero or one were excluded from our analyses (the reasons for this are given in Section 3.1.4).

Sections 3.5.1 – 3.5.3 describe the limitations that apply to one or more sets of analyses.

3.5.1 Examining the Effects of each Noninterview Adjustment Factor

The analyses examining the effects of each noninterview adjustment factor have the following limitations:

- The results shown are for changes after each noninterview adjustment factor is applied to the most recent weight (NIF1 is applied to the WVMS weights, NIF2 is applied to the WNIF1 weights, and MBF is applied to the WNIF2 weights), so it is unclear what effects NIF1 and NIF2 would have on the estimates, their CVs, and tract-level weight variation if NIF2 were applied to the weights before NIF1.

3.5.2 Mean Square Error, Variance, and Bias Analyses

The MSE, variance, and bias analyses have the following limitations:

- It is assumed that estimates formed using the WNIFM weights are unbiased, but this is probably not true. We are really only measuring the bias caused by using noninterview adjustments different from NIFM. The current and experimental noninterview-adjusted weights may even produce estimates with less nonresponse bias than estimates formed using the WNIFM weights.
- Adeshiyan (1998) shows that if the estimate formed using the WNIFM weights is used as a benchmark for bias computation, then the square bias of estimates formed using noninterview-adjusted weights is equal to $E\left(\hat{B}^2_{NI-ADJ}\right) - Var\left(\hat{Y}^i_{NI-ADJ} - \hat{Y}^i_{NIFM}\right)$. The paper suggests that the square bias should be estimated using the estimator $\hat{B}^2_{NI-ADJ} - \widehat{Var}\left(\hat{Y}^i_{NI-ADJ} - \hat{Y}^i_{NIFM}\right)$. We tried using this estimator, but found that $\widehat{Var}\left(\hat{Y}^i_{NI-ADJ} - \hat{Y}^i_{NIFM}\right)$ was often greater than $\hat{B}^2_{NI-ADJ}$, causing the square bias estimates to be negative. Therefore, we chose to estimate the square bias of estimates using the estimator $\hat{B}^2_{NI-ADJ}$, which may be a more biased estimator than the one used in Adeshiyan (1998).
- In general, when an estimated proportion is less than 0.5, its variance will tend to increase as the estimate increases. Therefore, examining relative MSEs and relative variances will reduce changes in the variance and MSE that are just caused by the estimate increasing or decreasing. However, when an estimated proportion is greater than 0.5, its variance will tend to decrease as the estimate increases, which means that changes in the relative MSE and relative variance for estimated proportions greater than 0.5 may be more related to whether the estimate increased or decreased than to simplifying the noninterview adjustment. Many of the person-level estimates examined were above 0.5, but only about five percent of the HU-level estimates examined were above 0.5. The overall findings from the HU-level characteristics were not different from the overall findings from the person-level characteristics, so this does not appear to be a major

concern. A similar limitation applies to the change in the CVs of estimates analysis described in Section 3.2.1.

3.5.3 Change in Final Estimate Analyses

The change in final estimate analyses have the following limitations:

- For each characteristic, geography, and type (current final weight or experimental final weight) of 2015 5-year estimate, the percent of estimates that significantly changed from 2014 to 2015 is shown, but the magnitude of the estimate change from 2014 to 2015 for each estimate is not shown. Therefore, it is unclear how much an estimate actually changed when using the experimental final weights instead of the current final weights to form the 2015 5-year estimate caused the result of the significance test to change.

4. Results

Overall, the results of the analyses suggested that simplifying the noninterview adjustment by removing the NIF2 and MBF adjustment factors from the HU weighting would cause little change in published tract-level estimates and would not notably affect their quality.

4.1 Survey Estimates Used in Analyses

Table 2 shows the number of estimates used in each analysis by results section number in this paper, geography, characteristic, and whether current methodology or experimental methodology weights were used to form 2015 5-year estimates. If no estimates were excluded, then for each examined characteristic, the tract-level analyses could have included up to 73,310 estimates, the county-level analyses could have included up to 3,220 estimates, and the state-level analyses could have included up to 52 estimates (the 50 states, the District of Columbia, and Puerto Rico).

Many tract-level estimates were excluded for several characteristics because of the estimate exclusion rule involving CVs that was used or because the estimated characteristic equaled 0 or 1, but each characteristic still included thousands of tracts. The smallest number of tracts included in a tract-level analysis was 6,976 for the Section 4.3 analyses of the proportion of persons who lived outside the U.S. and Puerto Rico one year ago (MIG2), so none of the tract-level analyses were limited by the number of estimates included.

A small percentage of county-level estimates were excluded for most characteristics examined except for MIG2, which included 1,840 and 1,833 county-level estimates in the two county-level analyses, and the proportion of HUs with a monthly electricity bill between $3 and $24 (ELEC2), which included 2,406 and 2,400 county-level estimates in the two county-level analyses.

Almost no estimates were excluded from the state-level analyses. The state-level analyses included 52 estimates for all characteristics except for the race and ethnicity characteristics. In order to create the race and ethnicity characteristics used in the analyses, we used variables from the HU weighting that are used to assign persons to demographic raking cells. These variables automatically assign all persons in Puerto Rico

to the same race and ethnicity (U.S. Census Bureau (2014) explains why this is done). Therefore, Puerto Rico was excluded from all of the race and ethnicity characteristic analyses.

Table 2 does not show the number of estimates used in Section 4.2.2 because tract-level weight variation was examined in this section. A total of 73,077 tracts were included in the Section 4.2.2 analyses.

4.2 Examining the Effects of each Noninterview Adjustment Factor

Based on the findings from the analyses in this section, we decided that the noninterview adjustment would be simplified to just NIF1 for each set of experimental weights that will be used in later analyses in this paper. NIF1 caused the largest changes in the estimates and was just as likely to decrease the CVs of the estimates as it was to increase them, suggesting that it should be kept in the noninterview adjustment process. NIF2 caused little movement in most estimates and their CVs, so removing it should have little impact on overall estimate quality. Removing MBF should reduce the overall CVs of estimates for most characteristics and may improve overall estimate quality.

4.2.1 Changes in Estimates and CVs of Estimates

Table 3 shows select percentiles of the distributions of the relative change in tract-level estimates after applying each noninterview adjustment factor (NIF1, NIF2, and MBF) to the HU weights, by characteristic. Table 4 shows select percentiles of the distributions of the relative change in the CVs of tract-level estimates after applying each noninterview adjustment factor to the HU weights, by characteristic.

Overall, it appears that the NIF1 adjustment factor caused the largest changes in the tract-level estimates for estimates near the tails of the estimate change distributions, while NIF2 and MBF caused the largest changes in the tract-level estimates for estimates that are closer to the middle of the estimate change distributions. NIF1 caused the largest changes in the estimates for most characteristics at the 0^{th}, 1^{st}, 5^{th}, 95^{th}, 99^{th}, and 100^{th} percentiles of the estimate change distributions, MBF caused the largest changes in the estimates for the majority of characteristics at the 50^{th} and 75^{th} percentiles, and NIF2 and MBF each caused the largest changes in the estimates at the 25^{th} percentile for about half of the characteristics examined.

The NIF2 adjustment factor appears to cause little to no change in most tract-level estimates, suggesting that removing it from the noninterview adjustment would not have a notable impact on estimate quality. For the average HU-level characteristic examined, at least 98 percent of its tract-level estimates experienced changes no greater than 2.18% in magnitude after applying NIF2 to the weights.[5] For the average person-level characteristic examined, at least 98 percent of its tract-level estimates experienced changes no greater than 1.70% in magnitude after applying NIF2 to the weights. These changes were notably smaller than the ones that the estimates experienced after applying NIF1 to the weights. For the average HU-level characteristic examined, at least 98 percent of its tract-level estimates experienced changes no greater than 3.95% in

[5] We obtained this statistic by computing the average magnitude of the estimate change after applying NIF2 to the weights at the 1^{st} percentile (1.86%) and at the 99^{th} percentile (2.18%) of the change distributions among the examined HU-level characteristics and then used the larger magnitude. Other statistics like this throughout the paper were obtained in a similar manner.

magnitude after applying NIF1 to the weights. For the average person-level characteristic examined, at least 98 percent of its tract-level estimates experienced changes no greater than 2.71% in magnitude after applying NIF1 to the weights.

The utility characteristics, which we thought NIF2 might affect more than other characteristics due to potential seasonal variation in gas and electric bills, did not notably deviate from the overall average HU-level characteristic. For the average utility characteristic, at least 98 percent of its tract-level estimates experienced changes no greater than 2.33% in magnitude after applying NIF2 to the weights and changes no greater than 3.98% in magnitude after applying NIF1 to the weights.

The changes in the estimates were about equally likely to be positive or negative after applying the NIF1 and NIF2 adjustment factors, but the magnitudes of the positive changes were generally larger than the magnitudes of the negative changes after applying NIF2 to the weights. The median change in the estimates after applying NIF1 to the weights was 0.00% for all examined characteristics except vacancy status, which had a median estimate change of -2.30% after applying NIF1 to the weights. The magnitude of the largest median estimate change after applying NIF2 to the weights for any characteristic was 0.06%. When looking at all of the characteristics examined, there was not a strong pattern regarding whether the magnitude of the change in the estimate after applying NIF1 to the weights was larger or smaller at the 25^{th} percentile vs the 75^{th} percentile, at the 5^{th} percentile vs the 95^{th} percentile, or at the 1^{st} percentile vs the 99^{th} percentile, but the magnitude of the change at the 100^{th} percentile was generally larger than it was at the 0^{th} percentile. However, for most of the examined characteristics, the magnitude of the change in the estimate after applying NIF2 to the weights was larger at the 25^{th} percentile than at the 75^{th} percentile, smaller at the 5^{th} percentile than at the 95^{th} percentile, smaller at the 1^{st} percentile than at the 99^{th} percentile, and smaller at the 0^{th} percentile than at the 100^{th} percentile.

The changes in the estimates after applying the MBF adjustment factor were often systematic. For 11 out of 36 of the examined characteristics, at least 75 percent of the estimates changed in one direction after applying MBF to the weights, suggesting that MBF causes more systematic changes in the estimates than NIF1 or NIF2.

The distributions of the changes in the CVs of the tract-level estimates after applying each noninterview adjustment factor to the weights followed similar patterns to the distributions of the changes in the tract-level estimates. However, the changes in the CVs after applying MBF were less systematic than the changes in the estimates after applying MBF and the median change in CV after applying MBF was positive for nearly all of the characteristics examined. This suggests that removing MBF from the HU weighting would reduce the variances of most estimates and could improve overall estimate quality. Also, for most characteristics, the magnitudes of the changes in the CV after applying NIF1 to the weights and after applying NIF2 to the weights were larger at the 75^{th} percentile than at the 25^{th} percentile, larger at the 95^{th} percentile than at the 5^{th} percentile, larger at the 99^{th} percentile than at the 1^{st} percentile, and larger at the 100^{th} percentile than at the 0^{th} percentile, suggesting that NIF1 and NIF2 both cause larger increases than decreases in the CVs of estimates. Additionally, the relative changes in the CVs of the estimates were generally smaller than the relative changes in the estimates.

4.2.2 Change in Weight Variation

Table 5 shows select percentiles of the distributions of the change in the CV of the weights within tracts after applying each noninterview adjustment factor.

Overall, it appears that NIF1 and NIF2 each caused a net increase in the CV of the weights within tracts. The median changes in the CV of the weights within tracts after applying NIF1 and NIF2 were 0.00% and 0.01%, respectively. Also, for both NIF1 and NIF2, the magnitude of the change was larger at the 75th percentile than at the 25th percentile, larger at the 95th percentile than at the 5th percentile, larger at the 99th percentile than at the 1st percentile, and larger at the 100th percentile than at the 0th percentile, suggesting that there was an overall net increase in weight variation within tracts after NIF1 and NIF2 were each applied to the weights.

MBF increased the CV of the weights within most tracts, suggesting that removing it from the HU weighting could reduce estimate variance. The median change in the CV of the weights within tracts after applying MBF to the weights was 0.52%. Also, the change in the CV of the weights within tracts after applying MBF was 0.22% at the 25th percentile, so at least 75% of tracts experienced increases in the CV of their weights after applying MBF.

4.3 Mean Square Error, Variance, and Bias Analyses

The findings from the mean square error, variance, and bias analyses suggest that the overall quality of estimates increases when using the experimental noninterview-adjusted weights instead of the current noninterview-adjusted weights to form the estimates, although the difference in overall quality between the two types of estimates appears to be very small. Therefore, it appears that the NIF2 and MBF adjustment factors could be removed from the HU weighting methodology without notably impacting estimate quality.

4.3.1 Relative Mean Square Error

Tables 6 and 7 show select percentiles of the distributions of the relative MSEs for tract-level estimates formed using the noninterview-adjusted weights by weight type (current vs experimental) for HU-level characteristics and person-level characteristics, respectively.

Overall, it appears that the distributions of relative MSEs for tract-level estimates formed using the experimental version of the noninterview-adjusted weights were nearly identical to those distributions when using the current version of the noninterview-adjusted weights to form the estimates. There are notable differences between the experimental and current noninterview-adjusted weight relative MSE distributions at the 100th percentile for most of the characteristics examined, but the values at the 100th percentile are the maximum values, which are usually outliers, so this is not a major concern.

4.3.2 Relative Change in Relative Mean Square Error

Tables 8 and 9 show select percentiles of the distributions of the relative change in relative MSE for tract-level estimates when using the experimental noninterview-adjusted

weights to form the estimates compared to the current noninterview-adjusted weights to form the estimates for HU-level characteristics and person-level characteristics, respectively.

Overall, it appears that for most characteristics, the tract-level estimates experienced a net decrease in relative MSE when using the experimental noninterview-adjusted weights instead of the current noninterview-adjusted weights. Out of the 40 HU-level characteristics and 13 person-level characteristics examined, three HU-level characteristics had positive median relative changes in relative MSE, two HU-level characteristics had median relative changes in relative MSE that equaled 0.00%, and three person-level characteristics had positive median relative changes in relative MSE. All other examined characteristics had negative median relative changes in relative MSE. Also, for almost all of the characteristics that had negative median relative changes in relative MSE, the magnitude of the relative change in relative MSE was greater at the 25^{th} percentile than at the 75^{th} percentile, greater at the 5^{th} percentile than at the 95^{th} percentile, and greater at the 1^{st} percentile than at the 99^{th} percentile, suggesting that the magnitude of the decreases in relative MSE was generally greater than the magnitude of the increases in relative MSE when using the experimental noninterview-adjusted weights instead of the current noninterview-adjusted weights to form the estimates.

The three HU-level characteristics with positive median relative changes in relative MSE were the proportion of HUs that were rented (TEN3), the proportion of HUs that had no gas bill or did not use gas (GAS1), and the proportion of HUs that were in poverty (HPOV). TEN3 had a median relative change in relative MSE equal to 1.40%, GAS1 had a median relative change in relative MSE equal to 0.11%, and HPOV had a median relative change in relative MSE equal to 0.05%. TEN3 is formed using the household tenure variable, which is one of the variables that defines the cells used in the MBF adjustment factor, so it is not surprising that removing the MBF adjustment factor from the noninterview adjustment could have an overall negative impact on TEN3 estimates. Also, we believe that gas and other utility bills may be highly seasonal, so it is not surprising that removing NIF2 from the HU weighting could cause the overall relative MSE of GAS1 estimates to increase. However, since the other 20 utility characteristics examined experienced negative median relative changes in relative MSE, this is not a major concern. It is also possible that the overall increase in relative MSE for GAS1 was caused by removing MBF since some apartment renters are not charged for gas that heats their apartments, so there may be a relationship between having no gas bill and household tenure. Even though the median relative change in relative MSE for HPOV was positive, it was only 0.05%, which is very small.

The three person-level characteristics with positive median relative changes in relative MSE were the proportion of persons whose race was Black alone (RACE2), the proportion of persons that lived in a different HU in the United States or Puerto Rico one year ago (MIG3), and the proportion of persons that were Hispanic (HISP). RACE2 had a median relative change in relative MSE equal to 0.06%, MIG3 had a median relative change in relative MSE equal to 0.04%, and HISP had a median relative change in relative MSE equal to 0.01%, which are each very small and not a major concern.

4.3.3 Relative Variance and Relative Square Bias

Tables 10 and 11 show select percentiles of the distributions of the relative variance for tract-level estimates formed using the noninterview-adjusted weights by weight type

(current vs experimental) for HU-level characteristics and person-level characteristics, respectively. Tables 12 and 13 show select percentiles of the distributions of the relative square bias for tract-level estimates formed using the noninterview-adjusted weights by weight type (current vs experimental) for HU-level characteristics and person-level characteristics, respectively.

Overall, it appears that the relative variance distributions in Tables 10 and 11 were usually very close to the relative MSE distributions in Tables 6 and 7. This indicates that the bias caused by forming the estimates using weights with noninterview adjustments different from NIFM generally had little impact on overall estimate quality. Also, the relative variance was generally slightly smaller when using the experimental weights instead of the current weights. The average examined characteristic had a median relative variance of 8.14% when using the current noninterview-adjusted weights and 8.12% when using the experimental noninterview-adjusted weights. At the 99th percentile of the tract-level distributions, the average examined characteristic had a relative variance of 27.58% when using the current noninterview-adjusted weights and 27.53% when using the experimental noninterview-adjusted weights.

Based on the relative square bias distributions shown in Tables 12 and 13, it appears that the estimates formed using the experimental noninterview-adjusted weights were generally slightly more biased than the estimates formed using the current noninterview-adjusted weights, but the relative square bias of the estimates was usually very small. The average median relative square bias among the HU-level and person-level characteristics examined was 0.01% when using the current noninterview-adjusted weights and 0.02% when using the experimental noninterview-adjusted weights. Also, at the 99th percentile, the average relative square bias among the HU-level and person-level characteristics examined was 0.65% when using the current noninterview-adjusted weights and 0.73% when using the experimental noninterview-adjusted weights. Although the relative square bias was usually slightly larger when using the experimental noninterview-adjusted weights instead of the current noninterview-adjusted weights, the increase in bias was generally not noticeable when examining the relative MSEs of the estimates because the relative variance generally decreased when using the experimental noninterview-adjusted weights instead of the current noninterview-adjusted weights, cancelling out most or all of the increase in bias.

4.4 Change in Final Estimate Analyses

The analyses performed to examine the changes in the final estimates caused by simplifying the noninterview adjustment found that using the experimental final weights instead of the current final weights usually caused little change in the final estimates, suggesting that simplifying the noninterview adjustment would have little impact on published estimates.

4.4.1 Percentage Point Change in Final Estimate

Tables 14 and 15 show select percentiles of the distributions of percentage point changes in tract-level estimates when using the experimental final weights instead of the current final weights for the examined HU-level and person-level characteristics, respectively.

Overall, using the experimental final weights instead of the current final weights caused little change in most of the tract-level estimates. Only three characteristics had median

percentage point changes that were greater than 0.10 percentage points in magnitude. Also, at least 98 percent of the tract-level estimates for 37 out of 40 HU-level characteristics and all 13 person-level characteristics experienced percentage point changes that were less than 1.00 percentage points in magnitude.

4.4.2 Significant Changes in Estimates from 2014 to 2015

Tables 16 and 17 show the percent of 2015 5-year state-level, county-level, and tract-level estimates that significantly changed from the 2014 5-year estimates when using the current and experimental final weights for the 2015 5-year estimates for HU-level and person-level characteristics, respectively. They also show the difference in the percent of significant changes when using the experimental final weights instead of the current final weights to form the 2015 5-year estimates.

Overall, it appears that using the experimental final weights instead of the current final weights to form 2015 5-year estimates had little impact on the percent of 5-year county-level and tract-level estimates that significantly changed from 2014 to 2015, but it had a notable impact on the percent of 5-year state-level estimates that significantly changed from 2014 to 2015.

At the tract level, 36 out of 40 HU-level characteristics and all 13 person-level characteristics experienced changes in the percent of their estimates with significant changes from 2014 to 2015 that were less than 0.20 percentage points in magnitude. The largest change in the percent of significant changes between 2014 and 2015 5-year tract-level estimates that any characteristic experienced was 0.49 percentage points in magnitude.

At the county level, the change in the percent of significant changes from 2014 to 2015 was generally larger than at the tract level, but it was less than 1.00 percentage points in magnitude for 37 out of 40 HU-level characteristics and 12 out of 13 person-level characteristics. The three HU-level characteristics that experienced changes in the percent of significant changes in their county-level estimates that were larger than 1.00 percentage points were all formed using the household tenure variable. It is not surprising that they experienced larger changes since household tenure is used as one of the variables to define the adjustment cells for the MBF adjustment factor.

At the state level, the change in the percent of significant changes from 2014 to 2015 was usually much larger than at the county or tract levels for HU-level characteristics. The absolute value of the change in the percent of significant changes from 2014 to 2015 was about 4.42 percentage points for the average HU-level characteristic. However, since each characteristic can only have up to 52 state-level estimates, the change in the percent of estimates that significantly changed from 2014 to 2015 can be misleading. For example, if the number of estimates that significantly changed from 2014 to 2015 increased by one estimate, that would represent an increase of about 1.92 percentage points. Therefore, an average absolute change of 4.42 percentage points indicates that the number of 5-year state-level estimates that significantly changed from 2014 to 2015 increased or decreased by about two or three estimates on average. Also, compared to county-level and tract-level estimates, very small changes in state-level estimates can be statistically significant since state-level estimates are generally formed using larger sample sizes and therefore have smaller standard errors.

At the state level, there was no change in the percent of significant changes from 2014 to 2015 for most of the person-level characteristics that were examined. Eleven out of 13 of the examined characteristics had no change in the percent of significant changes from 2014 to 2015. The percent of 5-year state-level estimates that significantly changed from 2014 to 2015 increased by 7.69 percentage points (four estimates) for two of the characteristics formed using the mobility status variable.

5. Discussion

5.1 Conclusions

Overall, it appears that simplifying the noninterview adjustment used in the ACS HU weighting to only NIF1 would have no notable impact on overall estimate quality. Small, local geography and building type appear to sufficiently account for the nonresponse bias of estimates without notably increasing their variances. Although simplifying the noninterview adjustment appears to slightly increase the overall bias of estimates, the reduction in variance cancels out this increase in bias. Therefore, starting with data year 2017, the noninterview adjustment in the ACS HU weighting methodology will be simplified to only NIF1.

5.2 Future Research

Based on the findings from this study, some ideas for future research regarding the noninterview adjustment used in the ACS HU weighting include:

- Using one noninterview adjustment factor defined by tract.
- Using no noninterview adjustment factors.

Both of these ideas would probably increase the bias of estimates, but they may also decrease their variances by enough to cancel out the increase in bias.

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Table 1. Definitions for Characteristics (Char.) in Tables

Variable	Char.	Definition
Household Type	HHT1	Family household, Married-couple
	HHT2	Family household, Male reference person, No Spouse
	HHT3	Family household, Female reference person, No Spouse
	HHT4	Nonfamily household, Male reference person, Living Alone
	HHT5	Nonfamily household, Male reference person, Not Living Alone
	HHT6	Nonfamily household, Female reference person, Living Alone
	HHT7	Nonfamily household, Female reference person, Not Living Alone
Household Poverty Status	HPOV	Income in the past 12 months below poverty level
Household Tenure	TEN1	Owned with a mortgage
	TEN2	Owned free and clear
	TEN3	Rented
	TEN4	Occupied without payment of rent
Number of Persons in Housing Unit (HU)	NP1	Number of Persons in HU = 1
	NP2	Number of Persons in HU = 2
	NP3	Number of Persons in HU = 3
	NP4	Number of Persons in HU = 4
	NP5	Number of Persons in HU = 5
	NP6	Number of Persons in HU $\geq$ 6
Vacancy Status	VAC	Vacant HU
Monthly HU Electricity Cost	ELEC1	Electricity Not Used or No Charge
	ELEC2	\$3 $\leq$ Monthly Electricity Cost $\leq$ \$24
	ELEC3	\$25 $\leq$ Monthly Electricity Cost $\leq$ \$49
	ELEC4	\$50 $\leq$ Monthly Electricity Cost $\leq$ \$74
	ELEC5	\$75 $\leq$ Monthly Electricity Cost $\leq$ \$99
	ELEC6	\$100 $\leq$ Monthly Electricity Cost $\leq$ \$149
	ELEC7	\$150 $\leq$ Monthly Electricity Cost $\leq$ \$199
	ELEC8	Monthly Electricity Cost $\geq$ \$200
Monthly HU Gas Cost	GAS1	Gas Not Used or No Charge
	GAS2	\$4 $\leq$ Monthly Gas Cost $\leq$ \$24
	GAS3	\$25 $\leq$ Monthly Gas Cost $\leq$ \$49
	GAS4	\$50 $\leq$ Monthly Gas Cost $\leq$ \$74
	GAS5	\$75 $\leq$ Monthly Gas Cost $\leq$ \$99
	GAS6	\$100 $\leq$ Monthly Gas Cost $\leq$ \$149
	GAS7	\$150 $\leq$ Monthly Gas Cost $\leq$ \$199
	GAS8	Monthly Gas Cost $\geq$ \$200
Average Monthly HU Water Cost	WATER1	No Water Charge
	WATER2	\$0.25 $\leq$ Average Monthly Water Cost $\leq$ \$25
	WATER3	\$25 < Average Monthly Water Cost $\leq$ \$50
	WATER4	\$50 < Average Monthly Water Cost $\leq$ \$75
	WATER5	Average Monthly Water Cost > \$75
Ethnicity	HISP	Hispanic
Employment Status	EMP1	Employed
	EMP2	Unemployed
	EMP3	Not in Labor Force
Race	RACE1	White Alone
	RACE2	Black Alone
	RACE3	Some Other Race
High School Graduation Status	HS	Graduated High School
4-Year College Graduation Status	COLL	Has Bachelor's Degree
Health Insurance Coverage	INSUR	Has Health Insurance
Mobility Status	MIG1	Person lived in this HU 1 year ago
	MIG2	Person lived outside the U.S. and P.R. 1 year ago
	MIG3	Person lived in a different HU in the U.S. or P.R. 1 year ago

Source: U.S. Census Bureau, 2011-2015 American Community Survey Data Dictionary
Note: The definitions for some characteristics were written by the authors.

Table 2. Number of Estimates Used in Analyses, by Characteristic (Char.), Paper Results Section Number, Geography, and Type of Ending Weight

	Section 4.2.1	Section 4.3	Section 4.4.1	Section 4.4.2					
	Tract	Tract	Tract	State		County		Tract	
Char.	EXP	EXP	EXP	CUR	EXP	CUR	EXP	CUR	EXP
HHT1	72,886	72,857	72,888	52	52	3,220	3,220	72,903	72,904
HHT2	57,651	57,566	58,732	52	52	3,185	3,182	61,853	61,877
HHT3	71,406	71,376	71,515	52	52	3,211	3,211	71,849	71,848
HHT4	71,718	71,684	71,817	52	52	3,220	3,220	72,099	72,103
HHT5	42,216	42,137	43,394	52	52	3,104	3,100	47,212	47,220
HHT6	72,284	72,251	72,308	52	52	3,220	3,220	72,395	72,409
HHT7	37,493	37,433	38,122	52	52	3,025	3,027	41,897	41,795
HPOV	70,499	70,467	70,722	52	52	3,220	3,219	71,249	71,259
TEN1	71,987	71,958	71,970	52	52	3,217	3,217	72,055	72,055
TEN2	71,538	71,506	71,504	52	52	3,219	3,219	71,627	71,627
TEN3	72,165	72,137	72,239	52	52	3,220	3,220	72,336	72,330
TEN4	26,294	26,233	27,157	52	52	3,213	3,211	30,277	30,237
NP1	*	72,798	72,828	52	52	3,220	3,220	72,850	72,847
NP2	*	72,899	72,928	52	52	3,220	3,220	72,933	72,932
NP3	*	72,460	72,512	52	52	3,218	3,218	72,608	72,610
NP4	*	71,130	71,295	52	52	3,215	3,215	71,632	71,629
NP5	*	61,351	62,421	52	52	3,208	3,207	64,660	64,681
NP6	*	44,365	47,082	52	52	3,164	3,164	50,951	50,927
VAC	62,104	62,025	62,964	52	52	3,220	3,220	65,241	65,241
ELEC1	12,905	12,864	12,980	52	52	2,887	2,895	14,266	14,256
ELEC2	18,777	18,753	18,984	52	52	2,406	2,400	20,913	20,893
ELEC3	58,612	58,555	58,793	52	52	3,174	3,174	60,787	60,792
ELEC4	70,468	70,434	70,549	52	52	3,214	3,213	70,952	70,954
ELEC5	71,785	71,751	71,768	52	52	3,214	3,214	72,056	72,045
ELEC6	72,602	72,572	72,615	52	52	3,218	3,219	72,661	72,662
ELEC7	71,300	71,267	71,301	52	52	3,219	3,219	71,613	71,611
ELEC8	71,202	71,167	71,245	52	52	3,219	3,219	71,554	71,570
GAS1	68,583	68,541	68,731	52	52	3,219	3,219	69,174	69,190
GAS2	60,588	60,539	60,760	52	52	3,193	3,190	62,224	62,234
GAS3	67,299	67,256	67,301	52	52	3,204	3,205	68,119	68,126
GAS4	64,287	64,245	64,273	52	52	3,200	3,200	65,284	65,279
GAS5	56,161	56,117	56,135	52	52	3,182	3,182	58,608	58,613
GAS6	59,166	59,118	59,195	52	52	3,204	3,204	61,028	61,055
GAS7	43,636	43,581	43,807	52	52	3,090	3,095	46,900	46,930
GAS8	47,025	46,981	47,197	52	52	3,150	3,151	50,190	50,219
WATER1	*	59,504	59,929	52	52	3,220	3,220	61,629	61,620
WATER2	*	70,633	70,613	52	52	3,213	3,213	70,865	70,877
WATER3	*	68,676	68,711	52	52	3,212	3,212	69,527	69,520
WATER4	*	66,659	66,711	52	52	3,208	3,208	67,446	67,433
WATER5	*	64,712	64,764	52	52	3,199	3,198	65,692	65,705
HISP	56,772	56,717	57,864	51	51	3,035	3,037	59,842	59,860
EMP1	73,029	72,989	73,050	52	52	3,220	3,220	73,033	73,033
EMP2	70,702	70,660	70,728	52	52	3,196	3,193	71,673	71,679
EMP3	72,999	72,960	73,012	52	52	3,220	3,220	73,001	73,001
RACE1	70,838	70,800	70,860	51	51	3,128	3,128	70,754	70,754
RACE2	50,416	50,345	51,060	51	51	2,809	2,808	53,118	53,154
RACE3	52,198	52,120	52,843	51	51	3,014	3,015	55,474	55,468
HS	*	72,979	73,033	52	52	3,220	3,220	73,017	73,019
COLL	*	72,736	72,770	52	52	3,219	3,219	72,827	72,829
INSUR	*	72,871	72,911	52	52	3,220	3,220	72,877	72,877
MIG1	*	72,923	72,959	52	52	3,218	3,218	72,928	72,929
MIG2	*	6,976	7,156	52	52	1,840	1,833	8,434	8,403
MIG3	*	72,090	72,228	52	52	3,216	3,215	72,528	72,532

*This characteristic was not included in the Section 4.2.1 analyses.
Source: U.S. Census Bureau, 2010-2014 and 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 3. Distributions of Relative Changes in Tract-Level Estimates after Applying each Noninterview (NI) Adjustment Factor to HU Weights, by Characteristic (Char.)

		Percentile								
Char.	**NI Factor**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HHT1	NIF1	-14.72	-3.03	-1.44	-0.09	0.00	0.08	0.61	1.63	12.98
	NIF2	-4.01	-0.78	-0.35	-0.08	0.00	0.08	0.35	0.80	6.44
	MBF	-4.37	-1.82	-1.21	-0.61	-0.35	-0.17	0.01	0.19	6.15
HHT2	NIF1	-13.66	-3.36	-1.50	-0.11	0.00	0.13	1.27	3.69	23.60
	NIF2	-9.84	-2.42	-1.24	-0.35	-0.02	0.30	1.27	2.89	30.22
	MBF	-11.83	-1.35	-0.60	-0.03	0.26	0.65	1.59	2.84	17.45
HHT3	NIF1	-14.74	-2.35	-1.01	-0.09	0.00	0.09	1.11	3.13	29.22
	NIF2	-10.16	-1.75	-0.86	-0.23	-0.01	0.20	0.85	2.01	14.20
	MBF	-6.73	-0.82	-0.26	0.10	0.34	0.66	1.40	2.35	8.77
HHT4	NIF1	-11.31	-2.40	-1.04	-0.11	0.00	0.12	1.89	4.81	36.95
	NIF2	-8.88	-1.79	-0.88	-0.24	-0.01	0.22	0.92	2.06	14.55
	MBF	-7.02	-0.75	-0.28	0.08	0.31	0.63	1.31	2.17	7.98
HHT5	NIF1	-19.55	-3.24	-1.52	-0.15	0.00	0.17	1.85	5.24	45.71
	NIF2	-11.78	-2.69	-1.37	-0.39	-0.03	0.33	1.41	3.33	25.34
	MBF	-13.27	-1.18	-0.42	0.10	0.43	0.87	1.90	3.24	14.36
HHT6	NIF1	-14.26	-2.09	-0.93	-0.12	0.00	0.10	1.61	4.11	46.23
	NIF2	-8.72	-1.50	-0.73	-0.20	-0.01	0.19	0.76	1.74	11.32
	MBF	-6.48	-0.89	-0.42	-0.06	0.12	0.34	0.84	1.43	6.55
HHT7	NIF1	-13.65	-3.26	-1.55	-0.18	0.00	0.19	2.07	6.01	61.38
	NIF2	-10.33	-2.80	-1.38	-0.39	-0.03	0.34	1.48	3.51	24.92
	MBF	-13.46	-1.42	-0.51	0.06	0.40	0.83	1.82	3.11	13.98
HPOV	NIF1	-11.69	-2.42	-1.10	-0.13	0.00	0.12	2.04	5.29	31.72
	NIF2	-9.22	-1.74	-0.86	-0.23	-0.01	0.21	0.87	1.94	15.03
	MBF	-6.78	-0.57	-0.13	0.18	0.43	0.77	1.54	2.43	8.03
TEN1	NIF1	-20.07	-5.00	-2.40	-0.19	0.00	0.12	1.04	2.97	38.74
	NIF2	-5.36	-0.90	-0.40	-0.09	0.00	0.09	0.39	0.90	7.83
	MBF	-7.45	-2.69	-1.80	-0.94	-0.53	-0.26	-0.05	0.07	3.54
TEN2	NIF1	-20.49	-4.96	-2.34	-0.17	0.00	0.11	1.00	2.89	39.11
	NIF2	-4.42	-0.95	-0.46	-0.12	0.00	0.13	0.49	1.03	5.64
	MBF	-6.17	-2.72	-1.83	-0.97	-0.55	-0.27	-0.06	0.07	2.44
TEN3	NIF1	-11.94	-2.84	-1.43	-0.27	0.00	0.21	3.35	7.61	79.22
	NIF2	-7.55	-1.39	-0.62	-0.13	0.00	0.12	0.62	1.49	14.72
	MBF	-6.96	-0.02	0.17	0.62	1.05	1.60	2.69	4.07	12.90
TEN4	NIF1	-14.72	-3.44	-1.48	-0.05	0.00	0.10	1.08	3.58	37.11
	NIF2	-12.44	-2.91	-1.53	-0.46	-0.04	0.38	1.66	3.67	17.79
	MBF	-9.12	-1.29	-0.23	0.42	0.91	1.56	2.96	4.70	11.45
VAC	NIF1	-79.44	-13.19	-8.60	-4.28	-2.30	-0.99	0.00	0.00	6.40
	NIF2	-3.41	-0.64	-0.29	-0.07	0.00	0.07	0.28	0.60	11.96
	MBF	-3.24	-1.13	-0.68	-0.20	0.03	0.27	0.82	1.70	7.94
ELEC1	NIF1	-18.67	-4.61	-2.01	-0.21	0.00	0.19	2.80	7.60	45.72
	NIF2	-11.05	-3.49	-1.76	-0.50	-0.05	0.39	1.86	4.61	36.08
	MBF	-14.86	-1.94	-0.85	-0.09	0.28	0.78	1.98	3.56	12.87
ELEC2	NIF1	-12.50	-3.88	-1.92	-0.29	0.00	0.34	3.57	8.50	34.94
	NIF2	-8.94	-2.94	-1.40	-0.35	-0.02	0.31	1.57	4.22	35.50
	MBF	-14.24	-1.51	-0.68	-0.07	0.24	0.63	1.57	2.80	8.54
ELEC3	NIF1	-13.84	-3.08	-1.36	-0.16	0.00	0.17	2.55	6.64	58.61
	NIF2	-19.72	-2.27	-1.11	-0.28	-0.02	0.25	1.14	2.84	19.60
	MBF	-6.78	-1.26	-0.53	-0.04	0.19	0.50	1.25	2.29	11.73
ELEC4	NIF1	-17.84	-2.29	-0.96	-0.09	0.00	0.09	1.48	4.35	53.79
	NIF2	-8.82	-1.87	-0.88	-0.22	-0.01	0.20	0.91	2.17	14.12
	MBF	-7.60	-1.07	-0.50	-0.09	0.09	0.32	0.94	1.77	10.01
ELEC5	NIF1	-13.21	-2.39	-1.00	-0.08	0.00	0.08	1.07	3.23	25.26
	NIF2	-7.49	-1.72	-0.82	-0.21	-0.01	0.19	0.84	1.97	12.76
	MBF	-11.05	-1.15	-0.61	-0.18	0.01	0.22	0.75	1.47	10.78
ELEC6	NIF1	-14.90	-2.21	-0.92	-0.06	0.00	0.06	0.68	1.94	12.61
	NIF2	-5.95	-1.16	-0.56	-0.15	-0.01	0.14	0.56	1.23	8.40
	MBF	-4.26	-0.94	-0.53	-0.18	-0.03	0.11	0.43	0.86	6.64

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 3 (cont.). Distributions of Relative Changes in Tract-Level Estimates after Applying each Noninterview (NI) Adjustment Factor to HU Weights, by Characteristic (Char.)

		Percentile								
Char.	**NI Factor**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
ELEC7	NIF1	-18.95	-3.16	-1.38	-0.08	0.00	0.08	0.76	2.15	26.81
	NIF2	-10.12	-1.47	-0.70	-0.19	-0.01	0.17	0.70	1.55	14.70
	MBF	-5.32	-1.30	-0.78	-0.30	-0.09	0.07	0.46	0.92	5.42
ELEC8	NIF1	-18.95	-3.68	-1.72	-0.10	0.00	0.08	0.81	2.26	29.63
	NIF2	-8.05	-1.30	-0.63	-0.16	0.00	0.14	0.60	1.34	11.95
	MBF	-7.08	-1.41	-0.87	-0.35	-0.14	0.01	0.34	0.80	6.76
GAS1	NIF1	-16.51	-3.15	-1.35	-0.09	0.00	0.09	2.64	7.09	42.10
	NIF2	-8.81	-1.26	-0.57	-0.13	0.00	0.11	0.59	1.40	9.29
	MBF	-5.44	-0.53	-0.18	0.02	0.17	0.50	1.17	1.81	9.09
GAS2	NIF1	-22.65	-3.49	-1.48	-0.08	0.00	0.11	1.18	3.63	38.81
	NIF2	-7.73	-2.00	-0.96	-0.23	0.02	0.27	1.09	2.42	16.89
	MBF	-10.05	-1.77	-0.98	-0.32	-0.05	0.18	0.82	1.65	10.34
GAS3	NIF1	-16.05	-3.60	-1.49	-0.09	0.00	0.10	0.95	2.86	23.49
	NIF2	-6.95	-1.74	-0.81	-0.19	0.01	0.22	0.89	2.06	25.12
	MBF	-10.20	-1.69	-0.94	-0.32	-0.08	0.10	0.59	1.26	8.16
GAS4	NIF1	-16.61	-3.73	-1.69	-0.10	0.00	0.10	0.96	2.80	27.95
	NIF2	-9.85	-1.78	-0.87	-0.22	-0.01	0.21	0.89	2.08	11.40
	MBF	-7.87	-1.74	-0.98	-0.36	-0.11	0.10	0.61	1.30	5.99
GAS5	NIF1	-20.20	-4.10	-1.85	-0.11	0.00	0.11	0.97	2.67	38.68
	NIF2	-9.47	-2.10	-1.02	-0.28	-0.03	0.22	1.01	2.33	22.09
	MBF	-19.13	-1.96	-1.13	-0.45	-0.15	0.08	0.65	1.47	16.08
GAS6	NIF1	-15.61	-4.16	-1.90	-0.11	0.00	0.10	0.89	2.52	38.68
	NIF2	-13.20	-1.99	-0.96	-0.27	-0.04	0.19	0.92	2.13	17.14
	MBF	-9.11	-1.95	-1.15	-0.46	-0.18	0.03	0.50	1.20	8.53
GAS7	NIF1	-20.20	-4.30	-1.96	-0.10	0.00	0.10	0.91	2.72	44.20
	NIF2	-15.37	-2.30	-1.14	-0.34	-0.05	0.23	1.08	2.50	16.85
	MBF	-13.60	-2.13	-1.28	-0.53	-0.20	0.04	0.63	1.48	9.94
GAS8	NIF1	-22.11	-4.47	-1.95	-0.09	0.00	0.09	0.89	2.72	30.54
	NIF2	-10.21	-2.20	-1.12	-0.34	-0.06	0.21	1.03	2.35	14.85
	MBF	-9.10	-2.25	-1.32	-0.54	-0.21	0.02	0.57	1.38	8.80
HISP	NIF1	-12.10	-2.50	-1.04	-0.07	0.00	0.08	1.22	3.88	22.36
	NIF2	-11.30	-2.15	-1.01	-0.23	-0.01	0.19	1.00	2.54	27.23
	MBF	-13.65	-1.32	-0.58	-0.08	0.10	0.40	1.20	2.37	14.05
EMP1	NIF1	-6.59	-0.73	-0.27	-0.02	0.00	0.03	0.27	0.73	7.49
	NIF2	-2.97	-0.47	-0.21	-0.05	0.00	0.05	0.20	0.47	2.94
	MBF	-2.43	-0.31	-0.15	-0.03	0.02	0.08	0.22	0.41	2.02
EMP2	NIF1	-17.47	-2.35	-1.02	-0.08	0.00	0.09	1.10	3.30	32.17
	NIF2	-8.57	-2.04	-0.99	-0.27	-0.03	0.22	0.99	2.38	13.64
	MBF	-8.05	-1.12	-0.50	-0.07	0.15	0.43	1.11	2.05	11.20
EMP3	NIF1	-6.46	-1.27	-0.49	-0.04	0.00	0.03	0.42	1.11	7.57
	NIF2	-3.36	-0.61	-0.30	-0.08	0.00	0.08	0.31	0.65	4.68
	MBF	-2.87	-0.69	-0.41	-0.16	-0.06	0.02	0.17	0.37	2.06
RACE1	NIF1	-20.57	-1.35	-0.35	-0.01	0.00	0.01	0.22	0.89	34.51
	NIF2	-4.13	-0.53	-0.18	-0.03	0.00	0.03	0.18	0.52	15.18
	MBF	-4.33	-0.79	-0.32	-0.07	-0.01	0.01	0.11	0.39	6.63
RACE2	NIF1	-12.10	-2.60	-1.10	-0.08	0.00	0.10	1.78	5.15	48.07
	NIF2	-11.56	-2.08	-0.96	-0.24	-0.01	0.20	0.99	2.50	22.60
	MBF	-9.80	-1.08	-0.44	-0.01	0.20	0.56	1.36	2.39	11.77
RACE3	NIF1	-14.30	-2.89	-1.19	-0.08	0.00	0.09	1.26	3.93	96.81
	NIF2	-12.95	-2.32	-1.10	-0.27	-0.01	0.23	1.15	2.82	20.05
	MBF	-13.83	-1.72	-0.89	-0.29	-0.04	0.22	0.95	2.02	12.19

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 4. Distributions of Relative Changes in CVs of Tract-Level Estimates after Applying each Noninterview (NI) Adjustment Factor to HU Weights, by Characteristic (Char.)

		Percentile								
Char.	**NI Factor**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HHT1	NIF1	-9.93	-2.08	-0.92	-0.11	0.00	0.06	1.54	3.76	67.82
	NIF2	-15.40	-1.35	-0.65	-0.17	-0.01	0.15	0.61	1.35	7.19
	MBF	-8.60	-0.29	-0.03	0.23	0.46	0.79	1.63	2.70	12.05
HHT2	NIF1	-6.61	-1.42	-0.56	-0.03	0.00	0.03	0.64	1.90	13.99
	NIF2	-7.84	-1.33	-0.62	-0.15	-0.01	0.14	0.60	1.44	11.27
	MBF	-8.57	-0.72	-0.32	-0.05	0.05	0.22	0.75	1.69	10.58
HHT3	NIF1	-17.13	-1.61	-0.65	-0.05	0.00	0.05	0.76	2.06	13.24
	NIF2	-10.16	-1.32	-0.63	-0.16	-0.01	0.15	0.62	1.41	10.33
	MBF	-3.14	-0.69	-0.32	-0.06	0.06	0.23	0.76	1.60	7.49
HHT4	NIF1	-17.36	-2.03	-0.84	-0.06	0.00	0.07	0.84	2.28	16.98
	NIF2	-11.82	-1.44	-0.67	-0.18	-0.01	0.16	0.67	1.51	9.96
	MBF	-4.58	-0.67	-0.32	-0.06	0.06	0.23	0.75	1.56	9.33
HHT5	NIF1	-9.66	-1.67	-0.66	-0.04	0.00	0.05	0.70	2.07	17.84
	NIF2	-9.30	-1.44	-0.65	-0.16	-0.01	0.14	0.63	1.48	14.56
	MBF	-9.28	-0.78	-0.34	-0.06	0.04	0.19	0.69	1.57	8.69
HHT6	NIF1	-12.54	-2.08	-0.84	-0.06	0.00	0.09	0.94	2.45	20.40
	NIF2	-6.77	-1.44	-0.68	-0.17	-0.01	0.16	0.67	1.56	11.06
	MBF	-7.15	-0.63	-0.29	-0.04	0.08	0.25	0.71	1.46	4.98
HHT7	NIF1	-10.66	-1.71	-0.70	-0.04	0.00	0.06	0.77	2.23	16.44
	NIF2	-10.37	-1.42	-0.64	-0.15	0.00	0.15	0.64	1.57	18.07
	MBF	-6.05	-0.84	-0.36	-0.07	0.02	0.16	0.61	1.44	15.07
HPOV	NIF1	-21.11	-2.43	-0.98	-0.07	0.00	0.08	0.83	2.20	33.65
	NIF2	-9.72	-1.53	-0.70	-0.18	0.00	0.16	0.68	1.54	13.08
	MBF	-4.58	-0.79	-0.40	-0.11	0.02	0.19	0.72	1.59	10.33
TEN1	NIF1	-16.71	-3.20	-1.35	-0.16	0.00	0.03	1.58	3.97	78.26
	NIF2	-11.84	-1.19	-0.59	-0.16	0.00	0.15	0.58	1.20	8.54
	MBF	-4.56	-0.23	0.00	0.24	0.45	0.74	1.44	2.38	12.41
TEN2	NIF1	-23.48	-1.99	-0.82	-0.07	0.00	0.05	1.05	2.49	24.87
	NIF2	-6.07	-1.12	-0.54	-0.14	0.00	0.13	0.52	1.11	5.85
	MBF	-8.58	-0.30	-0.08	0.07	0.19	0.38	0.93	1.81	8.57
TEN3	NIF1	-32.36	-9.24	-4.55	-0.33	0.00	0.19	1.83	4.66	66.12
	NIF2	-13.40	-1.61	-0.74	-0.19	0.00	0.18	0.74	1.64	14.08
	MBF	-16.05	-2.49	-1.63	-0.82	-0.40	-0.07	0.66	1.73	11.07
TEN4	NIF1	-9.10	-1.23	-0.41	-0.01	0.00	0.01	0.44	1.50	11.38
	NIF2	-9.45	-1.63	-0.76	-0.19	-0.01	0.16	0.75	1.73	7.24
	MBF	-4.29	-1.17	-0.55	-0.12	0.00	0.15	0.89	2.04	12.57
VAC	NIF1	-5.13	-1.45	-0.70	-0.01	0.11	0.67	2.34	4.68	58.78
	NIF2	-3.12	-0.49	-0.20	-0.04	0.00	0.04	0.19	0.47	6.08
	MBF	-6.83	-0.56	-0.24	-0.04	0.01	0.07	0.29	0.62	5.82
ELEC1	NIF1	-12.39	-1.90	-0.67	-0.03	0.00	0.04	0.78	2.24	20.59
	NIF2	-7.63	-1.68	-0.73	-0.16	0.00	0.16	0.78	2.01	12.55
	MBF	-9.16	-1.03	-0.42	-0.08	0.01	0.12	0.63	1.62	10.25
ELEC2	NIF1	-14.16	-2.10	-0.83	-0.06	0.00	0.10	1.00	2.64	18.78
	NIF2	-7.08	-1.44	-0.62	-0.14	0.00	0.14	0.70	1.92	16.57
	MBF	-9.63	-0.84	-0.33	-0.06	0.02	0.12	0.51	1.21	6.08
ELEC3	NIF1	-15.27	-2.26	-0.90	-0.06	0.00	0.08	0.97	2.52	30.86
	NIF2	-23.69	-1.52	-0.69	-0.17	0.00	0.16	0.68	1.70	29.00
	MBF	-6.61	-0.75	-0.33	-0.06	0.05	0.20	0.65	1.45	9.55
ELEC4	NIF1	-20.07	-1.73	-0.70	-0.05	0.00	0.06	0.84	2.28	19.17
	NIF2	-11.35	-1.39	-0.65	-0.16	0.00	0.15	0.62	1.47	14.50
	MBF	-6.52	-0.63	-0.26	-0.03	0.09	0.25	0.72	1.51	8.20
ELEC5	NIF1	-8.03	-1.48	-0.61	-0.04	0.00	0.05	0.82	2.20	17.51
	NIF2	-7.12	-1.30	-0.62	-0.16	0.00	0.14	0.60	1.37	10.20
	MBF	-7.47	-0.55	-0.23	-0.02	0.10	0.28	0.75	1.51	7.01
ELEC6	NIF1	-7.87	-1.36	-0.58	-0.05	0.00	0.05	0.84	2.08	15.64
	NIF2	-8.07	-1.22	-0.57	-0.15	0.00	0.14	0.55	1.18	5.75
	MBF	-5.22	-0.42	-0.17	0.02	0.14	0.31	0.77	1.43	11.07

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 4 (cont.). Distributions of Relative Changes in CVs of Tract-Level Estimates after Applying each Noninterview (NI) Adjustment Factor to HU Weights, by Characteristic (Char.)

		Percentile								
Char.	**NI Factor**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
ELEC7	NIF1	-8.52	-1.35	-0.55	-0.04	0.00	0.04	0.78	2.07	19.11
	NIF2	-9.64	-1.20	-0.57	-0.15	-0.01	0.14	0.55	1.19	8.37
	MBF	-4.47	-0.43	-0.18	0.00	0.12	0.30	0.78	1.51	7.66
ELEC8	NIF1	-15.00	-1.79	-0.70	-0.06	0.00	0.04	0.96	2.47	18.16
	NIF2	-7.99	-1.22	-0.58	-0.15	-0.01	0.14	0.56	1.18	14.62
	MBF	-4.27	-0.41	-0.16	0.03	0.16	0.35	0.84	1.54	11.25
GAS1	NIF1	-24.50	-5.77	-2.29	-0.12	0.00	0.10	1.21	3.35	36.38
	NIF2	-11.27	-1.65	-0.80	-0.21	0.00	0.20	0.78	1.73	16.01
	MBF	-12.57	-1.25	-0.69	-0.20	-0.01	0.18	0.70	1.46	7.10
GAS2	NIF1	-10.83	-1.65	-0.61	-0.03	0.00	0.03	0.69	1.90	22.36
	NIF2	-6.44	-1.32	-0.62	-0.16	-0.01	0.13	0.58	1.34	11.31
	MBF	-8.83	-0.61	-0.26	-0.04	0.06	0.21	0.69	1.46	13.65
GAS3	NIF1	-8.93	-1.53	-0.62	-0.04	0.00	0.04	0.79	2.13	19.84
	NIF2	-10.62	-1.24	-0.60	-0.16	-0.01	0.13	0.57	1.29	8.84
	MBF	-4.28	-0.56	-0.23	-0.02	0.09	0.26	0.71	1.44	8.26
GAS4	NIF1	-7.21	-1.38	-0.53	-0.03	0.00	0.04	0.74	1.94	13.57
	NIF2	-8.15	-1.19	-0.56	-0.15	0.00	0.13	0.55	1.24	8.94
	MBF	-3.35	-0.56	-0.24	-0.02	0.08	0.25	0.72	1.47	7.87
GAS5	NIF1	-11.17	-1.25	-0.47	-0.03	0.00	0.03	0.61	1.72	11.78
	NIF2	-7.78	-1.17	-0.56	-0.14	0.00	0.13	0.55	1.23	9.38
	MBF	-6.65	-0.57	-0.24	-0.03	0.06	0.22	0.68	1.41	8.86
GAS6	NIF1	-8.34	-1.32	-0.50	-0.03	0.00	0.03	0.69	1.88	13.87
	NIF2	-8.17	-1.22	-0.57	-0.14	0.00	0.14	0.56	1.25	14.61
	MBF	-4.74	-0.55	-0.23	-0.02	0.08	0.25	0.72	1.50	7.48
GAS7	NIF1	-8.91	-1.22	-0.41	-0.02	0.00	0.02	0.53	1.56	15.22
	NIF2	-7.11	-1.18	-0.54	-0.14	0.00	0.13	0.53	1.21	7.43
	MBF	-4.58	-0.61	-0.25	-0.04	0.05	0.18	0.65	1.39	8.35
GAS8	NIF1	-10.95	-1.36	-0.47	-0.02	0.00	0.02	0.63	1.84	14.45
	NIF2	-5.16	-1.24	-0.58	-0.15	0.00	0.15	0.57	1.27	15.62
	MBF	-5.68	-0.62	-0.25	-0.03	0.06	0.22	0.70	1.44	11.05
HISP	NIF1	-15.64	-2.12	-0.88	-0.04	0.00	0.05	0.74	2.10	15.62
	NIF2	-34.71	-1.37	-0.65	-0.17	-0.01	0.16	0.66	1.49	35.46
	MBF	-34.96	-0.90	-0.44	-0.11	0.03	0.21	0.70	1.51	17.57
EMP1	NIF1	-29.29	-1.94	-0.78	-0.07	0.00	0.06	0.91	2.42	45.06
	NIF2	-57.76	-1.45	-0.72	-0.19	-0.01	0.17	0.71	1.60	57.42
	MBF	-37.91	-0.76	-0.38	-0.08	0.06	0.26	0.77	1.52	67.20
EMP2	NIF1	-8.93	-1.55	-0.63	-0.03	0.00	0.04	0.73	2.14	16.84
	NIF2	-35.67	-1.41	-0.66	-0.17	-0.01	0.15	0.63	1.49	12.83
	MBF	-5.46	-0.68	-0.31	-0.05	0.07	0.26	0.78	1.64	38.68
EMP3	NIF1	-29.29	-1.75	-0.72	-0.05	0.00	0.07	0.88	2.28	45.06
	NIF2	-57.76	-1.42	-0.69	-0.18	-0.01	0.16	0.67	1.44	205.0
	MBF	-65.61	-0.57	-0.25	-0.01	0.13	0.33	0.86	1.61	67.20
RACE1	NIF1	-14.11	-2.84	-1.21	-0.07	0.00	0.09	1.42	4.74	45.00
	NIF2	-27.11	-2.94	-1.37	-0.35	-0.03	0.27	1.40	3.60	80.28
	MBF	-29.92	-1.57	-0.66	-0.10	0.17	0.57	1.69	3.46	31.31
RACE2	NIF1	-23.12	-3.14	-1.20	-0.08	0.00	0.07	0.89	2.65	43.16
	NIF2	-11.21	-1.57	-0.73	-0.19	-0.01	0.17	0.74	1.74	32.83
	MBF	-8.79	-1.22	-0.57	-0.14	0.02	0.19	0.72	1.55	9.21
RACE3	NIF1	-47.04	-1.77	-0.73	-0.03	0.00	0.04	0.69	2.03	19.79
	NIF2	-23.84	-1.32	-0.62	-0.16	0.00	0.15	0.64	1.51	15.10
	MBF	-26.25	-0.80	-0.39	-0.09	0.03	0.19	0.65	1.34	31.31

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 5. Distributions of Relative Changes in CV of Weights within Tracts after Applying each Noninterview (NI) Adjustment Factor to the HU Weights

	Percentile								
NI Factor	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
NIF1	-17.77	-2.11	-0.92	-0.08	0.00	0.15	2.31	5.78	1,210
NIF2	-78.41	-1.80	-0.85	-0.22	0.01	0.25	1.04	2.53	998.3
MBF	-76.82	-0.53	-0.13	0.22	0.52	0.94	1.90	3.20	677.7

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 6. Distributions of RelMSEs for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (HU-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HHT1	CUR	0.01	0.13	0.24	0.56	0.99	1.80	4.93	11.20	37.24
	EXP	0.01	0.12	0.24	0.55	0.98	1.79	4.90	11.14	38.23
HHT2	CUR	0.17	4.12	7.13	12.57	17.79	24.19	32.47	36.34	41.85
	EXP	0.17	4.12	7.13	12.56	17.76	24.17	32.44	36.32	44.29
HHT3	CUR	0.02	1.38	2.27	4.55	7.02	10.71	20.45	30.23	38.67
	EXP	0.02	1.38	2.28	4.55	7.01	10.70	20.44	30.28	38.61
HHT4	CUR	0.20	1.34	2.54	4.83	7.17	10.79	20.60	30.32	40.39
	EXP	0.20	1.34	2.54	4.82	7.16	10.77	20.57	30.30	41.40
HHT5	CUR	0.65	4.02	7.06	14.31	20.85	28.09	34.31	36.86	45.25
	EXP	0.64	4.04	7.04	14.32	20.83	28.11	34.29	36.86	49.03
HHT6	CUR	0.30	1.12	1.79	3.19	4.77	7.40	15.17	25.88	38.25
	EXP	0.29	1.11	1.78	3.18	4.76	7.38	15.15	25.90	37.52
HHT7	CUR	1.25	4.35	7.61	14.98	21.67	28.90	34.26	36.87	75.29
	EXP	1.25	4.33	7.60	14.97	21.63	28.89	34.24	36.84	73.96
HPOV	CUR	0.02	0.73	1.43	3.46	6.40	11.51	23.80	31.73	40.33
	EXP	0.02	0.73	1.44	3.47	6.40	11.50	23.78	31.71	38.55
TEN1	CUR	0.04	0.18	0.31	0.69	1.26	2.36	7.09	17.90	40.22
	EXP	0.04	0.18	0.31	0.68	1.24	2.35	7.09	17.98	42.67
TEN2	CUR	0.02	0.29	0.68	1.62	2.69	4.70	12.40	24.72	42.93
	EXP	0.02	0.29	0.68	1.62	2.69	4.71	12.41	24.77	43.62
TEN3	CUR	0.00	0.04	0.19	0.88	2.10	4.82	14.12	25.39	38.65
	EXP	0.00	0.05	0.19	0.90	2.14	4.88	14.21	25.56	40.17
TEN4	CUR	0.11	3.10	5.88	14.18	21.88	29.34	34.70	36.99	46.75
	EXP	0.11	3.09	5.88	14.16	21.88	29.32	34.70	37.05	49.01
NP1	CUR	0.09	0.57	0.94	1.74	2.59	3.97	8.10	15.40	38.59
	EXP	0.09	0.57	0.94	1.73	2.59	3.96	8.08	15.42	40.83
NP2	CUR	0.07	0.37	0.77	1.37	1.94	2.82	5.25	8.88	37.48
	EXP	0.07	0.37	0.77	1.36	1.94	2.81	5.25	8.85	37.19
NP3	CUR	0.20	1.40	2.40	3.83	5.24	7.34	13.21	22.54	43.07
	EXP	0.20	1.40	2.39	3.82	5.22	7.32	13.17	22.49	43.51
NP4	CUR	0.14	1.54	2.51	4.56	6.79	10.26	19.87	30.15	40.61
	EXP	0.14	1.53	2.51	4.55	6.77	10.23	19.84	30.14	39.62
NP5	CUR	0.29	3.13	5.19	9.51	14.13	20.69	31.25	35.61	44.22
	EXP	0.30	3.12	5.19	9.50	14.09	20.64	31.21	35.59	46.19
NP6	CUR	0.05	2.97	5.69	12.54	18.94	26.44	33.48	36.78	46.34
	EXP	0.05	2.97	5.68	12.52	18.93	26.39	33.43	36.68	49.62
VAC	CUR	0.00	0.24	1.31	5.23	10.40	18.17	31.07	36.04	1,140
	EXP	0.00	0.25	1.31	5.22	10.39	18.18	31.08	36.05	1,431
ELEC1	CUR	0.09	1.85	6.35	17.10	24.19	30.36	35.28	37.07	48.58
	EXP	0.09	1.87	6.32	17.05	24.17	30.32	35.21	37.06	48.09
ELEC2	CUR	0.84	2.82	5.12	12.13	19.61	27.88	33.99	36.95	55.66
	EXP	0.85	2.80	5.11	12.11	19.60	27.86	33.93	36.90	59.82
ELEC3	CUR	0.35	1.36	2.26	5.06	9.21	16.88	30.43	34.99	47.60
	EXP	0.35	1.36	2.26	5.05	9.19	16.84	30.40	34.96	47.26
ELEC4	CUR	0.15	1.27	2.04	3.65	5.80	9.99	22.11	31.53	42.91
	EXP	0.15	1.26	2.04	3.64	5.78	9.97	22.07	31.48	43.32
ELEC5	CUR	0.21	1.17	2.36	4.27	6.31	9.56	18.49	28.89	38.63
	EXP	0.21	1.17	2.35	4.26	6.30	9.54	18.46	28.85	38.36
ELEC6	CUR	0.08	0.55	1.23	2.24	3.21	4.68	9.11	17.36	37.83
	EXP	0.08	0.54	1.23	2.23	3.20	4.67	9.10	17.31	38.07
ELEC7	CUR	0.22	1.06	2.05	3.58	5.35	8.48	18.35	29.86	40.56
	EXP	0.22	1.05	2.04	3.57	5.34	8.45	18.35	29.81	39.11
ELEC8	CUR	0.04	0.46	0.83	1.86	3.49	7.00	18.33	29.87	39.93
	EXP	0.04	0.46	0.83	1.85	3.48	6.97	18.26	29.83	39.39

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 6 (cont). Distributions of RelMSEs for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (HU-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
GAS1	CUR	0.00	0.01	0.08	0.50	1.70	5.80	21.60	31.69	39.53
	EXP	0.00	0.01	0.08	0.50	1.70	5.81	21.57	31.70	38.53
GAS2	CUR	0.08	1.06	2.00	5.15	9.20	16.14	29.91	34.38	41.30
	EXP	0.08	1.06	2.00	5.14	9.19	16.12	29.90	34.33	44.00
GAS3	CUR	0.17	1.08	1.67	3.36	5.77	10.44	24.01	32.41	43.52
	EXP	0.18	1.08	1.67	3.35	5.76	10.43	24.00	32.35	41.77
GAS4	CUR	0.24	1.60	2.56	4.85	7.84	13.30	27.14	33.28	39.16
	EXP	0.24	1.60	2.55	4.84	7.83	13.28	27.08	33.31	40.52
GAS5	CUR	0.43	2.18	3.47	6.99	11.54	18.77	30.80	35.16	40.46
	EXP	0.44	2.17	3.47	6.97	11.53	18.75	30.78	35.12	39.19
GAS6	CUR	0.34	1.26	2.42	4.94	8.58	15.36	29.61	34.39	41.86
	EXP	0.34	1.26	2.41	4.93	8.56	15.33	29.58	34.33	42.87
GAS7	CUR	0.72	2.41	4.51	9.02	14.46	22.21	31.83	35.84	48.09
	EXP	0.72	2.41	4.51	9.01	14.43	22.20	31.82	35.81	44.98
GAS8	CUR	0.29	1.11	2.52	6.40	11.57	19.71	31.22	35.19	45.98
	EXP	0.28	1.10	2.52	6.39	11.53	19.71	31.20	35.14	45.94
WATER1	CUR	0.00	0.02	0.10	1.95	7.29	15.41	29.70	34.56	40.66
	EXP	0.00	0.02	0.10	1.96	7.28	15.39	29.69	34.55	43.78
WATER2	CUR	0.06	0.43	0.94	2.06	3.27	5.56	15.57	28.78	42.72
	EXP	0.06	0.43	0.94	2.05	3.27	5.55	15.55	28.74	43.11
WATER3	CUR	0.11	0.65	1.11	2.24	3.95	7.89	21.48	31.60	42.18
	EXP	0.11	0.65	1.10	2.23	3.94	7.87	21.46	31.61	40.00
WATER4	CUR	0.12	0.93	1.56	3.12	5.22	9.46	23.21	32.51	40.57
	EXP	0.12	0.93	1.55	3.10	5.21	9.44	23.16	32.49	40.07
WATER5	CUR	0.03	0.49	0.99	2.88	5.93	11.77	26.80	33.47	40.10
	EXP	0.03	0.49	0.99	2.87	5.91	11.74	26.79	33.44	43.67

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 7. Distributions of RelMSEs for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (Person-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HISP	CUR	0.00	0.04	0.38	4.39	11.11	20.28	32.63	36.41	41.82
	EXP	0.00	0.04	0.38	4.40	11.09	20.26	32.60	36.40	45.03
EMP1	CUR	0.01	0.08	0.13	0.23	0.35	0.56	1.26	2.60	35.22
	EXP	0.01	0.08	0.13	0.23	0.35	0.56	1.25	2.61	35.25
EMP2	CUR	0.08	2.56	4.01	6.92	9.94	14.53	24.92	32.45	41.38
	EXP	0.08	2.55	4.00	6.90	9.93	14.51	24.88	32.44	40.44
EMP3	CUR	0.02	0.18	0.37	0.67	0.95	1.35	2.43	4.24	37.11
	EXP	0.02	0.18	0.37	0.67	0.95	1.35	2.42	4.22	36.68
RACE1	CUR	0.00	0.00	0.00	0.04	0.17	0.56	4.00	19.61	38.41
	EXP	0.00	0.00	0.00	0.04	0.17	0.56	4.00	19.62	38.27
RACE2	CUR	0.00	0.02	0.25	3.99	11.26	21.15	33.24	36.58	46.71
	EXP	0.00	0.02	0.25	4.00	11.26	21.15	33.27	36.55	42.15
RACE3	CUR	0.00	0.37	2.01	7.75	14.40	22.96	33.62	36.65	45.34
	EXP	0.00	0.38	2.01	7.74	14.39	22.97	33.59	36.64	42.78
HS	CUR	0.00	0.03	0.07	0.13	0.22	0.39	0.86	1.47	36.27
	EXP	0.00	0.03	0.07	0.13	0.22	0.39	0.86	1.47	36.10
COLL	CUR	0.05	0.19	0.37	1.05	2.11	4.04	10.42	19.66	37.78
	EXP	0.05	0.19	0.37	1.05	2.11	4.04	10.39	19.61	37.38
INSUR	CUR	0.00	0.00	0.01	0.04	0.09	0.19	0.45	0.82	35.73
	EXP	0.00	0.00	0.01	0.04	0.09	0.19	0.45	0.82	35.50
MIG1	CUR	0.00	0.01	0.02	0.07	0.16	0.32	0.76	1.49	35.42
	EXP	0.00	0.01	0.02	0.07	0.16	0.31	0.76	1.47	39.54
MIG2	CUR	1.48	7.51	12.28	20.96	27.46	32.45	36.39	37.34	40.61
	EXP	1.49	7.47	12.25	20.97	27.52	32.42	36.34	37.28	40.37
MIG3	CUR	0.13	1.59	2.73	5.22	7.84	11.73	21.24	30.43	39.81
	EXP	0.14	1.59	2.74	5.22	7.84	11.72	21.24	30.42	40.17

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 8. Distributions of Relative Changes in RelMSEs for Tract-Level Estimates using Noninterview-Adjusted Weights by HU-Level Characteristic (Char.) (Experimental - Current)

	Percentile								
Char.	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HHT1	-21.15	-6.27	-3.56	-1.42	-0.61	-0.03	1.42	3.93	37.39
HHT2	-34.87	-3.91	-1.88	-0.50	-0.05	0.37	1.59	3.57	28.38
HHT3	-20.88	-3.88	-1.89	-0.51	-0.02	0.47	1.86	4.14	26.45
HHT4	-17.59	-4.09	-2.04	-0.60	-0.07	0.40	1.71	3.82	45.73
HHT5	-25.55	-3.97	-1.89	-0.50	-0.03	0.42	1.77	3.76	20.88
HHT6	-33.66	-4.39	-2.18	-0.68	-0.14	0.30	1.47	3.37	26.75
HHT7	-27.32	-4.30	-2.00	-0.54	-0.06	0.36	1.59	3.61	24.25
HPOV	-23.21	-4.03	-1.92	-0.46	0.05	0.62	2.30	5.04	44.50
TEN1	-27.55	-7.61	-4.26	-1.62	-0.66	0.07	2.10	5.21	35.34
TEN2	-17.80	-4.29	-2.09	-0.54	0.00	0.57	2.39	4.98	36.92
TEN3	-30.85	-7.01	-2.82	0.07	1.40	3.46	9.24	16.75	76.39
TEN4	-24.10	-5.45	-2.64	-0.65	-0.04	0.53	2.26	4.67	45.60
NP1	-19.62	-4.08	-2.07	-0.63	-0.12	0.34	1.63	3.75	37.84
NP2	-19.18	-3.53	-1.92	-0.71	-0.25	0.15	1.18	2.95	31.00
NP3	-14.37	-3.83	-1.98	-0.68	-0.19	0.20	1.20	2.77	23.88
NP4	-28.19	-3.77	-1.99	-0.67	-0.18	0.21	1.20	2.75	43.23
NP5	-19.89	-3.70	-1.85	-0.54	-0.09	0.27	1.23	2.78	24.43
NP6	-17.48	-3.57	-1.71	-0.47	-0.07	0.27	1.22	2.79	21.94
VAC	-20.53	-2.12	-0.85	-0.17	0.00	0.18	0.91	2.34	69.07
ELEC1	-25.54	-5.13	-2.24	-0.51	-0.03	0.39	1.85	4.22	27.88
ELEC2	-24.55	-4.38	-2.00	-0.47	-0.05	0.30	1.45	3.43	24.67
ELEC3	-28.28	-4.42	-2.13	-0.58	-0.08	0.34	1.57	3.57	28.61
ELEC4	-28.09	-4.19	-2.04	-0.63	-0.13	0.28	1.42	3.24	34.78
ELEC5	-16.58	-3.98	-2.02	-0.64	-0.14	0.25	1.30	2.99	55.85
ELEC6	-13.24	-3.62	-1.95	-0.69	-0.22	0.17	1.16	2.70	27.71
ELEC7	-18.65	-3.72	-1.98	-0.67	-0.17	0.21	1.16	2.62	23.18
ELEC8	-23.47	-4.19	-2.26	-0.80	-0.25	0.17	1.17	2.83	23.52
GAS1	-20.03	-4.54	-2.21	-0.53	0.11	0.92	3.47	7.22	45.22
GAS2	-26.14	-3.83	-1.86	-0.50	-0.06	0.31	1.39	3.11	35.66
GAS3	-19.12	-3.74	-1.88	-0.58	-0.11	0.28	1.36	2.93	30.02
GAS4	-14.85	-3.68	-1.86	-0.56	-0.11	0.26	1.26	2.78	20.18
GAS5	-18.65	-3.65	-1.74	-0.51	-0.07	0.28	1.23	2.61	18.08
GAS6	-22.24	-3.80	-1.85	-0.57	-0.09	0.27	1.27	2.82	41.92
GAS7	-17.15	-3.45	-1.64	-0.44	-0.04	0.29	1.20	2.64	45.81
GAS8	-19.23	-3.77	-1.86	-0.53	-0.06	0.31	1.34	2.95	24.46
WATER1	-24.97	-5.31	-2.60	-0.67	-0.01	0.66	3.08	7.27	47.71
WATER2	-17.37	-3.72	-1.87	-0.57	-0.12	0.25	1.23	2.85	19.01
WATER3	-17.80	-3.74	-1.90	-0.62	-0.15	0.22	1.24	2.89	38.49
WATER4	-16.90	-3.62	-1.87	-0.62	-0.17	0.18	1.12	2.57	18.66
WATER5	-21.28	-3.76	-1.96	-0.66	-0.18	0.18	1.12	2.61	39.34

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 9. Distributions of Relative Changes in RelMSEs for Tract-Level Estimates using Noninterview-Adjusted Weights by Person-Level Characteristic (Char.) (Experimental - Current)

	Percentile								
Char.	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HISP	-18.17	-3.97	-1.90	-0.50	0.01	0.52	1.92	4.17	22.17
EMP1	-20.20	-4.15	-2.13	-0.62	-0.04	0.48	1.85	3.94	19.22
EMP2	-17.41	-4.15	-2.02	-0.59	-0.09	0.33	1.49	3.32	20.88
EMP3	-20.10	-3.88	-2.01	-0.65	-0.13	0.31	1.43	3.13	22.93
RACE1	-40.77	-9.01	-4.28	-1.21	-0.19	0.61	2.75	6.10	55.57
RACE2	-37.07	-4.43	-2.05	-0.48	0.06	0.63	2.38	5.18	28.36
RACE3	-23.63	-3.82	-1.81	-0.48	-0.01	0.40	1.52	3.32	39.64
HS	-25.05	-5.32	-2.74	-0.91	-0.22	0.33	1.70	3.68	31.49
COLL	-17.44	-3.82	-1.99	-0.66	-0.13	0.33	1.50	3.35	23.37
INSUR	-34.36	-7.56	-4.08	-1.45	-0.42	0.37	2.11	4.60	26.38
MIG1	-34.86	-9.57	-5.34	-2.18	-0.95	0.01	1.89	4.80	49.46
MIG2	-16.49	-3.48	-1.68	-0.46	-0.04	0.34	1.42	2.87	34.01
MIG3	-19.93	-4.58	-2.19	-0.54	0.04	0.63	2.22	4.53	42.84

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 10. Distributions of RelVars for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (HU-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HHT1	CUR	0.01	0.13	0.24	0.55	0.98	1.78	4.88	11.10	37.09
	EXP	0.01	0.12	0.23	0.55	0.97	1.77	4.85	11.04	38.22
HHT2	CUR	0.17	4.08	7.10	12.51	17.69	24.07	32.33	36.15	39.92
	EXP	0.17	4.07	7.07	12.47	17.65	24.02	32.25	36.03	38.34
HHT3	CUR	0.02	1.36	2.26	4.53	6.97	10.65	20.36	30.08	38.43
	EXP	0.02	1.37	2.25	4.51	6.96	10.63	20.30	30.10	38.01
HHT4	CUR	0.20	1.34	2.51	4.79	7.12	10.73	20.49	30.23	39.51
	EXP	0.20	1.33	2.51	4.78	7.11	10.70	20.47	30.18	37.42
HHT5	CUR	0.64	4.00	6.99	14.24	20.74	27.96	34.18	36.69	42.88
	EXP	0.64	4.01	6.98	14.21	20.72	27.92	34.11	36.59	41.00
HHT6	CUR	0.30	1.10	1.76	3.15	4.72	7.35	15.09	25.80	38.07
	EXP	0.29	1.09	1.76	3.15	4.71	7.33	15.08	25.82	37.52
HHT7	CUR	1.25	4.29	7.52	14.88	21.54	28.77	34.11	36.71	42.22
	EXP	1.25	4.29	7.53	14.86	21.51	28.74	34.04	36.62	40.26
HPOV	CUR	0.02	0.72	1.42	3.43	6.36	11.43	23.66	31.60	37.72
	EXP	0.02	0.72	1.42	3.43	6.35	11.41	23.59	31.54	37.56
TEN1	CUR	0.04	0.18	0.31	0.68	1.24	2.33	6.97	17.72	37.37
	EXP	0.04	0.18	0.31	0.68	1.22	2.30	6.94	17.68	37.84
TEN2	CUR	0.02	0.29	0.68	1.61	2.66	4.65	12.27	24.43	38.22
	EXP	0.02	0.29	0.68	1.60	2.64	4.63	12.24	24.37	37.32
TEN3	CUR	0.00	0.04	0.18	0.85	2.05	4.75	14.04	25.31	37.47
	EXP	0.00	0.04	0.19	0.86	2.07	4.76	14.04	25.35	38.08
TEN4	CUR	0.11	3.07	5.85	14.10	21.76	29.20	34.55	36.80	42.62
	EXP	0.11	3.05	5.84	14.08	21.75	29.20	34.47	36.80	45.34
NP1	CUR	0.09	0.56	0.93	1.71	2.56	3.94	8.05	15.32	37.67
	EXP	0.09	0.56	0.93	1.71	2.56	3.93	8.02	15.32	37.85
NP2	CUR	0.07	0.36	0.76	1.36	1.93	2.80	5.22	8.81	37.45
	EXP	0.07	0.36	0.76	1.35	1.92	2.79	5.20	8.78	37.17
NP3	CUR	0.20	1.39	2.39	3.81	5.21	7.30	13.13	22.40	37.33
	EXP	0.20	1.39	2.38	3.80	5.19	7.27	13.09	22.34	38.39
NP4	CUR	0.14	1.53	2.50	4.53	6.75	10.21	19.76	30.01	38.47
	EXP	0.14	1.52	2.49	4.52	6.73	10.17	19.70	29.96	38.14
NP5	CUR	0.29	3.10	5.17	9.46	14.05	20.58	31.12	35.44	39.39
	EXP	0.30	3.09	5.16	9.43	14.00	20.53	31.06	35.37	39.50
NP6	CUR	0.05	2.95	5.66	12.46	18.85	26.30	33.32	36.54	41.93
	EXP	0.05	2.94	5.64	12.43	18.82	26.23	33.27	36.42	39.26
VAC	CUR	0.00	0.23	1.28	5.16	10.33	18.08	31.00	35.96	41.10
	EXP	0.00	0.23	1.28	5.16	10.32	18.08	31.00	35.97	38.01
ELEC1	CUR	0.09	1.83	6.27	16.95	24.00	30.16	35.03	36.91	40.33
	EXP	0.09	1.82	6.28	16.91	23.98	30.14	35.00	36.86	38.75
ELEC2	CUR	0.84	2.78	5.06	12.00	19.47	27.71	33.78	36.75	40.23
	EXP	0.83	2.78	5.05	11.99	19.44	27.68	33.71	36.67	41.95
ELEC3	CUR	0.35	1.36	2.24	5.01	9.13	16.74	30.26	34.73	39.54
	EXP	0.35	1.36	2.24	5.01	9.11	16.71	30.23	34.69	41.44
ELEC4	CUR	0.15	1.26	2.03	3.63	5.76	9.92	22.01	31.41	38.59
	EXP	0.14	1.25	2.02	3.62	5.74	9.90	21.96	31.32	37.87
ELEC5	CUR	0.21	1.17	2.34	4.24	6.28	9.51	18.40	28.79	38.45
	EXP	0.21	1.16	2.34	4.23	6.26	9.48	18.37	28.70	37.79
ELEC6	CUR	0.08	0.54	1.23	2.23	3.20	4.66	9.07	17.28	37.71
	EXP	0.08	0.54	1.22	2.22	3.18	4.64	9.05	17.22	37.21
ELEC7	CUR	0.22	1.05	2.03	3.56	5.33	8.43	18.26	29.70	40.34
	EXP	0.22	1.05	2.02	3.55	5.30	8.41	18.23	29.62	39.11
ELEC8	CUR	0.04	0.45	0.83	1.84	3.47	6.95	18.22	29.77	38.07
	EXP	0.04	0.45	0.82	1.83	3.45	6.93	18.15	29.67	37.68

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 10 (cont). Distributions of RelVars for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (HU-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
GAS1	CUR	0.00	0.01	0.08	0.49	1.67	5.71	21.43	31.53	39.46
	EXP	0.00	0.01	0.08	0.49	1.67	5.70	21.41	31.51	37.86
GAS2	CUR	0.08	1.05	1.99	5.11	9.13	16.05	29.79	34.21	39.20
	EXP	0.08	1.05	1.98	5.10	9.11	16.02	29.75	34.16	38.45
GAS3	CUR	0.16	1.08	1.66	3.34	5.73	10.38	23.87	32.19	39.23
	EXP	0.17	1.08	1.65	3.33	5.71	10.35	23.83	32.16	40.21
GAS4	CUR	0.24	1.60	2.55	4.82	7.79	13.22	26.97	33.14	38.27
	EXP	0.24	1.59	2.54	4.81	7.77	13.18	26.91	33.11	40.20
GAS5	CUR	0.43	2.17	3.46	6.95	11.48	18.68	30.67	35.00	38.88
	EXP	0.43	2.16	3.45	6.93	11.45	18.63	30.63	34.93	38.20
GAS6	CUR	0.34	1.26	2.40	4.92	8.53	15.28	29.49	34.22	41.19
	EXP	0.34	1.25	2.39	4.90	8.50	15.23	29.44	34.15	37.95
GAS7	CUR	0.72	2.39	4.48	8.97	14.40	22.11	31.71	35.67	42.73
	EXP	0.72	2.38	4.47	8.95	14.36	22.09	31.67	35.56	38.48
GAS8	CUR	0.29	1.10	2.51	6.35	11.50	19.62	31.09	35.02	40.19
	EXP	0.28	1.09	2.50	6.34	11.46	19.57	31.08	34.98	38.21
WATER1	CUR	0.00	0.02	0.10	1.92	7.17	15.23	29.52	34.30	38.57
	EXP	0.00	0.02	0.10	1.93	7.17	15.22	29.51	34.30	42.78
WATER2	CUR	0.06	0.43	0.93	2.03	3.24	5.50	15.41	28.53	38.08
	EXP	0.06	0.43	0.93	2.03	3.23	5.49	15.40	28.44	38.26
WATER3	CUR	0.11	0.65	1.10	2.22	3.93	7.84	21.35	31.47	38.86
	EXP	0.11	0.65	1.09	2.21	3.92	7.82	21.32	31.41	37.88
WATER4	CUR	0.12	0.92	1.55	3.09	5.19	9.40	23.09	32.31	39.78
	EXP	0.12	0.92	1.54	3.08	5.18	9.37	23.04	32.24	38.28
WATER5	CUR	0.03	0.48	0.98	2.86	5.89	11.70	26.65	33.31	39.90
	EXP	0.03	0.48	0.98	2.85	5.87	11.67	26.65	33.27	37.77

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 11. Distributions of RelVars for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (Person-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HISP	CUR	0.00	0.04	0.38	4.35	11.03	20.15	32.44	36.26	40.41
	EXP	0.00	0.04	0.37	4.36	11.01	20.14	32.40	36.18	38.88
EMP1	CUR	0.01	0.08	0.13	0.23	0.35	0.55	1.25	2.58	34.49
	EXP	0.01	0.08	0.13	0.23	0.35	0.55	1.24	2.58	34.47
EMP2	CUR	0.08	2.54	3.98	6.88	9.89	14.46	24.82	32.31	39.29
	EXP	0.08	2.53	3.97	6.86	9.87	14.42	24.73	32.22	38.32
EMP3	CUR	0.02	0.18	0.36	0.67	0.94	1.34	2.41	4.21	36.95
	EXP	0.02	0.18	0.36	0.66	0.94	1.33	2.40	4.19	36.25
RACE1	CUR	0.00	0.00	0.00	0.04	0.17	0.56	3.95	19.50	37.75
	EXP	0.00	0.00	0.00	0.04	0.17	0.55	3.94	19.43	37.21
RACE2	CUR	0.00	0.02	0.25	3.95	11.20	21.04	33.10	36.40	41.06
	EXP	0.00	0.02	0.25	3.94	11.18	21.02	33.11	36.33	39.56
RACE3	CUR	0.00	0.37	1.99	7.70	14.32	22.85	33.46	36.47	39.75
	EXP	0.00	0.37	1.99	7.69	14.31	22.83	33.41	36.45	42.64
HS	CUR	0.00	0.03	0.07	0.13	0.22	0.39	0.86	1.46	35.91
	EXP	0.00	0.03	0.07	0.13	0.22	0.38	0.85	1.46	35.70
COLL	CUR	0.04	0.19	0.36	1.04	2.09	4.00	10.36	19.58	37.78
	EXP	0.04	0.19	0.36	1.04	2.08	3.99	10.32	19.51	37.21
INSUR	CUR	0.00	0.00	0.01	0.04	0.09	0.19	0.45	0.82	35.73
	EXP	0.00	0.00	0.01	0.04	0.09	0.19	0.45	0.81	35.50
MIG1	CUR	0.00	0.01	0.02	0.07	0.16	0.32	0.76	1.48	35.42
	EXP	0.00	0.01	0.02	0.07	0.16	0.31	0.75	1.46	39.19
MIG2	CUR	1.48	7.48	12.18	20.83	27.33	32.28	36.25	37.10	40.14
	EXP	1.49	7.46	12.22	20.81	27.33	32.23	36.21	37.08	37.97
MIG3	CUR	0.13	1.57	2.71	5.18	7.79	11.66	21.16	30.31	39.09
	EXP	0.14	1.58	2.71	5.17	7.78	11.63	21.08	30.21	38.86

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 12. Distributions of Relative Square Biases for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (HU-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HHT1	CUR	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.19	4.60
	EXP	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.23	4.11
HHT2	CUR	0.00	0.00	0.00	0.01	0.03	0.09	0.39	0.95	8.48
	EXP	0.00	0.00	0.00	0.01	0.03	0.12	0.49	1.23	15.76
HHT3	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.19	0.49	5.14
	EXP	0.00	0.00	0.00	0.00	0.02	0.06	0.25	0.65	7.90
HHT4	CUR	0.00	0.00	0.00	0.00	0.01	0.05	0.21	0.56	9.62
	EXP	0.00	0.00	0.00	0.00	0.02	0.05	0.25	0.65	8.50
HHT5	CUR	0.00	0.00	0.00	0.01	0.03	0.11	0.45	1.05	8.66
	EXP	0.00	0.00	0.00	0.01	0.04	0.13	0.55	1.35	20.75
HHT6	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.20	0.51	10.77
	EXP	0.00	0.00	0.00	0.00	0.01	0.05	0.21	0.53	11.13
HHT7	CUR	0.00	0.00	0.00	0.01	0.04	0.13	0.50	1.20	37.34
	EXP	0.00	0.00	0.00	0.01	0.04	0.13	0.52	1.31	39.77
HPOV	CUR	0.00	0.00	0.00	0.00	0.01	0.05	0.23	0.64	8.85
	EXP	0.00	0.00	0.00	0.00	0.02	0.06	0.30	0.78	9.21
TEN1	CUR	0.00	0.00	0.00	0.00	0.00	0.02	0.12	0.44	9.17
	EXP	0.00	0.00	0.00	0.00	0.00	0.02	0.15	0.50	10.23
TEN2	CUR	0.00	0.00	0.00	0.00	0.01	0.03	0.18	0.56	8.35
	EXP	0.00	0.00	0.00	0.00	0.02	0.06	0.27	0.75	9.12
TEN3	CUR	0.00	0.00	0.00	0.00	0.01	0.03	0.20	0.63	16.90
	EXP	0.00	0.00	0.00	0.00	0.02	0.07	0.33	0.86	16.42
TEN4	CUR	0.00	0.00	0.00	0.01	0.04	0.13	0.53	1.17	14.28
	EXP	0.00	0.00	0.00	0.01	0.04	0.12	0.51	1.28	11.75
NP1	CUR	0.00	0.00	0.00	0.00	0.01	0.02	0.12	0.33	14.13
	EXP	0.00	0.00	0.00	0.00	0.01	0.03	0.12	0.34	11.60
NP2	CUR	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.19	9.46
	EXP	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.22	10.17
NP3	CUR	0.00	0.00	0.00	0.00	0.01	0.03	0.14	0.38	15.65
	EXP	0.00	0.00	0.00	0.00	0.01	0.04	0.17	0.44	14.99
NP4	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.20	0.54	5.85
	EXP	0.00	0.00	0.00	0.00	0.01	0.05	0.23	0.61	5.43
NP5	CUR	0.00	0.00	0.00	0.00	0.02	0.08	0.35	0.84	11.22
	EXP	0.00	0.00	0.00	0.01	0.03	0.09	0.39	0.95	11.21
NP6	CUR	0.00	0.00	0.00	0.01	0.03	0.10	0.43	1.04	8.28
	EXP	0.00	0.00	0.00	0.01	0.04	0.11	0.49	1.18	14.35
VAC	CUR	0.00	0.00	0.00	0.00	0.02	0.06	0.26	0.71	1,112
	EXP	0.00	0.00	0.00	0.00	0.02	0.06	0.28	0.73	1,405
ELEC1	CUR	0.00	0.00	0.00	0.01	0.05	0.16	0.71	1.84	16.08
	EXP	0.00	0.00	0.00	0.01	0.05	0.16	0.69	1.78	16.78
ELEC2	CUR	0.00	0.00	0.00	0.01	0.04	0.13	0.62	1.60	27.23
	EXP	0.00	0.00	0.00	0.01	0.04	0.13	0.61	1.56	32.65
ELEC3	CUR	0.00	0.00	0.00	0.00	0.02	0.07	0.37	1.03	13.28
	EXP	0.00	0.00	0.00	0.00	0.02	0.08	0.38	1.02	12.86
ELEC4	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.21	0.61	9.89
	EXP	0.00	0.00	0.00	0.00	0.01	0.05	0.23	0.67	10.53
ELEC5	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.18	0.50	4.45
	EXP	0.00	0.00	0.00	0.00	0.01	0.04	0.20	0.54	4.51
ELEC6	CUR	0.00	0.00	0.00	0.00	0.00	0.02	0.09	0.24	3.67
	EXP	0.00	0.00	0.00	0.00	0.01	0.02	0.10	0.27	3.68
ELEC7	CUR	0.00	0.00	0.00	0.00	0.01	0.03	0.15	0.42	4.81
	EXP	0.00	0.00	0.00	0.00	0.01	0.04	0.18	0.47	5.58
ELEC8	CUR	0.00	0.00	0.00	0.00	0.01	0.03	0.15	0.43	5.80
	EXP	0.00	0.00	0.00	0.00	0.01	0.03	0.17	0.46	8.83

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 12 (cont). Distributions of Relative Square Biases for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (HU-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
GAS1	CUR	0.00	0.00	0.00	0.00	0.00	0.03	0.23	0.74	8.89
	EXP	0.00	0.00	0.00	0.00	0.01	0.04	0.27	0.84	8.43
GAS2	CUR	0.00	0.00	0.00	0.00	0.02	0.06	0.30	0.79	6.95
	EXP	0.00	0.00	0.00	0.00	0.02	0.07	0.33	0.83	8.41
GAS3	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.22	0.61	6.98
	EXP	0.00	0.00	0.00	0.00	0.01	0.05	0.25	0.68	15.07
GAS4	CUR	0.00	0.00	0.00	0.00	0.01	0.05	0.24	0.65	5.42
	EXP	0.00	0.00	0.00	0.00	0.02	0.06	0.28	0.74	8.51
GAS5	CUR	0.00	0.00	0.00	0.00	0.02	0.07	0.31	0.77	9.10
	EXP	0.00	0.00	0.00	0.00	0.02	0.08	0.35	0.84	10.02
GAS6	CUR	0.00	0.00	0.00	0.00	0.01	0.05	0.26	0.66	9.00
	EXP	0.00	0.00	0.00	0.00	0.02	0.07	0.30	0.72	10.02
GAS7	CUR	0.00	0.00	0.00	0.00	0.02	0.08	0.32	0.83	8.89
	EXP	0.00	0.00	0.00	0.01	0.03	0.09	0.37	0.93	10.45
GAS8	CUR	0.00	0.00	0.00	0.00	0.02	0.07	0.29	0.77	10.69
	EXP	0.00	0.00	0.00	0.01	0.03	0.08	0.34	0.85	10.97
WATER1	CUR	0.00	0.00	0.00	0.00	0.01	0.08	0.48	1.47	20.25
	EXP	0.00	0.00	0.00	0.00	0.02	0.08	0.48	1.39	20.03
WATER2	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.20	0.54	7.84
	EXP	0.00	0.00	0.00	0.00	0.01	0.05	0.22	0.62	8.79
WATER3	CUR	0.00	0.00	0.00	0.00	0.01	0.03	0.15	0.50	7.60
	EXP	0.00	0.00	0.00	0.00	0.01	0.03	0.18	0.57	8.32
WATER4	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.19	0.57	6.14
	EXP	0.00	0.00	0.00	0.00	0.01	0.04	0.20	0.64	7.22
WATER5	CUR	0.00	0.00	0.00	0.00	0.01	0.04	0.21	0.62	8.19
	EXP	0.00	0.00	0.00	0.00	0.01	0.05	0.23	0.68	18.87

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 13. Distributions of Relative Square Biases for Tract-Level Estimates using Noninterview-Adjusted Weights by Weight Type (Person-Level Characteristics (Char.))

		Percentile								
Char.	**Weight**	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HISP	CUR	0.00	0.00	0.00	0.00	0.02	0.07	0.33	0.86	6.83
	EXP	0.00	0.00	0.00	0.00	0.02	0.08	0.40	1.08	13.01
EMP1	CUR	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.76
	EXP	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.78
EMP2	CUR	0.00	0.00	0.00	0.00	0.02	0.06	0.25	0.61	5.72
	EXP	0.00	0.00	0.00	0.00	0.02	0.07	0.29	0.75	6.52
EMP3	CUR	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.09	1.15
	EXP	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.11	1.38
RACE1	CUR	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.17	7.83
	EXP	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.20	8.00
RACE2	CUR	0.00	0.00	0.00	0.00	0.02	0.06	0.32	0.84	23.34
	EXP	0.00	0.00	0.00	0.00	0.02	0.08	0.37	0.97	18.38
RACE3	CUR	0.00	0.00	0.00	0.00	0.02	0.08	0.38	0.95	7.57
	EXP	0.00	0.00	0.00	0.01	0.03	0.09	0.41	1.06	10.54
HS	CUR	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.88
	EXP	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	1.09
COLL	CUR	0.00	0.00	0.00	0.00	0.01	0.02	0.12	0.32	3.59
	EXP	0.00	0.00	0.00	0.00	0.01	0.03	0.15	0.39	4.02
INSUR	CUR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.88
	EXP	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	1.09
MIG1	CUR	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	1.59
	EXP	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.87
MIG2	CUR	0.00	0.00	0.00	0.01	0.05	0.17	0.63	1.37	4.64
	EXP	0.00	0.00	0.00	0.02	0.06	0.17	0.65	1.41	8.97
MIG3	CUR	0.00	0.00	0.00	0.00	0.01	0.05	0.23	0.63	9.84
	EXP	0.00	0.00	0.00	0.00	0.02	0.07	0.31	0.77	20.12

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 14. Distributions of Percentage Point Changes in Tract-Level Estimates using Final Weights by HU-Level Characteristic (Char.) (Experimental - Current)

	Percentile								
Char.	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HHT1	-10.35	-0.70	-0.35	-0.05	0.11	0.28	0.60	1.00	7.29
HHT2	-2.88	-0.42	-0.24	-0.08	-0.01	0.06	0.19	0.38	3.95
HHT3	-9.37	-0.65	-0.36	-0.14	-0.03	0.07	0.28	0.53	6.67
HHT4	-6.19	-0.67	-0.37	-0.13	-0.03	0.07	0.27	0.53	6.25
HHT5	-3.93	-0.39	-0.21	-0.08	-0.01	0.05	0.17	0.33	6.45
HHT6	-5.56	-0.63	-0.36	-0.13	-0.01	0.10	0.31	0.58	14.11
HHT7	-6.28	-0.34	-0.19	-0.07	0.00	0.05	0.16	0.31	2.57
HPOV	-6.29	-0.75	-0.42	-0.15	-0.04	0.07	0.29	0.60	6.61
TEN1	-6.73	-0.63	-0.29	0.00	0.16	0.33	0.65	1.00	7.14
TEN2	-7.14	-0.64	-0.32	-0.05	0.07	0.21	0.51	0.88	9.01
TEN3	-6.58	-1.13	-0.73	-0.38	-0.21	-0.05	0.19	0.49	5.12
TEN4	-6.90	-0.54	-0.28	-0.11	-0.03	0.03	0.18	0.39	6.67
NP1	-10.99	-0.72	-0.43	-0.18	-0.04	0.08	0.31	0.57	10.48
NP2	-8.65	-0.67	-0.37	-0.12	0.01	0.15	0.41	0.71	8.50
NP3	-4.60	-0.53	-0.30	-0.10	0.00	0.11	0.30	0.52	7.38
NP4	-3.48	-0.49	-0.26	-0.08	0.01	0.10	0.28	0.49	6.24
NP5	-2.84	-0.36	-0.19	-0.06	0.00	0.07	0.20	0.37	3.29
NP6	-3.36	-0.34	-0.18	-0.06	0.00	0.06	0.18	0.33	5.06
VAC	-10.71	-0.31	-0.14	-0.03	0.01	0.07	0.19	0.36	6.52
ELEC1	-3.29	-0.53	-0.24	-0.07	0.00	0.06	0.20	0.54	6.67
ELEC2	-2.91	-0.40	-0.23	-0.08	0.00	0.06	0.19	0.35	4.76
ELEC3	-6.01	-0.55	-0.31	-0.11	-0.01	0.08	0.26	0.48	7.79
ELEC4	-6.55	-0.64	-0.35	-0.12	-0.01	0.10	0.33	0.61	7.69
ELEC5	-13.16	-0.58	-0.33	-0.11	0.00	0.11	0.33	0.60	7.14
ELEC6	-8.50	-0.75	-0.41	-0.14	0.01	0.15	0.42	0.75	4.29
ELEC7	-7.06	-0.63	-0.34	-0.11	0.01	0.12	0.35	0.65	7.14
ELEC8	-11.64	-0.70	-0.37	-0.11	0.02	0.15	0.42	0.77	12.53
GAS1	-9.95	-0.91	-0.51	-0.19	-0.04	0.10	0.39	0.77	6.67
GAS2	-5.56	-0.61	-0.33	-0.10	0.00	0.10	0.31	0.59	6.15
GAS3	-6.12	-0.67	-0.37	-0.11	0.00	0.12	0.37	0.67	5.27
GAS4	-5.41	-0.61	-0.33	-0.10	0.01	0.11	0.34	0.61	4.88
GAS5	-3.78	-0.50	-0.28	-0.08	0.01	0.10	0.29	0.51	3.63
GAS6	-4.14	-0.59	-0.31	-0.09	0.01	0.12	0.35	0.64	7.14
GAS7	-4.10	-0.48	-0.25	-0.07	0.01	0.09	0.27	0.49	4.80
GAS8	-8.12	-0.58	-0.29	-0.08	0.01	0.11	0.34	0.65	6.90
WATER1	-8.51	-0.97	-0.53	-0.17	-0.03	0.08	0.35	0.75	10.52
WATER2	-6.23	-0.80	-0.44	-0.14	0.00	0.15	0.45	0.81	9.52
WATER3	-8.19	-0.74	-0.41	-0.13	0.00	0.15	0.44	0.79	6.66
WATER4	-7.50	-0.71	-0.38	-0.12	0.01	0.14	0.41	0.72	7.87
WATER5	-16.67	-0.69	-0.36	-0.10	0.01	0.14	0.42	0.77	8.57

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 15. Distributions of Percentage Point Changes in Tract-Level Estimates using Final Weights by Person-Level Characteristic (Char.) (Experimental - Current)

	Percentile								
Char.	**0th**	**1st**	**5th**	**25th**	**50th**	**75th**	**95th**	**99th**	**100th**
HISP	-8.59	-0.41	-0.19	-0.05	0.00	0.06	0.19	0.40	8.41
EMP1	-22.22	-0.58	-0.30	-0.09	0.02	0.13	0.34	0.62	7.14
EMP2	-11.36	-0.30	-0.16	-0.05	0.00	0.04	0.14	0.27	5.13
EMP3	-7.14	-0.61	-0.32	-0.12	-0.01	0.09	0.30	0.57	22.22
RACE1	-9.64	-0.51	-0.21	-0.06	0.00	0.06	0.22	0.50	22.22
RACE2	-10.94	-0.47	-0.21	-0.06	0.00	0.05	0.19	0.45	10.17
RACE3	-22.22	-0.35	-0.16	-0.05	0.00	0.05	0.16	0.38	8.93
HS	-6.20	-0.46	-0.23	-0.07	0.01	0.09	0.27	0.52	11.31
COLL	-4.95	-0.39	-0.20	-0.05	0.02	0.10	0.26	0.46	6.06
INSUR	-8.93	-0.39	-0.18	-0.04	0.02	0.08	0.23	0.45	6.50
MIG1	-9.09	-0.39	-0.18	-0.04	0.03	0.11	0.29	0.52	22.22
MIG2	-3.92	-0.20	-0.09	-0.03	0.00	0.02	0.08	0.18	1.29
MIG3	-22.22	-0.52	-0.28	-0.11	-0.03	0.04	0.18	0.38	9.09

Source: U.S. Census Bureau, 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 16. Percent of Significant Changes from 2014 5-Year Estimates to 2015 5-Year Estimates using Current and Experimental Final Weights by HU-Level Characteristic (Char.) and Geography

	State			County			Tract		
Char.	**CUR**	**EXP**	**DIFF**	**CUR**	**EXP**	**DIFF**	**CUR**	**EXP**	**DIFF**
HHT1	48.08	28.85	-19.23	17.95	17.33	-0.62	16.31	16.11	-0.20
HHT2	26.92	25.00	-1.92	16.51	16.84	0.33	17.62	17.61	-0.01
HHT3	30.77	44.23	13.46	17.16	17.81	0.65	16.86	16.83	-0.03
HHT4	48.08	28.85	-19.23	17.80	17.55	-0.25	15.88	15.83	-0.05
HHT5	38.46	30.77	-7.69	18.33	18.32	-0.01	17.78	17.83	0.05
HHT6	28.85	28.85	0.00	16.74	16.89	0.16	15.05	15.00	-0.05
HHT7	25.00	19.23	-5.77	16.83	16.82	-0.01	17.60	17.62	0.02
HPOV	36.54	42.31	5.77	18.76	19.17	0.41	16.21	16.23	0.01
TEN1	92.31	88.46	-3.85	30.56	26.92	-3.64	18.40	17.91	-0.49
TEN2	84.62	90.38	5.77	23.55	25.72	2.17	17.02	17.33	0.31
TEN3	78.85	57.69	-21.15	23.48	19.84	-3.63	17.61	17.29	-0.32
TEN4	25.00	21.15	-3.85	18.55	18.19	-0.36	18.27	18.25	-0.03
NP1	53.85	44.23	-9.62	17.27	16.83	-0.43	15.22	15.23	0.01
NP2	51.92	57.69	5.77	17.27	17.33	0.06	15.76	15.77	0.01
NP3	26.92	25.00	-1.92	18.37	17.96	-0.40	16.32	16.41	0.09
NP4	32.69	26.92	-5.77	19.63	19.63	0.00	17.07	17.12	0.05
NP5	15.38	13.46	-1.92	17.55	18.12	0.57	17.99	17.96	-0.04
NP6	32.69	34.62	1.92	20.23	19.82	-0.41	19.45	19.44	-0.01
VAC	53.85	50.00	-3.85	22.42	22.64	0.22	16.66	16.64	-0.02
ELEC1	76.92	75.00	-1.92	24.18	23.66	-0.52	21.56	21.44	-0.12
ELEC2	57.69	53.85	-3.85	21.57	21.50	-0.07	18.57	18.60	0.03
ELEC3	90.38	92.31	1.92	30.40	30.43	0.03	19.72	19.73	0.01
ELEC4	71.15	71.15	0.00	23.86	23.90	0.04	17.68	17.69	0.02
ELEC5	78.85	76.92	-1.92	24.46	24.77	0.31	18.63	18.63	0.00
ELEC6	65.38	65.38	0.00	22.41	22.58	0.18	18.06	18.09	0.02
ELEC7	69.23	71.15	1.92	22.55	22.58	0.03	19.03	18.97	-0.06
ELEC8	90.38	90.38	0.00	34.05	34.23	0.19	20.89	20.88	-0.01
GAS1	80.77	80.77	0.00	29.14	28.80	-0.34	19.76	19.61	-0.15
GAS2	69.23	71.15	1.92	27.37	27.15	-0.23	19.63	19.64	0.02
GAS3	51.92	50.00	-1.92	24.94	25.21	0.27	19.21	19.19	-0.02
GAS4	86.54	84.62	-1.92	26.31	26.28	-0.03	19.57	19.56	-0.01
GAS5	61.54	57.69	-3.85	25.42	25.17	-0.25	19.94	19.96	0.02
GAS6	67.31	69.23	1.92	24.09	24.00	-0.09	19.21	19.20	-0.01
GAS7	73.08	75.00	1.92	28.28	28.30	0.02	21.04	21.05	0.00
GAS8	82.69	82.69	0.00	33.62	32.94	-0.68	22.92	22.73	-0.19
WATER1	55.77	61.54	5.77	23.94	23.98	0.03	20.12	20.09	-0.03
WATER2	78.85	84.62	5.77	30.35	30.22	-0.12	20.99	20.96	-0.03
WATER3	100.0	100.0	0.0	49.35	49.44	0.09	26.85	26.80	-0.05
WATER4	80.77	80.77	0.00	32.76	33.07	0.31	24.26	24.26	0.00
WATER5	92.31	94.23	1.92	35.17	35.55	0.39	23.35	23.51	0.17

Source: U.S. Census Bureau, 2010-2014 and 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.

Table 17. Percent of Significant Changes from 2014 5-Year Estimates to 2015 5-Year Estimates using Current and Experimental Final Weights by Person-Level Characteristic (Char.) and Geography

	State			County			Tract		
Char.	**CUR**	**EXP**	**DIFF**	**CUR**	**EXP**	**DIFF**	**CUR**	**EXP**	**DIFF**
HISP	100.0	100.0	0.0	72.82	72.80	-0.02	22.25	22.29	0.04
EMP1	67.31	67.31	0.00	24.16	24.25	0.09	17.97	17.96	-0.01
EMP2	100.0	100.0	0.0	49.62	49.89	0.27	22.75	22.83	0.08
EMP3	88.46	88.46	0.00	29.19	28.23	-0.96	18.29	18.32	0.03
RACE1	92.16	92.16	0.00	44.88	44.85	-0.03	21.92	21.90	-0.02
RACE2	90.20	90.20	0.00	39.05	38.92	-0.13	22.39	22.39	0.00
RACE3	96.08	96.08	0.00	40.44	40.30	-0.15	22.32	22.27	-0.05
HS	98.08	98.08	0.00	39.41	40.47	1.06	19.28	19.40	0.12
COLL	100.0	100.0	0.0	26.72	26.78	0.06	17.86	17.94	0.08
INSUR	100.0	100.0	0.0	55.93	56.55	0.62	23.62	23.78	0.16
MIG1	32.69	40.38	7.69	23.43	23.43	0.00	19.28	19.29	0.01
MIG2	17.31	17.31	0.00	21.41	21.99	0.57	20.13	20.15	0.01
MIG3	34.62	42.31	7.69	23.82	23.61	-0.21	19.30	19.30	0.00

Source: U.S. Census Bureau, 2010-2014 and 2011-2015 American Community Survey (ACS) 5-Year Data
Note: For information on sampling error, non-sampling error, and confidentiality protection in the ACS, see https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html.