

Is It Over Yet? Assessing the Effects of the COVID-19 Pandemic on Housing Vacancy Survey Estimates for 2020 and 2021

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Abstract

Rising COVID-19 case counts in early 2020 led to changes in the data collection procedures used for the Current Population Survey's Housing Vacancy Survey supplement (CPS/HVS), an important source of information about vacancy rates and the homeownership rate in the United States. On March 20, 2020, the Census Bureau suspended in-person data collection attempts and shifted all data collection operations to telephone-based attempts, a change that remained in place through July 2020, when in-person data collection began to be gradually reintroduced. This paper examines the implications of these data collection changes for CPS/HVS estimates. First, the paper presents a series of nonresponse analyses that use auxiliary data sources to describe differences between responding versus nonresponding housing units, as well as to examine changes in these differences over time. The nonresponse analyses find significant changes in these nonresponse outcomes in the second and third quarters of 2020, effects that dissipate in the fourth quarter of 2020 and all four quarters of 2021. Second, the paper develops an alternative nonresponse weighting adjustment factor and examines the implications for CPS/HVS estimates of the homeownership rate, gross vacancy rate, rental vacancy rate, and homeowner vacancy rate. The results suggest that the observed changes in nonresponse outcomes likely contributed to elevated homeownership rate estimates for the second and third quarters of 2020. The vacancy rate estimates are not similarly sensitive to the alternative nonresponse weighting adjustment; however, the results illustrate the potential for the CPS/HVS vacancy rates to underestimate the actual levels of vacancy due to the weighting methodology's assumption that all nonresponding housing units are occupied. Data users should consider these results when interpreting the CPS/HVS estimates of vacancy and homeownership for the quarters affected by the changes in data collection procedures.

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Introduction

In response to the onset of the COVID-19 pandemic in the United States, the Census Bureau on March 20, 2020, suspended in-person interview attempts for its ongoing surveys, including the Current Population Survey's Housing Vacancy Survey supplement (CPS/HVS).¹ In-person interview attempts—termed 'personal visits'—are the primary mode of data collection for CPS/HVS, which relies on these visits to accurately identify vacant and non-residential properties as well as to complete household interviews. Following the suspension of personal visits, CPS/HVS interviewers made extensive efforts to replace personal visits with telephone-based contact attempts. Despite these efforts, the share of CPS/HVS sample cases resolved as nonresponses increased from 14-15 percent in each quarter of 2019 to 18 percent in the first quarter of 2020 and 28 percent in the second quarter of 2020. As in-person interview attempts were gradually reinstated, the nonresponse share subsequently reversed to 24 percent in the third quarter of 2020 and 18-22 percent in the fourth quarter of 2020 and each quarter of 2021.

Spader et al. (2021) examined the implications of this change in data collection procedures for CPS/HVS estimates through the third quarter of 2020. The current paper updates the analyses in Spader et al. (2021) through the fourth quarter of 2021. Additionally, this paper uses similar methods to examine the extent to which response rate decreases from 2015 to 2019 prior to the pandemic carry similar consequences for CPS/HVS estimates. In both analyses, a central research objective is to determine the extent to which nonresponse is randomly distributed across sampled housing units or concentrated among specific types of households or housing units. Decreases in the response rate do not necessarily reduce the accuracy of survey estimates if the changes in nonresponse are random or otherwise independent of the variables used to produce estimates. However, the response rate decreases may affect the CPS/HVS estimates to the extent that the suspension of personal visits reduced the response rates of some groups more than others—e.g., vacant versus occupied units, rental versus homeowner units, etc.

Assessing these patterns of nonresponse is therefore necessary to understand the extent to which the CPS/HVS estimates may be affected by the changes in nonresponse. For example, the CPS/HVS estimate of the homeownership rate increased from 65.3 percent in the first quarter of 2020 to 67.9 percent in the second quarter. This increase of 2.6 percentage points marks the largest quarter-to-quarter change in the homeownership rate in the CPS/HVS historical series dating back to 1964.² Because the changes in data collection procedures affected the response rates in the first and second quarters of 2020, it is unclear to what extent this increase may be due to the data collection changes rather than the actual changes in homeownership that occurred during the initial months of the pandemic.

This paper pursues two research objectives in an attempt to better understand the consequences of changing response rates for the CPS/HVS estimates. First, the paper conducts a series of nonresponse analyses that describe the differences between responding versus nonresponding housing units within a

¹ The Housing Vacancy Survey supplement collects additional information about vacant units, whereas information about homeownership is collected for occupied units in the Current Population Survey. For ease of notation, this paper uses the CPS/HVS label to refer to the combined set of vacancy rate and homeownership rate estimates. Additional information about the quarterly CPS/HVS estimates is available at: <https://www.census.gov/housing/hvs/index.html>.

² U.S. Census Bureau. Housing Vacancies and Homeownership (CPS/HVS). Table 14. Homeownership Rates for the U.S. and Regions: 1964 to Present." Published October 27th, 2020.

given time period and then examine changes in these nonresponse outcomes across periods. These analyses document the extent to which nonresponse was nonrandom in 2015 prior to the response rate decreases that are the focus of this paper. The analyses then describe the size and nature of the changes in nonresponse patterns that appear between 2015 and 2019 and between 2019 and each quarter of 2020 and 2021, respectively. The results do not find significant changes in sample composition following the incremental declines in the response rate from 2015 and 2019; conversely, they describe multiple significant changes in nonresponse outcomes in the second and third quarters of 2020 following the pandemic-related suspension of personal visits.³

Second, the paper develops a nonresponse weighting adjustment factor and examines the implications of its use for the CPS/HVS estimates of the homeownership rate, rental vacancy rate, homeowner vacancy rate, and gross vacancy rate. The analyses use a propensity-score-based approach to develop a nonresponse weighting adjustment factor and apply it to the CPS/HVS weights. The results suggest that the observed changes in sample composition may have contributed to elevated homeownership rate estimates for the second and third quarters of 2020, and that this effect dissipated in subsequent quarters. In contrast, the vacancy rates are not significantly affected by the nonresponse adjustment factor; however, the discussion of these results describes the potential for the CPS/HVS vacancy rates to underestimate the actual levels of vacancy to the extent that the suspension of personal visits increased the risk of violating the weighting methodology's assumption that data collection attempts will identify all vacant units.

Changes to HVS Data Collection Procedures

In response to rising numbers of COVID-19 cases in the United States, the Census Bureau suspended personal visits for the CPS/HVS on March 20, 2020. The suspension of personal visits continued in all areas of the United States for the CPS/HVS data collection periods in April, May, and June 2020. Beginning in July 2020, personal visits began to be reintroduced in a subset of localities, with ongoing review and updates each month in response to local conditions. Table 1 shows the percentage of sample cases for which personal visits were allowed in each quarter of 2020 and 2021 by region. The percentages show that personal visits were gradually reintroduced in most areas by the end of 2020, but also that some restrictions continued through the third quarter of 2021. The fourth quarter of 2021 was the first quarter when personal visits were allowed in all areas throughout the country.

During the periods when personal visits were suspended, the Census Bureau continued to collect the CPS/HVS by telephone, making efforts to collect telephone interviews for all sample units including vacant units and ineligible units. The standard CPS/HVS data collection procedures use personal visits as the primary mode of data collection but allow telephone interviews when certain conditions are met. The CPS/HVS sample design is a rotating panel that collects data on sample housing units for eight separate months. Once selected, a housing unit is in the sample for four consecutive months, out for eight months, and then in the sample for four months. Under the standard CPS/HVS data collection procedures, the first and fifth interviews are required to be collected through personal visits. In other months, a telephone interview can be completed with HVS-eligible sample housing units if the unit was HVS-eligible in the previous month, the unit is located geographically distant from the interviewer's

³ Use of the term statistically significant in the text of this paper indicates that a finding is significant at the 90 percent level or higher. All tables report significance at the 90, 95, and 99 percent levels.

home and other remaining interviews, and the name and telephone number of a reliable respondent is available and a telephone interview is acceptable to that person.⁴

The suspension of in-person interviews meant that telephone contact attempts replaced in-person interview attempts for all housing units, regardless of a unit's month in sample. These telephone contacts relied on phone numbers identified through multiple sources. For housing units with a completed interview in a previous month, interviewers attempted to contact the occupant or knowledgeable proxy interviewed during the previous month. Additionally, interviewers were encouraged to use the resources available to them to identify contact information for sample housing units and/or knowledgeable proxy respondents. These included internal resources such as purchased third-party telephone lookup databases, as well as public records databases such as tax assessor records. Interviewers could also use online searches to identify leasing offices or telephone contacts with knowledgeable local sources such as real estate agents, neighbors, and postal workers who might be able to identify vacant units, provide contact information for the property owner, or complete a proxy interview. Beginning in December 2020, interviewers were also allowed to drive by the sample unit to try to determine the vacancy status. The removal of personal visit restrictions subsequently reversed these changes, returning to the previous procedures for determining when a telephone interview is allowed.

In each month, CPS/HVS data collection generally begins at the start of the week containing the 19th and closes out early the following week. The suspension of personal visits on March 20, 2020 occurred on the Friday during the week of data collection. While interviewers were able to make at least one personal visit attempt to most sample units prior to the suspension of personal visits, the suspension of personal visits occurred prior to the completion of data collection activities for March 2020—and therefore prior to the completion of data collection for the first quarter 2020.

While interviewers made extensive efforts to complete data collection using telephone-based contact attempts, response rates declined following the suspension of personal visits. Table 2 displays the unweighted share of sample housing units recorded as nonrespondents in each quarter of the analysis period. Using CPS/HVS terminology, these nonresponding units are coded as 'Type As,' which include housing units that are eligible for an occupied interview but for which no data are collected (e.g., refusals). The nonresponse shares in Table 2 show the ratio of these Type A nonresponses to the full sample of housing units, which also includes completed interviews of occupied units, HVS-eligible Type B vacant units, other Type B units, and Type C ineligible units.⁵ The percentages in the first column of Table 2 indicate that the share of sample housing units recorded as nonresponses increased from approximately 14-15 percent of sample housing units in each quarter of 2019 to 28 percent in the second quarter of 2020 before returning to 19 percent of sample cases in the first two quarters of 2021. This pattern reflects the increase in nonresponse that accompanied the suspension of personal visits in 2020, along with the subsequent reduction in nonresponse as personal visits were reintroduced. The figures also show a modest increase in nonresponses to 21-22 percent in the second half of 2021 as the Delta and Omicron waves of COVID-19 infections spread throughout the U.S.

⁴ For additional information, refer to the Current Population Survey Interviewing Manual (2015) at https://www.census.gov/housing/hvs/methodology/CPS_Manual_April2015.pdf.

⁵ Additional information about the technical definitions of each of these groups is available in Chapter 3-2 of CPS Technical Paper 77 (U.S. Census Bureau 2019).

The additional columns of Table 2 report the nonresponse share in each quarter by month-in-sample (MIS) group. These patterns show that the highest nonresponse share (45%) appears in the second quarter of 2020 for MIS 1, which includes the housing units that were rotating into the sample for the first time and that did not have any stored contact information from interviews in previous months. While higher nonresponse rates in the MIS 1 group aren't necessarily problematic for the CPS/HVS estimates, they may raise concerns to the extent that the availability of telephone contact information from previous interview months is correlated with vacancy, tenure, or other estimated outcomes. The nonresponse shares for subsequent quarters show the lingering effects as these units moved into later months-in-sample.

Lastly, the figures in Table 2 also reflect the more incremental increases in nonresponse that occurred in the years preceding 2019. Between the third quarter of 2015 and the second quarter of 2016—the four quarters following full implementation of the CPS sample redesign⁶—the nonresponse share of sample housing units was approximately 11-12 percent, compared to 14-15 percent in each quarter of 2019.

Implications of Unit Nonresponse for Survey-Based Estimates

The recent changes to CPS/HVS data collection in response to COVID-19 and the resulting drop in response rates have occurred against longer-term trends in survey nonresponse. Since the 1990s, survey nonresponse has increased across almost all household surveys, including large government surveys (Czajka and Beyler 2016). Declines in survey response rates are concerning because the foundation of household surveys rests on probability sampling, in which samples of a target population are drawn from a sampling frame, which includes all of the households that compose the target population (Groves 2006; Brick and Williams 2013). The main assumption of this strategy is that for the sample to be representative of the target population, there must be complete response to all survey measures on the survey instrument. When missing data are present, this introduces the potential for estimates to be biased.

However, nonresponse alone is not sufficient to create bias in survey estimates. When data are missing at random, meaning the missing data are not correlated with the survey measure of interest, nonresponse does not bias the resulting survey estimate for the survey measure (Groves and Peytcheva 2008). This suggests a weak correlation between nonresponse rates and survey measure bias where a low response rate does not indicate the presence of bias nor a high response rate the absence of bias. Survey estimate bias may also vary across survey estimates on the same survey more than estimates across different surveys (Groves and Peytcheva 2008; Peytcheva and Groves 2009; Yan and Curtin 2010). Assessing bias is an item-specific process that involves looking at the relationships between the characteristics of respondents and nonrespondents, nonresponse, and each survey measure of interest.

Since survey nonresponse and concerns over survey bias have received considerable attention in recent years, most surveys employ at least minimal strategies to decrease or correct for potential issues related to nonresponse. Strategies for assessing and mitigating bias created by nonresponse vary by the type of missing data at hand. These include unit nonresponse, item nonresponse, incomplete coverage of populations, and partial nonresponse in panel surveys (Groves and Peytcheva 2008). All of these types

⁶ Refer to Chapters 2-1 and 2-2 of CPS Technical Paper 77 (U.S. Census Bureau 2019) for more information about the CPS's sample frame and sample design. Additional information about the sample redesign is also available in the Bureau of Labor Statistics' CPS Technical Documentation at: www.bls.gov/cps/sample_redesign_2014.pdf.

of missing data are worthwhile subjects of research, but, in this paper, we focus on unit nonresponse, or when an interviewer is unable to obtain sufficient survey measures for a sample unit.

A common method of combating unit nonresponse bias is to use post-survey weighting adjustments.⁷ These methods use outside information, called auxiliary data, on both respondents and nonrespondents to adjust survey weights to correct for potential bias on survey estimates. Auxiliary data may take the form of data from the sampling frame, administrative records, and survey paradata such as field representative observations (Groves and Peytcheva 2008; Kreuter and Olson 2011).

The two primary methods for creating weighting adjustments for unit nonresponse are adjustment cell weighting and response propensity weighting. The purpose of each of these strategies is to use auxiliary variables with information on both respondents and nonrespondents to predict the probability of response to a survey or for a given survey measure and reduce or eliminate nonresponse bias. Each of these methods has advantages and disadvantages, and the decision of which one to use is dependent on the available auxiliary data and the survey measure of interest.

Adjustment cell weighting involves creating cells by cross-tabulating auxiliary variables of interest for respondents and nonrespondents and then calculating the probability of response in the different cells. Because cell weighting is a non-parametric method, it provides some protection against model misspecification, nonlinear estimates, and interactions between variables that may occur in parametric modeling. This is useful especially when dealing with continuous variables (Haziza and Lesage 2016). One disadvantage, depending on the amount of data available, is that some cells in this method may have a limited number of cases, resulting in unstable probabilities. A technique for overcoming this issue is to combine cells with small sample sizes that have similar probabilities. A more sophisticated version of adjustment cell weighting, the chi-square automatic interaction detection (CHAID) algorithm, is used when the number of variables is large. This method merges and collapses the created cells until the data are grouped by similar response probabilities (Chen et al. 2015).

In response propensity weighting, a series of covariates is used to predict a group receiving or not receiving a treatment using logistic regression (Rosenbaum and Rubin 1983). As this method has been applied to survey nonresponse, the term “response propensity weighting” was developed to explain how the probability of response, a proxy for response propensity in surveys, is predicted using auxiliary variables that are associated with both nonresponse and the survey measure of interest. The resulting probabilities are used to adjust survey weights and correct for unit nonresponse bias. Response propensity weighting is more complicated than the adjustment cell method, but avoids the issues related to small cell sizes and unreliable cell probabilities (Brick 2013; Chen et al. 2015).

Chen et al. (2015) describe two limitations of response propensity weighting and offer a potential solution. The first limitation is that response propensity weighting is dependent on correctly specifying

⁷Other strategies to increase survey response rates include follow-up interviews, administering the survey in multiple modes, and prioritizing some cases over others when attempting interview (Fowler 2013; Groves 2006). These strategies are most effective when carefully tailored to balance nonresponse across sampled units with different characteristics. If a strategy for increasing response rates results in non-random increases in response patterns across some sampled units, this could actually increase bias on survey measures. Because changes to the survey mode for HVS/CPS had to be made quickly, using one of the aforementioned strategies was not an option, and this paper necessarily focuses on post-survey weighting adjustments.

the model, as poor model fit will yield biased coefficients. For the second limitation, response propensity weighting sometimes yields very small propensities for small samples, and these groups can then receive very large weights. Chen et al. (2015) reference the work of Little (1986) on the response propensity stratification method, in which the resulting response propensities are then used to form adjustment cells. Using this method reduces issues with poor model fit and/or small propensities.

An additional criticism of past work using response propensity weighting is that researchers often assume that the propensity to respond is fixed for a sample unit rather than variable across survey conditions—e.g., the number of attempts by interviewers to obtain a response.⁸ One proposed way to avoid this issue is to directly model survey conditions by having a vector of predictors include data collection attempts, such as numbers of call attempts, survey mode, incentives, and refusal conversion attempts (Brick 2013; Olsen and Groves 2012; Schouten et al. 2011). Using data collection measures has proven useful in propensity score modeling experiments aimed at case prioritization for a large government survey (Tolliver et al. 2019).

Often response propensity weighting and adjustment cell weighting methods are combined with additional techniques to adjust the weights according to known population totals. For example, many government surveys take a two-step approach of using adjustment cell weighting to correct for nonresponse bias combined with raking to calibrate the resulting weights against existing population totals (Haziza and Lesage 2016). In these methods, data on respondents and nonrespondents are used in combination with independent housing unit and/or population estimates to adjust survey weights to account for potential nonresponse bias (Bethlehem 2002).

No single weighting adjustment strategy has been demonstrated to be superior to others in reducing nonresponse bias (Chen et al. 2015; Brick 2013). What appears to be most important is to have powerful auxiliary variables that predict both nonresponse and the survey measure of interest and selecting a strategy that best takes advantage of these data. Strategies that limit the amount of auxiliary data that can be incorporated may be less beneficial (Brick 2013). Conversely, the incorporation of supplemental data sources beyond what is available from the survey itself can be valuable to the extent that such data broadens the set of auxiliary variables available to predict nonresponse.

In recent years, researchers have developed linking methods to broaden the set of auxiliary data available for nonresponse analyses of Census Bureau surveys (Brummet 2014; Wagner and Layne 2014). These efforts initially focused on understanding the consequences of nonresponse patterns prior to the COVID-19 pandemic in the CPS's Annual Social and Economic Supplement (CPS ASEC; Bee et al. 2015), the Survey of Income and Program Participation (Eggleston and Westra 2020), and the Consumer Expenditure Survey (Brummet et al. 2018; Sabelhaus et al. 2015). More recently, Rothbaum and Bee (2020) examine the consequences of changing nonresponse patterns for income estimates in the 2020 CPS ASEC collected during the early months of the pandemic, and Berchick et al. (2020) examine 2020 CPS ASEC estimates of health insurance for evidence of nonresponse bias. While several of these prior analyses use auxiliary data to examine nonresponse bias in the CPS, the current study and its predecessor to our knowledge are the first to apply these methods to the Housing Vacancy Survey (Spader et al. 2021).

Data and Methodology

⁸ This criticism is just as valid for cell adjustment methods that ignore data collection attempts in estimating response propensities.

The analyses in this paper pursue multiple research objectives. First, we conduct a series of nonresponse analyses that compare the characteristics of responding versus nonresponding housing units over time, measuring the extent to which CPS/HVS nonresponse patterns have changed. An initial set of analyses compare nonresponse patterns in 2019 to the period following the most recent CPS/HVS redesign in 2015. These analyses examine the extent to which the patterns of nonresponse changed from 2015 to 2019 during the period of incremental decreases in survey response. Additional analyses then compare nonresponse patterns during the pandemic period in 2020 and 2021 to the patterns observed in 2019. This second set of analyses examines the extent to which nonresponse patterns changed following the suspension of personal visits in March 2020. A final research objective of the paper is to develop and apply a nonresponse weighting adjustment factor to explore the extent to which the observed changes in nonresponse patterns affected the CPS/HVS estimates. In each of these analyses, the availability of supplemental data that contain information about both responding and nonresponding households is central to the research design.

The base dataset for the analyses is the monthly sample of housing units for CPS/HVS data collection. We append the monthly datasets from July 2015 through June 2016—the first 12 months following full implementation of the sample redesign—and from January 2019 through December 2021. We categorize this data into quarters to match the CPS/HVS quarterly releases, and supplement it with information from multiple sources. First, information from the 2010 Decennial Census and property records from Black Knight Inc. are each merged to the base sample at the housing unit level, using the Census Bureau’s Master Address File identifier (MAFID) to conduct the merge (Brummet 2014). The 2010 Census contains information about the vacancy status, tenure, and other attributes of the unit at the time of the census. The vendor data from Black Knight Inc. contains information about the housing unit compiled from county tax assessor records and other sources. Additionally, neighborhood attributes measured at the census tract level are added from the American Community Survey’s 2018 5-year estimates. Table 3 contains a summary of the data sources and variables added from each source. Because none of the supplementary data sources contains complete coverage of all housing units in the base sample, the analyses add indicator variables for whether a match cannot be found as additional covariates.

The nonresponse analyses use this information to compare the characteristics of responding versus nonresponding housing units. For a given period, the analyses test whether the characteristics of nonresponding units are statistically different from the characteristics of housing units with a completed response. Using CPS/HVS terminology, the analyses compare the characteristics of Type A nonresponses to the characteristics of the pooled sample of completed interviews, Type B vacant/unoccupied units, and Type C ineligible units. These initial comparisons describe the extent to which differential nonresponse is present in the CPS/HVS sample, capturing both longstanding response patterns and any recent changes unique to the period selected.

The second step in the nonresponse analyses is to compare the differences between responding and nonresponding units across quarters. These comparisons test whether the size of the differences changed significantly across periods. These difference-in-difference comparisons have the potential to shed light on whether the pandemic-related suspension of personal visits affected response patterns. However, the comparisons may also reflect the effects of any other confounding factors that altered the likelihood of nonresponse among the observed subgroups across quarters. The comparisons should therefore be interpreted as the combined effect of the data collection changes and all other factors that affected nonresponse patterns during the periods being compared.

The results of these analyses then inform the development of an alternative weight using a propensity-score-based adjustment for nonresponse. Under the current methodology, the CPS/HVS weights adjust for nonresponse in two ways. First, the CPS household weight applied to occupied units includes a nonresponse weighting adjustment factor that adjusts for differences in response across primary sampling units (PSUs) and central city location status. The nonresponse adjustment factor groups PSUs within the same state that are similar in metropolitan status and size and then splits these clusters based on central city and non-central-city location to form the adjustment cells. This nonresponse adjustment factor is incorporated into the CPS household weights applied to occupied units; however, the HVS supplement weights applied to vacant units do not have any similar adjustment for nonresponse.⁹ Second, the process of controlling the weights to independent population totals may also reduce the effects of differential nonresponse to the extent that nonresponse is correlated with the demographic subgroups used in the population controls. A more detailed description of the weighting components included in the standard methodology is available in CPS Technical Paper 77 (U.S. Census Bureau 2019).

An important feature of the current methodology is its assumption that all Type A nonresponses are occupied units and that none are vacant. This feature is implicit in the application of the nonresponse adjustment factor to occupied units but not to vacant units. By calculating the nonresponse adjustment factor as the inverse of the ratio of completed interviews to the sum of complete interviews plus Type A nonresponses within each adjustment cell, the nonresponse adjustment factor weights the completed interviews up to the total universe of completed interviews and Type A nonresponses. This adjusted total of occupied units is then combined with the vacant responses when the population control totals are applied to weight the units up to the total number of housing units in U.S. This sequence of steps relies on the assumption that all vacant units will be identified during the in-person data collection attempts. To the extent that vacant units are not identified by the in-person data collection attempts and are instead coded as Type A nonresponses, the CPS/HVS estimates of vacancy rates may underestimate vacancy. Moreover, any changes in the likelihood that vacant units are not identified by the in-person data collection attempts may limit the validity of comparisons of the CPS/HVS estimates of vacancy rates across quarters.

The analyses in this paper therefore examine the sensitivity of CPS/HVS estimates to the use of an alternative weighting approach that uses the supplemental data sources to develop a propensity-score-based adjustment for nonresponse. The propensity scores are constructed by estimating logistic regressions with the following form:

$$(1) \quad \text{Log}(\text{Pr}(Y_i / (1 - \text{Pr}(Y_i))) = \alpha + X_i\beta_1 + G_i\beta_2 + M_i\beta_3$$

Where Y_i is an indicator for whether the housing unit did not respond, X_i is a vector of covariates from the supplemental data sources described above, G_i is a set of fixed effects that interact 51 indicator variables for the states and Washington, DC with 3 metropolitan status categories, and M_i is a set of fixed effects that interact the three metropolitan status categories with eight month-in-sample categories.¹⁰ Equation 1 is estimated separately for each quarter using logistic regressions on the pooled sample of all housing units in the CPS monthly basic files for each quarter.

⁹ The HVS supplement weights are indirectly affected by the CPS household weights through the denominator of the regional housing unit adjustment, which includes the CPS estimate of the total count of occupied units.

¹⁰ Refer to Appendix A in Spader et al. (2021) for additional information about the model specification process along with model fit statistics.

These regressions are then used to calculate the predicted probability of response for each sample housing unit in each quarter. The alternative nonresponse weighting adjustment factor is calculated as the inverse of the predicted probability of response, and the alternative weights are constructed by multiplying this alternative nonresponse adjustment factor by the base weights to account for differences in response propensities. As described in CPS Technical Paper 77, the base weights are sufficient to produce unbiased estimates of vacancy rates and the homeownership rate under strong assumptions about ideal survey conditions such as zero frame error, zero non-sampling error, and nonresponse patterns that are independent of the variables used to produce the estimates (U.S. Census Bureau 2019). The alternative nonresponse weighting adjustment relaxes the last assumption, requiring only that the nonresponse patterns are independent of the unobservable factors not controlled for in the logistic regressions. However, it does not relax any concerns about frame error or other sources of non-sampling error.

Results and Discussion

The first research objective for the analyses in this paper is to conduct nonresponse analyses that examine the extent of change in the characteristics of respondents and nonrespondents over time. Tables 4-8 present the results of these nonresponse analyses. All statistics are calculated using a base weight that adjusts for differences in sampling probabilities, and the standard errors are calculated using replicate weights.

Within each period, the tables present the results of t-tests of the difference in means between nonresponding housing units defined as Type A cases versus responding housing units defined as the pooled sample of completed interviews, Type B vacant/unoccupied units, and Type C ineligible units. These comparisons provide insight into whether nonresponding units were randomly distributed across the sample in each period by testing whether the mean attributes of nonresponding housing units are statistically different from the mean attributes of responding units. Significant differences do not necessarily imply that the final CPS/HVS estimates will under- or over-represent a given characteristic, because subsequent weighting adjustments such as the nonresponse adjustment factor and the process of controlling to independent population totals may correct for differences in nonresponse patterns. Nonetheless, these estimates provide insight into the extent to which nonrandom patterns of nonresponse raise concerns about the potential for nonresponse bias that require correction through the subsequent adjustments.

The tables also report the results of difference-in-difference estimates that compare the differences between the nonresponding and responding units across periods. Within each period, the differences are calculated as the mean value for nonresponding units minus the mean value for responding units. The difference-in-difference estimates are then calculated as the difference for the later period minus the difference for the earlier period, so positive values on the difference-in-differences estimates reflect attributes that became more common among nonrespondents over time—and therefore less represented in the CPS/HVS sample of respondents. These difference-in-differences comparisons provide insight into the extent to which the CPS/HVS nonresponse patterns changed over time. Similar to the within-period comparisons, it is possible that the subsequent weighting adjustment factors may partially or fully correct for any identified changes. Significant results for the difference-in-difference estimates therefore provide insight into the potential risk that nonresponse bias might affect the comparability of estimates across periods to the extent that the subsequent nonresponse weighting adjustments do not fully account for the identified changes.

Nonresponse Analyses: 2015-2019

Table 4 presents the results of nonresponse analyses that examine whether the incremental increases in nonresponse during the years prior to the pandemic were accompanied by significant changes in sample composition. The results compare the characteristics of responding and nonresponding housing units in 2019 to the first four quarters following the CPS/HVS sample redesign—the third quarter of 2015 to the second quarter of 2016 (labeled “2015/2016”).¹¹ The analyses might ideally compare the 2019 outcomes to even earlier periods to capture the full extent of the nonresponse rate declines over the preceding decade; However, the information needed to link sample housing units to the auxiliary data is not available prior to the sample redesign in 2015, so apples-to-apples comparisons to earlier periods are not possible. As shown in Table 2, the share of nonresponding units increased from 11-12 percent in 2015/2016 to 14-15 percent in 2019.

An initial finding from the output shown in Table 4 is that the within-period comparisons for both 2015/2016 and 2019 show multiple significant differences between the mean attributes of responding versus nonresponding housing units, suggesting that nonresponse was not randomly distributed in either period. For example, the results for 2015/2016 show that 12.7 percent of responding housing units were in MIS 1, and that the corresponding share among nonresponding units is 2.0 percentage points higher (14.7 percent)—a difference that is statistically significant. This difference indicates that sample housing units in MIS 1 may be slightly underrepresented in the sample of respondents. The final estimates therefore rely on the nonresponse adjustment factor and the process of controlling the weights to independent population totals to account for this difference.

The results for 2015/2016 also show significant differences between the mean attributes of responding and nonresponding housing units for multiple other variables. For example, the 2010 Census variables in Table 4 (which are defined in Table 3) show that the set of nonresponding housing units contains fewer seasonally vacant units; more rental units and fewer units owned with a mortgage; more units in multi-family buildings and fewer trailers or other dwelling types; fewer households with heads age 65 or over and more households with heads younger than age 50; and more households headed by a Black householder. The neighborhood characteristics from the 2014-2018 American Community Survey (ACS) mirror several of these findings, showing that higher shares of nonresponding housing units are located in neighborhoods with lower vacancy rates; fewer single-family and more multi-family buildings; lower homeownership rates; lower population shares of persons in the White alone race category; lower population shares age 55 or over and higher population shares age 35 to 54; higher incomes; higher population shares with a college degree; and lower population shares with U.S. citizenship. Taken together, these differences describe the extent to which nonresponse was not randomly distributed in 2015/2016, the baseline period for the comparisons in Table 4.

A second finding from the results in Table 4 is that the differences observed in 2015/2016 did not change significantly by 2019, with almost no significant results in the difference-in-differences estimates. The sole exception is the indicator variable for whether a housing unit was owned by a White householder in the 2010 Census. In 2015/2016, the within-period estimates show that 59.3 percent of responding cases were units owned by a White householder in the 2010 Census, and that the corresponding share for nonrespondents was only 0.6 percentage points higher—a difference that is not

¹¹ While initial implementation of the sample redesign began in earlier quarters, the third quarter of 2015 is the first quarter in which 100 percent of sample housing units reflected the redesign and contained the identifiers needed for linking sample units to the auxiliary data sources.

statistically significant. Conversely, the estimates for 2019 indicate that 58.9 percent of responding cases were units owned by a White householder in the 2010 Census, and that the corresponding share for nonrespondents was significantly lower by 4.5 percentage points. The difference-in-differences estimate therefore shows that the Type A share decreased by 5.1 percentage points relative to the change in the responses share, and that this change is statistically significant at the 10 percent level.

While this estimate reflects a significant change in the relative attributes of nonresponding versus responding units between 2015/2016 and 2019, it is the only significant change shown in Table 4. The remaining attributes in Table 4 do not provide any evidence that the incremental increases in survey nonresponse between 2015/2016 and 2019 were accompanied by significant changes in sample composition. These results therefore do not raise broad concerns about the comparability of estimates between 2015/2016 and 2019, suggesting that the differences in the attributes of respondents versus nonrespondents were mostly stable during this period.

Nonresponse Analyses: 2019-2021

Tables 5-8 present the results of similar nonresponse analyses that examine whether the CPS/HVS sample composition changed significantly following the onset of the COVID-19 pandemic and the suspension of personal visits in March 2020. Specifically, the nonresponse analyses compare each quarter of 2020 and 2021 to the outcomes observed in 2019 prior to onset of the COVID-19 pandemic. Table 1 previously showed the extent to which the share of housing units affected by the suspension of personal visits varied across quarters. Tables 5-8 therefore present separate estimates for each quarter of 2020 and 2021, comparing the outcomes for the quarter to the pooled sample for the four quarters of 2019.

The results in Table 5 for the first quarter of 2020 do not provide any evidence that the initial suspension of personal visits and the early weeks of the COVID-19 pandemic altered the CPS/HVS sample composition between 2019 and the first quarter of 2020. Similar to the results in Table 4, the within-period comparisons show multiple significant differences between the mean attributes of responding versus nonresponding housing units. However, the difference-in-differences estimates do not find any significant changes in these outcomes compared to 2019. Taken together, these findings do not provide any evidence to suggest that survey nonresponse in the first quarter of 2020 was affected by the midweek suspension of personal visits during March data collection. Instead, the absence of any significant difference-in-differences estimates suggests that any differences in the attributes of responding versus nonresponding housing units were stable across periods, so comparisons between the first quarter of 2020 and previous quarters in 2019 should not be subject to any caveats about the potential for changes in nonresponse outcomes.

Conversely, the estimates for the second and third quarters of 2020 in Tables 5 and 6 show multiple significant changes in the difference-in-difference estimates. For example, Table 5 shows that the share of responding units in MIS 1 in the second quarter of 2020 was 9.7 percent, and that this share is 11.3 percentage points lower than the share of nonresponding units in MIS 1—a difference that is statistically significant. The difference-in-differences estimate then shows that this difference in the second quarter of 2020 represents a significant increase of 9.6 percentage points from the difference in 2019. As Table 4 previously showed, the 2019 share of responding units in MIS 1 was 12.7 percent, which was 1.7 percentage points lower than the share of nonresponding units in MIS 1 and statistically significant. This shift in nonresponse outcomes in the second quarter of 2020 suggests that MIS 1 units became more represented in the sample of nonresponding cases and less represented in the sample of responses. The

difference-in-differences estimates for the remaining MIS months show that this shift was accompanied by a significant increase in the differences for MIS 2 and offset by significant decreases in the differences for MIS 4, 6, 7, and 8.

The difference-in-differences estimates for the second quarter of 2020 show multiple additional significant changes. The set of nonresponding units in the second quarter of 2020 increasingly included fewer units that were owned free and clear in the 2010 Census; fewer units identified as owner-occupied by Black Knight's measure; more units that could not be matched to Black Knight data; and more units in neighborhoods with higher poverty rates and lower incomes in the ACS data. Taken together, these estimates describe a shifting pattern of survey nonresponse outcomes in the second quarter of 2020 compared to prior quarters.

The difference-in-difference estimates in Table 6 suggest that many of these changes continued into the third quarter of 2020. The estimates for the third quarter are consistent in sign and significance for a majority of the attributes that showed significant difference-in-differences estimates in the second quarter. The exceptions are that several attributes are no longer statistically significant, and two variables show significant difference-in-differences estimates in the third quarter of 2020 but not the second quarter—specifically, the MIS 5 indicator and the ACS measure of the neighborhood population share with a 4-year college degree or higher both show negative changes in the difference between nonresponses and responses. Taken as a whole, these estimates suggest that the third quarter of 2020 continued to show multiple significant changes in nonresponse outcomes compared to 2019.

In contrast, the estimates for the fourth quarter of 2020 (Table 6) and all four quarters of 2021 (Tables 7 and 8) do not show any statistically significant changes in the difference-in-differences estimates. Similar to the results for the first quarter of 2020, the within-period comparisons show multiple significant differences between the mean attributes of responding versus nonresponding housing units. However, the difference-in-differences estimates do not find any significant changes in these outcomes compared to 2019. These results suggest that the changes in survey nonresponse outcomes that appeared in the second and third quarters of 2020 had disappeared or substantially lessened by the fourth quarter of 2020.

These findings for 2020 and 2021 are consistent with the timing of the disruption to CPS/HVS data collection from the suspension of personal visits. As shown in Table 1, the reintroduction of personal visits in many areas meant that the share of sample housing units that were affected by the suspension of personal visits decreased from 100 percent in the second quarter of 2020 and 37 percent in the third quarter to just 6 percent in the fourth quarter and 0-2 percent in each quarter of 2021. However, the onset of the COVID-19 pandemic disrupted daily life in myriad ways, so care must be taken in attributing causality to any potential explanations. Whatever the cause, the results in Tables 5-8 describe meaningful shifts in CPS/HVS survey nonresponse that appeared in the second quarter of 2020, continued into the third quarter of 2020, and then dissipated in the fourth quarter of 2020 and all four quarters of 2021.

Alternative Nonresponse Weighting Adjustment Factor

The third and final research objective for this paper is to develop a propensity-score-based nonresponse weighting adjustment factor and to examine its implications for CPS/HVS estimates of the homeownership rate and vacancy rates. Table 9 displays the coefficient estimates of the logistic regressions used to model the likelihood that a housing unit did not respond. A separate logit regression

is estimated for each quarter. Each model regresses an indicator of whether the unit did not respond on a selected subset of the attributes from the prior nonresponse analyses, as well as two sets of fixed effects. The first set of fixed effects interacts each state by the three metropolitan status indicators (principal city, other MSA/CBSA, and non-metropolitan). The second interacts the eight month-in-sample categories by the three metropolitan status indicators. Together, these fixed effects are designed to capture variation in nonresponse associated with differences in data collection activities across different geographies and for different MIS groups. The coefficients from these models are then used to generate predicted likelihoods of nonresponse for each sample housing unit, which are then converted into the nonresponse adjustment factor and the adjusted weight using the procedures described in the Data and Methodology section.

Table 10 reports estimates of the homeownership rate, gross vacancy rate, rental vacancy rate, and homeowner vacancy rate using the propensity-score-based nonresponse weighting adjustment described above (labeled the “NEW” estimates). For comparison, Table 10 also includes estimates using the CPS base weight and the CPS base weight multiplied by the current nonresponse adjustment factor (labeled the “BW” and “CUR” estimates, respectively). The statistical tests reported in Table 10 test whether the BW and CUR estimates are significantly different from the NEW estimate for the same quarter. For ease of review, Figures 1-4 visualize these estimates in line charts, along with the published figures that rely on the CPS/HVS final weight.

The homeownership rate estimates in Table 10 and Figure 1 show that applying the alternative nonresponse adjustment to the CPS base weights significantly reduces the homeownership rate estimate in each quarter. For example, in the first quarter of 2019, the NEW estimate of the homeownership rate was 65.5 percent, compared to the BW estimate of 66.4 percent and the CUR estimate of 66.1 percent. Similarly, the NEW estimates for the remaining quarters of 2019 each fall below the BW estimate by between 0.8 and 1.1 percentage points. In contrast, the difference between the NEW and BW estimates subsequently increases to 3.2 percentage points in the second quarter of 2020 and 2.7 percentage points in the third quarter of 2020. These differences subsequently dissipate in the remaining quarters of the analysis period, returning to 1.6 percentage points in the fourth quarter of 2020 and 1.3-1.5 percentage points for each quarter of 2021.

The results suggest that correcting for observed sample composition changes using the alternative nonresponse adjustment factor significantly reduces the size of the homeownership rate increases estimated for the second and third quarters of 2020. Table 11 displays the change in the homeownership rate in each quarter from the rate in the first quarter of 2019. The results show that the NEW estimate of 1.8 percentage points for the second quarter of 2020 is significantly smaller than the BW estimate of 4.2 percentage points and the CUR estimate of 4.1 percentage points. Similarly, the NEW estimate of 1.7 percentage points for the third quarter of 2020 is significantly smaller than the BW estimate of 3.6 percentage points and the CUR estimate of 3.7 percentage points. These muted increases in the NEW estimates suggest that the alternative nonresponse adjustment factor controls for sample composition changes that are not addressed by the existing nonresponse adjustment.

This finding is limited to the second and third quarters of 2020. The Table 11 estimates for the homeownership rate show that the NEW estimates are not statistically different from the BW or CUR estimates in the fourth quarter of 2020 or any quarter of 2021. The upshot is that the results in Tables 10 and 11 do not suggest that sample composition changes continued to affect CPS/HVS estimates of the homeownership rate in the fourth quarter of 2020 or any quarter of 2021.

The temporal pattern of these results mirrors the findings from the nonresponse analyses, suggesting that the CPS/HVS estimates of the homeownership rate in the second and third quarters of 2020 are influenced by the observed changes in sample composition and that these effects dissipate in later quarters. However, there are important caveats. First, the alternative nonresponse weighting adjustment factor applied to the NEW estimates adjusts only for differences in observed attributes, and there may be important additional changes in sample composition that are unobserved. Second, drawing inferences about the implications of these results for the published estimates based on the CPS/HVS final weight is more complicated than comparisons between the NEW estimates and the BW or CUR estimates. In addition to the difference in nonresponse adjustment factors, comparison of the NEW and published estimates must also consider the additional adjustment factors and population controls applied to the published estimates. Interpretation of the published estimates in Figure 1 must therefore be done with caution, considering the additional weighting components used to construct the final weights.

Table 10 and Figures 2-4 present similar estimates for the rental vacancy rate, homeowner vacancy rate, and gross vacancy rate. In contrast to the results for the homeownership rates, the NEW estimates for the vacancy rates closely track the BW estimates in all quarters. For the rental and homeowner vacancy rates, the NEW estimates and the BW estimates differ by 0.1 percentage points or less in all quarters, and the differences are not statistically significant. For the gross vacancy rate, the NEW estimates and the BW estimates differ by 0.4 percentage points or less in all quarters, with significant differences in only two quarters—the second quarter of 2019 and the fourth quarter of 2021. One possible explanation for the similarity between the NEW and BW estimates is that the observed changes in nonresponse captured by the propensity-score models are not strongly correlated with vacancy—and therefore that adjusting for these changes does not substantially alter the vacancy rate estimates. However, an important caveat is that the covariates included in the logistic regressions may omit important attributes so that the nonresponse adjustment factor does not correct for the relevant changes in nonresponse patterns.

An additional finding from Table 10 and Figures 2-4 is that the BW and CUR estimates of the vacancy rates diverged in 2020 after moving roughly in tandem throughout 2019. For example, the difference between the BW and CUR estimates of the rental vacancy rate increased from approximately 1.3-1.4 percentage points in each quarter of 2019 to 2.7 percentage points by the second quarter of 2020, before falling back to 1.7-1.9 percentage points in each quarter of 2021. Similarly, the difference between the BW and CUR estimates of the gross vacancy rate increased from approximately 2.0-2.2 percentage points in each quarter of 2019 to 4.1 percentage points in the second quarter of 2020, before decreasing to 2.7-3.1 percentage points in each quarter of 2021. Because the only difference between the BW and CUR estimates is the choice of weights, these outcomes reflect the impact of the nonresponse adjustment factor applied to occupied units in the current methodology. Specifically, the divergence between the BW and CUR estimates of vacancy rates is directly proportional to the share of nonresponses in each quarter.

As described in the Data and Methodology section, the current CPS/HVS weighting methodology calculates the nonresponse weighting adjustment using the pooled set of completed interviews and Type A nonresponses, excluding Type B vacants and Type C ineligible. The resulting nonresponse weighting adjustment therefore weights up the occupied interviews to account for Type A nonresponses but does not include a similar nonresponse adjustment for the vacant units. This approach assumes that all vacant units will be identified during in-person data collection attempts, so all Type A nonresponses are occupied units. The result is that any vacant unit that cannot be identified and is instead coded as a

Type A nonresponse will increase the CPS/HVS estimate of occupied units and decrease the estimate of vacant units. Under normal conditions, interviewers make multiple in-person data collection attempts with the goal of identifying as many vacant units as possible and minimizing the effect of this assumption on CPS/HVS estimates. Additionally, comparisons of the CPS/HVS estimates across quarters are made under the assumption that the effects of any remaining misclassifications are approximately constant across quarters, allowing for valid comparisons over time.

The suspension of in-person data collection attempts in early 2020 could lead to violations of these assumptions, increasing the risk that vacant units might be missed and altering the data collection procedures used in different quarters. To the extent that vacant units were in fact missed and miscoded as Type A nonresponses during this period, the CUR estimates of each vacancy rate will underestimate the true vacancy rate. Conversely, the BW estimates in Table 10 apply the base weights to the combined sample of occupied and vacant units excluding Type A nonresponses. This approach implicitly assumes that Type A units are evenly distributed across vacant and occupied units, so the BW estimates will overestimate vacancy to the extent that the share of vacant units that were miscoded as Type A nonresponses is still lower than the nonresponse rate among occupied units. The true vacancy rate is therefore likely to fall between the CUR and BW estimates, and it will be closer to the CUR estimate than the BW estimate to the extent that the data collection operations were able to minimize the number of vacant units that miscoded as Type A nonresponses.

Because the true set of vacant units that were miscoded as Type A nonresponses cannot be observed, it is not possible to draw firm conclusions about the extent to which the CPS/HVS vacancy rates underestimated the true vacancy rate in 2020 or 2021. Data users should nonetheless be aware of these risks and consider the weighting methodology when interpreting the CPS/HVS estimates of vacancy rates for the quarters affected by the suspension of personal visits. The widespread suspension of personal visits during the second and third quarters of 2020 likely presents the greatest risk that vacant units might have been missed to the extent that telephone-based contact attempts were an imperfect substitute for in-person visits. Conversely, the risk likely lessened over time as personal visits were gradually reintroduced in more and more areas of the country. The return to 100 percent eligibility for personal visits in the fourth quarter of 2021 marks the first quarter when CPS/HVS data collection operations returned to their pre-pandemic procedures in all areas.

Summary and Conclusions

The onset of the COVID-19 pandemic in early 2020 led to changes in the data collection procedures used for the Housing Vacancy Survey, an important source of information about vacancy rates and the homeownership rate in the U.S. On March 20, 2020, the Census Bureau suspended in-person data collection attempts and shifted all data collection operations to telephone-based attempts. In-person data collection began to be gradually reintroduced in some areas beginning in July 2020, but in-person data collection was not fully reinstated in all areas until the fourth quarter of 2021. This paper updates the analyses in Spader et al. (2021) to examine the implications of these data collection changes for CPS/HVS estimates in 2020 and 2021. Additionally, it uses similar methods to examine the implications of increasing nonresponse to the CPS/HVS in the years preceding the pandemic.

The initial set of nonresponse analyses examines the implications of increasing nonresponse prior to the pandemic, comparing the characteristics of responding and nonresponding housing units in 2019 relative to the first four quarters following full implementation of the CPS/HVS sample redesign—the third quarter of 2015 to the second quarter of 2016. With one minor exception, these nonresponse

analyses found no significant changes in the relative attributes of responding versus nonresponding housing units between 2015/2016 and 2019, suggesting that the increases in nonresponse did not significantly affect sample composition during this period. These results therefore do not raise broad concerns about the comparability of estimates between 2015/2016 and 2019. Future analyses might seek to compare the 2019 outcomes to even earlier periods to capture the full extent of response rate declines over the preceding decade; however, such analyses will need to find alternative linking methods that allow for an apples-to-apples comparison of outcomes before and after the CPS/HVS sample redesign in 2015.

The nonresponse analyses for 2020 and 2021 document more widespread changes in the relative attributes of nonrespondents versus respondents that are concentrated in the second and third quarters of 2020. The results for the other quarters—the first and fourth quarters of 2020 and all four quarters of 2021—do not show any significant changes in nonresponse outcomes compared to 2019. In contrast, the results for the second and third quarters of 2020 show significant changes across multiple variables. Specifically, the findings suggest that the set of nonresponding units in the second quarter of 2020 included fewer units that were owned free and clear in the 2010 Census; fewer units identified as owner-occupied by Black Knight’s measure; more units that could not be matched to Black Knight data; and more units in neighborhoods with high poverty rates and lower incomes in the ACS data. The results for the third quarter similarly show multiple significant changes in nonresponse outcomes compared to 2019, including many but not all of the same attributes that showed changes in the second quarter. These findings together describe the presence of a significant shift in CPS/HVS nonresponse outcomes that begins in the second quarter of 2020, continues into the third quarter of 2020, and then dissipates in the fourth quarter of 2020 and all four quarters of 2021.

The alternative nonresponse weighting adjustment presented in this paper explores the extent to which these changes in sample composition affect estimates of the homeownership rate, the gross vacancy rate, the rental vacancy rate, and the homeowner vacancy rate. The results for the homeownership rate echo the findings of the nonresponse analyses, suggesting that the observed changes in sample composition likely contributed to the homeownership rate’s spike in the second and third quarters of 2020. When using the alternative nonresponse weighting adjustment to control for observed changes in the sample composition, the estimated change in the homeownership rate from the first quarter of 2019 to the second quarter of 2020 is 1.8 percentage points, significantly lower than the estimate of 4.1 percentage points using the existing methodology’s nonresponse adjustment. The results show a similar finding for the third quarter of 2020 but not in any subsequent quarters. There are important caveats in extrapolating from these findings to the published CPS/HVS estimates, as such comparisons must consider the additional adjustment factors and population controls used to produce the final weights for the published estimates. However, unless these additional weighting components indirectly account for the changes in nonresponse, the published estimates are likely to also be sensitive to the alternative nonresponse weighting adjustment. Data users should therefore apply caution when interpreting the homeownership rate estimates for the second and third quarters of 2020. Conversely, the nonresponse analyses and alternative nonresponse weighting adjustment do not provide any evidence to suggest that the homeownership rate estimates for the fourth quarter of 2020 or any quarter of 2021 were significantly affected by changes in sample composition.

The findings for the vacancy rates do not suggest that the CPS/HVS vacancy rate estimates are sensitive to the changes in nonresponse described by the nonresponse analyses. The rental and homeowner vacancy rate estimates produced using the nonresponse weighting adjustment are not significantly different than the estimates using the CPS base weights in any quarter. However, comparison of the

vacancy rate estimates using the CPS base weights and the existing nonresponse adjustment factor illustrates the potential for the suspension of in-person data collection attempts to violate a key assumption of the current weighting methodology for the vacancy rate estimates. Specifically, the current weighting methodology assumes that all vacant units can be identified during data collection, so that all Type A nonresponses can be treated as occupied units. The result is that the CPS/HVS estimates will underestimate the true vacancy rates to the extent that vacant units are not identified during data collection. While this assumption may have relatively trivial effects under normal data collection procedures when interviewers can make multiple in-person visits to identify vacant units, the suspension of in-person data collection following the onset of the COVID-19 pandemic posed greater risks. We cannot directly observe the extent to which this assumption was met or violated for individual quarters. Data users should therefore understand this assumption and consider the extent of changes to standard data collection procedures when interpreting the CPS/HVS estimates of vacancy rates for the quarters affected by the suspension of personal visits.

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Tables and Figures

Table 1: Percentage of Sample Cases Where Personal Visits Were Allowed.

	Region				
	All	Northeast	Midwest	South	West
Q1 2020	100% ^a	100% ^a	100% ^a	100% ^a	100% ^a
Q2 2020	0%	0%	0%	0%	0%
Q3 2020	63%	95%	72%	45%	61%
Q4 2020	94%	100%	90%	100%	84%
Q1 2021	98%	100%	100%	100%	91%
Q2 2021	99%	100%	99%	100%	98%
Q3 2021	100%	100%	100%	100%	98%
Q4 2021	100%	100%	100%	100%	100%

^a Personal visits were suspended midweek during the March data collection week.

Source: U.S Census Bureau, Housing Vacancies and Homeownership (CPS/HVS). Source and Accuracy, Fourth Quarter 2021

Note: Zero values are true zeros.

Table 2: Nonresponse Share of Sample Housing Units by Quarter and Month in Sample.

	All	MIS1	MIS2	MIS3	MIS4	MIS5	MIS6	MIS7	MIS8
<u>2015/2016</u>									
2015 Q3	11%	12%	10%	10%	11%	12%	11%	11%	10%
2015 Q4	11%	13%	11%	10%	10%	13%	11%	11%	10%
2016 Q1	12%	13%	11%	10%	10%	13%	12%	11%	11%
2016 Q2	11%	12%	10%	11%	10%	12%	11%	11%	10%
<u>2019</u>									
2019 Q1	15%	16%	14%	14%	14%	17%	15%	15%	14%
2019 Q2	15%	16%	14%	14%	14%	16%	15%	15%	15%
2019 Q3	14%	16%	14%	14%	14%	16%	14%	14%	14%
2019 Q4	15%	16%	14%	13%	13%	17%	15%	15%	13%
<u>2020</u>									
2020 Q1	18%	22%	17%	16%	16%	20%	18%	17%	16%
2020 Q2	28%	45%	37%	28%	22%	27%	25%	23%	20%
2020 Q3	24%	31%	28%	26%	25%	22%	21%	20%	19%
2020 Q4	18%	23%	20%	18%	18%	19%	17%	16%	14%
<u>2021</u>									
2021 Q1	19%	23%	21%	19%	19%	20%	18%	17%	16%
2021 Q2	19%	22%	20%	19%	19%	20%	19%	18%	16%
2021 Q3	20%	23%	21%	20%	20%	22%	20%	20%	18%
2021 Q4	22%	25%	23%	22%	21%	23%	22%	21%	20%

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2015, 2016, and 2019-2021.

Note: The nonresponse share shown in the table is calculated as the ratio of Type A nonresponses to the total number of housing units in the sample in each quarter, which also includes completed interviews, all Type Bs, and Type C ineligible. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

Table 3: Supplemental Data Sources and Variable Definitions.

Variable	Definition
<u>Current Population Survey & Housing Vacancy Survey Supplement</u>	
mis1-8	Month-in-sample (MIS) group for data collection. 1=MIS 1 ... 8=MIS 8.
metro1-3	Metropolitan status: 1=Principal city; 2=Metropolitan area outside principal city; 3=Nonmetropolitan area.
<u>Black Knight Inc. Records Pulled in 2018.</u>	
bkmis	Sample unit cannot be matched to units in Black Knight data pulled in 2018.
bkowner	Black Knight's measure of owner-occupancy: 1=Owner-occupied
bkreuter	Black Knight's measure of owner-occupancy: 1=Renter-occupied
<u>2010 Census</u>	
decmis	Sample unit cannot be matched to 2010 Census housing units using MAFID.
vacant1-7	Vacant unit: 1=For rent; 2=Rented, not occupied; 3=For sale only; 4=Sold, not occupied; 5=For seasonal/recreational use; 6=For migrant workers; 7=Other vacant.
blds/m/to	Building type: s=Single-family home; m=Multifamily structure; to=Mobile home or other building type
tenure1-4	Tenure status: 1=Owned free and clear; 2=Owned with a mortgage; 3=Rented; 4=Occupied without payment of cash rent
hht1-7	Household type: 1=Family, married; 2=Family, male reference person, no spouse; 3=Family, female reference person, no spouse; 4=Nonfamily, male reference person, living alone; 5=Nonfamily, male reference person, not living alone; 6=Nonfamily, female reference person, living alone; 7=Nonfamily, female reference person, not living alone.
age0134-6599	Age of the householder: 0134=35 or younger; 3549=35 to 49; 5064=60 to 64; 6599=65 or older.
hispanic	Hispanic origin of the householder: 1=Hispanic; 0=Non-Hispanic
white	Race of the householder: 1=White
black	Race of the householder: 1=Black
aian	Race of the householder: 1=American Indian or Alaska Native
asian	Race of the householder: 1=Asian
nhopi	Race of the householder: 1=Native Hawaiian or Pacific Islander
other	Race of the householder: 1=Other race
<u>2014-18 American Community Survey 5-Year Estimates</u>	
acsmis	Census tract of the sample unit cannot be matched to tracts in 2014-2018 American Community Survey 5-year estimates
pusf/24/mf	Percentage of tract housing units by structure type. Sf=Single-family detached, 24=2-4-unit structures, mf=5+-unit structures.
pvac ^c	Percentage of tract housing units that are vacant.
pown ^c	Percentage of tract housing units that are owner-occupied.
pa0114-7599	Percentage of tract population by age: 0114=14 or younger; 1524=15 to 24; 2534=25 to 34; 3554=35 to 54; 5574=55 to 74; 7599=75 or older.
phis ^c	Percentage of tract population: Hispanic
pnhw ^c	Percentage of tract population: Non-Hispanic White
pnhb ^c	Percentage of tract population: Non-Hispanic Black
pnha ^c	Percentage of tract population: Non-Hispanic Asian
pnho ^c	Percentage of tract population: Non-Hispanic other race
pcol ^c	Percentage of tract population age 25 and older with a 4-year college degree or higher.
pcit ^c	Percentage of tract population with U.S. citizenship.
ppho ^c	Percentage of tract households with telephone access in the home (including cell phones).
pmover ^c	Percentage of tract population age 1 and over who in 2017 or later.
pinc0124-100	Percentage of tract population by household income: 0124=Less than \$25,000; 2549=\$25,000-\$49,999; 5074=\$75,000-\$99,999; 100=\$100,000 or more.
ppov ^c	Percentage of tract population with household income below the poverty line.
medinc ^c	Median household income in the tract (in thousands).
medval ^c	Median home value in the tract (in thousands).

^cDenotes a continuous variable; All other variables are indicator variables.

Table 4: Nonresponse Analyses Comparing the Attributes of Nonrespondents and Respondents, 2015/2016 and 2019.

	2015/2016				2019				2015/16-2019	
	Responses		Nonresponses - Responses		Responses		Nonresponses - Responses		Difference in Differences	
	Mean	(S.E.)	Diff	(S.E.)	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)
<i>Current Population Survey & Housing Vacancy Survey</i>										
mis1	.127	.004	.020	.009**	.127	.003	.017	.008**	-.003	.011
mis2	.126	.004	-.006	.008	.125	.003	-.003	.007	.004	.011
mis3	.126	.003	-.009	.008	.126	.003	-.009	.007	.001	.010
mis4	.125	.004	-.010	.008	.125	.003	-.009	.007	.001	.011
mis5	.123	.004	.020	.008**	.123	.003	.015	.007**	-.005	.011
mis6	.124	.003	.003	.007	.124	.003	.001	.007	-.002	.010
mis7	.124	.003	-.002	.007	.124	.003	-.002	.007	.000	.010
mis8	.125	.003	-.014	.007**	.125	.003	-.011	.006*	.003	.010
metro1	.321	.023	.040	.023*	.313	.024	.058	.024**	.019	.032
metro2	.507	.033	.018	.027	.517	.034	.008	.028	-.010	.034
metro3	.172	.043	-.057	.030*	.171	.044	-.066	.029**	-.009	.024
<i>Black Knight Inc.</i>										
bkmis	.391	.017	.014	.021	.379	.016	.040	.020**	.026	.029
bkowner	.477	.015	.002	.022	.490	.015	-.028	.020	-.031	.027
bkrenter	.132	.011	-.016	.013	.131	.011	-.012	.014	.005	.018
<i>2010 Census</i>										
decmis	.067	.008	-.015	.011	.085	.008	.004	.012	.019	.016
vacant	.104	.011	-.033	.015**	.098	.011	-.023	.012*	.010	.015
vactype1	.028	.003	.002	.007	.025	.003	.005	.006	.003	.009
vactype2	.001	.001	.000	.001	.001	.001	.000	.001	.000	.002
vactype3	.013	.002	-.001	.004	.013	.002	.001	.004	.002	.006
vactype4	.003	.001	-.001	.002	.003	.001	-.001	.002	.000	.003
vactype5	.034	.010	-.026	.010**	.034	.010	-.023	.009**	.002	.007
vactype6	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
vactype7	.023	.003	-.008	.005	.022	.003	-.005	.005	.003	.007
blds	.666	.014	-.024	.020	.656	.014	-.056	.022**	-.032	.028
bldm	.210	.011	.058	.019***	.202	.011	.075	.018***	.017	.025
bldto	.058	.008	-.020	.010**	.057	.007	-.023	.008***	-.003	.013
tenure1	.379	.011	.027	.022	.378	.011	-.007	.017	-.034	.029
tenure2	.169	.008	-.039	.014***	.168	.008	-.047	.013***	-.008	.017
tenure3	.267	.010	.062	.020***	.257	.011	.077	.017***	.014	.025
tenure4	.015	.002	-.002	.004	.014	.002	-.003	.004	-.001	.005
hht1	.407	.010	-.002	.018	.406	.011	-.038	.020*	-.036	.028
hht2	.040	.003	.003	.008	.039	.003	.005	.008	.002	.012
hht3	.107	.005	.018	.013	.103	.006	.026	.012**	.009	.017
hht4	.096	.005	.014	.012	.095	.006	.011	.011	-.004	.016
hht5	.032	.003	.005	.006	.031	.003	.006	.007	.002	.010
hht6	.123	.005	.008	.012	.119	.006	.006	.012	-.002	.017
hht7	.024	.002	.002	.006	.024	.003	.003	.006	.001	.009
age0134	.162	.008	.045	.016***	.158	.009	.048	.015***	.003	.021
age3549	.235	.007	.054	.019***	.230	.008	.043	.017**	-.011	.025
age5064	.242	.008	.009	.017	.242	.009	-.016	.015	-.025	.022
age6599	.190	.008	-.061	.015***	.187	.008	-.056	.013***	.005	.020
hispanic	.094	.007	.007	.012	.093	.007	.015	.012	.008	.017
white	.593	.014	.006	.019	.589	.014	-.045	.019**	-.051	.029*

black	.098	.008	.028	.012**	.091	.009	.043	.014***	.015	.018
aian	.008	.003	.000	.003	.007	.002	.001	.004	.001	.005
asian	.033	.003	.006	.008	.034	.003	.004	.007	-.001	.010
nhopi	.001	.000	.000	.001	.001	.001	.000	.001	.000	.002
other	.002	.001	.001	.002	.002	.001	.001	.002	.000	.003

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acsmis	.014	.003	.002	.006	.022	.004	.002	.006	.000	.008
pusf	.740	.010	-.031	.013**	.744	.010	-.047	.013***	-.016	.017
pu24	.078	.003	.008	.005*	.077	.003	.014	.005***	.006	.006
pumf	.181	.008	.023	.010**	.180	.008	.033	.011***	.009	.013
pvac	.124	.010	-.021	.008***	.122	.010	-.018	.007**	.003	.007
pown	.639	.009	-.018	.010*	.644	.009	-.034	.011***	-.016	.014
pa0114	.179	.003	.005	.003	.182	.003	.004	.003	-.001	.004
pa1524	.136	.006	-.006	.005	.128	.004	.003	.003	.009	.006
pa2534	.137	.002	.008	.003**	.138	.002	.011	.003***	.003	.004
pa3554	.252	.002	.007	.003**	.255	.002	.004	.002	-.003	.003
pa5574	.226	.005	-.007	.004*	.227	.005	-.013	.004***	-.006	.005
pa7599	.070	.003	-.005	.002**	.070	.003	-.007	.002***	-.002	.003
phis	.152	.007	.010	.009	.153	.008	.013	.010	.003	.012
pnhw	.644	.013	-.029	.015*	.648	.013	-.050	.015***	-.021	.020
pnhb	.121	.009	.013	.010	.117	.009	.030	.010***	.017	.013
pnha	.049	.003	.006	.004	.048	.003	.006	.004	.000	.006
pnho	.034	.003	.000	.002	.034	.003	.001	.002	.000	.003
pcol	.315	.007	.014	.008*	.316	.008	.010	.009	-.004	.011
pcit	.926	.003	-.008	.004*	.926	.004	-.010	.005**	-.003	.006
ppho	.022	.001	-.001	.001	.022	.001	.000	.001	.000	.001
pmover	.050	.002	.001	.002	.050	.002	.003	.002*	.002	.002
pinc0124	.211	.005	-.011	.006*	.207	.005	-.003	.006	.008	.008
pinc2549	.223	.003	-.007	.004*	.222	.003	-.004	.004	.003	.004
pinc5099	.297	.004	.002	.003	.299	.003	.000	.004	-.002	.005
pinc100	.270	.006	.017	.008**	.273	.007	.007	.008	-.009	.011
ppov	.146	.005	-.007	.005	.142	.005	.002	.005	.009	.007
medinc	64.9	1.0	2.8	1.4**	65.4	1.1	1.3	1.4	-1.4	1.8
medval	256.7	7.5	12.4	9.5	258.2	7.6	3.0	9.6	-9.4	11.6

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2015, 2016, and 2019 linked to each supplemental data source identified in the table.

Note: This table shows the mean value of each attribute among completed responses (complete interviews, all Type Bs, and Type C ineligible), the difference between nonresponses (Type As) and responses, and the change in these differences from 2015/2016 to 2019, as well as the standard errors for each estimate. .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. Asterisks are shown only for the differences between nonresponses and responses and for the change in these differences from 2015/2016 to 2019. Significance is calculated using OLS regression models with replicate weights.

Table 5: Nonresponse Analyses Comparing the Attributes of Nonrespondents and Respondents, 2020 Q1 and 2020 Q2 versus 2019.

	2020 Q1				2020 Q1 – 2019		2020 Q2				2020 Q2 - 2019	
	Responses		Nonresponses - Responses		Difference in Differences		Responses		Nonresponses - Responses		Difference in Differences	
	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)
<i>Current Population Survey & Housing Vacancy Survey</i>												
mis1	.124	.009	.041	.018**	.024	.021	.097	.009	.113	.015***	.096	.017***
mis2	.126	.007	-.007	.014	-.004	.017	.110	.008	.051	.012***	.054	.014***
mis3	.127	.007	-.016	.014	-.007	.017	.125	.009	-.002	.011	.006	.014
mis4	.126	.007	-.015	.014	-.006	.016	.136	.011	-.040	.013***	-.031	.016*
mis5	.121	.007	.023	.016	.008	.019	.128	.010	-.009	.012	-.024	.016
mis6	.124	.008	-.002	.014	-.003	.017	.131	.008	-.025	.010**	-.026	.013**
mis7	.125	.007	-.007	.013	-.005	.016	.135	.007	-.036	.011***	-.035	.013***
mis8	.127	.007	-.018	.014	-.008	.016	.139	.009	-.051	.011***	-.041	.013***
metro1	.312	.027	.054	.033*	-.004	.032	.303	.027	.064	.030**	.005	.033
metro2	.519	.040	.002	.037	-.006	.032	.524	.039	-.017	.035	-.025	.033
metro3	.170	.045	-.057	.031*	.010	.023	.174	.045	-.047	.029	.020	.026
<i>Black Knight Inc.</i>												
bkmis	.379	.024	.052	.031*	.012	.031	.360	.022	.102	.029***	.062	.030**
bkowner	.490	.022	-.045	.033	-.016	.032	.512	.022	-.105	.029***	-.076	.029***
bkrenter	.131	.016	-.007	.020	.004	.020	.128	.015	.003	.019	.015	.021
<i>2010 Census</i>												
decmis	.097	.013	.000	.019	-.004	.019	.094	.012	.006	.016	.002	.018
vacant	.096	.013	-.023	.018	.001	.016	.099	.015	-.015	.016	.008	.016
vactype1	.025	.004	.006	.009	.001	.010	.023	.004	.011	.008	.006	.010
vactype2	.001	.001	-.001	.001	.000	.002	.001	.001	.000	.002	.001	.002
vactype3	.013	.003	-.001	.006	-.002	.007	.013	.003	-.001	.005	-.002	.005
vactype4	.003	.001	-.001	.002	.000	.002	.003	.002	.000	.002	.001	.003
vactype5	.033	.011	-.022	.011**	.001	.008	.037	.012	-.024	.012**	.000	.008
vactype6	.000	.000	.000	.001	.000	.001	.000	.000	.000	.001	.000	.001
vactype7	.021	.004	-.004	.007	.001	.008	.022	.004	-.002	.007	.003	.008
blds	.653	.020	-.061	.032*	-.005	.030	.669	.020	-.089	.027***	-.033	.029
bldm	.195	.017	.079	.026***	.004	.027	.185	.015	.089	.025***	.014	.027
bldto	.055	.009	-.018	.011	.005	.012	.053	.010	-.006	.012	.018	.013
tenure1	.378	.016	-.025	.029	-.018	.029	.390	.020	-.059	.024**	-.052	.026**
tenure2	.165	.012	-.042	.019**	.005	.019	.173	.012	-.049	.017***	-.002	.019
tenure3	.250	.016	.091	.028***	.014	.027	.230	.014	.119	.024***	.042	.027
tenure4	.014	.003	-.002	.005	.001	.006	.014	.003	-.001	.006	.002	.006
hht1	.402	.015	-.042	.028	-.004	.032	.409	.017	-.060	.022***	-.022	.026
hht2	.038	.004	.009	.011	.005	.011	.036	.005	.011	.010	.006	.011
hht3	.101	.009	.026	.016*	.000	.016	.097	.009	.033	.015**	.007	.018
hht4	.092	.007	.015	.017	.005	.017	.092	.009	.014	.015	.003	.016
hht5	.032	.005	.005	.011	-.001	.012	.029	.005	.009	.009	.002	.010
hht6	.118	.010	.005	.019	-.001	.020	.121	.009	-.002	.016	-.008	.019
hht7	.024	.004	.004	.009	.001	.008	.023	.004	.006	.008	.002	.009
age0134	.155	.012	.055	.022**	.008	.024	.144	.012	.066	.019***	.018	.023
age3549	.228	.012	.034	.023	-.009	.026	.224	.013	.031	.020	-.012	.023
age5064	.241	.013	-.018	.023	-.002	.024	.245	.014	-.032	.019*	-.016	.023
age6599	.184	.012	-.049	.018***	.007	.019	.194	.013	-.055	.017***	.001	.018
hispanic	.092	.010	.023	.020	.007	.021	.084	.010	.033	.018*	.017	.021
white	.582	.019	-.047	.028	-.002	.030	.594	.021	-.069	.026**	-.024	.031

black	.091	.011	.040	.019**	-.003	.020	.087	.012	.041	.019**	-.002	.023
aian	.007	.003	.001	.005	.000	.005	.007	.003	.002	.004	.001	.005
asian	.033	.005	.004	.010	-.001	.011	.033	.006	.002	.009	-.002	.011
nhopi	.001	.001	.000	.002	.000	.002	.001	.001	.000	.001	.000	.002
other	.001	.001	.001	.003	.001	.002	.001	.001	.001	.002	.000	.002
<i>2014-2018 American Community Survey 5-Year Estimates</i>												
acsmis	.018	.006	.001	.009	-.001	.009	.017	.006	-.004	.006	-.005	.008
pusf	.748	.014	-.048	.018***	-.001	.019	.754	.014	-.050	.017***	-.003	.018
pu24	.077	.005	.013	.009	-.001	.009	.074	.005	.015	.006**	.001	.007
pumf	.176	.012	.035	.014**	.002	.015	.173	.012	.035	.015**	.003	.016
pvac	.122	.011	-.014	.009	.003	.006	.123	.011	-.010	.008	.008	.006
pown	.646	.012	-.038	.015**	-.004	.016	.656	.012	-.054	.014***	-.020	.016
pa0114	.182	.003	.005	.004	.001	.004	.181	.003	.006	.003	.002	.004
pa1524	.128	.004	.003	.005	.001	.005	.127	.004	.006	.005	.003	.005
pa2534	.138	.004	.010	.004**	-.001	.004	.136	.004	.011	.004***	.001	.005
pa3554	.256	.003	.003	.003	-.001	.003	.256	.003	.001	.003	-.003	.003
pa5574	.227	.005	-.014	.006**	-.001	.005	.230	.005	-.016	.005***	-.003	.005
pa7599	.070	.003	-.007	.003**	.000	.003	.071	.003	-.007	.003***	.000	.003
phis	.153	.012	.019	.014	.006	.013	.146	.011	.029	.013**	.015	.015
pnhw	.648	.017	-.054	.021**	-.004	.021	.658	.017	-.070	.018***	-.020	.020
pnhb	.117	.010	.030	.015**	.000	.015	.113	.012	.037	.014***	.007	.016
pnha	.049	.004	.004	.006	-.002	.007	.049	.004	.003	.005	-.003	.006
pnho	.034	.003	.001	.003	.000	.002	.034	.003	.002	.004	.001	.004
pcol	.316	.011	.002	.011	-.008	.012	.323	.010	-.012	.012	-.022	.013
pcit	.927	.005	-.011	.007	-.001	.007	.929	.005	-.015	.007**	-.005	.008
ppho	.022	.001	.000	.001	.001	.001	.021	.001	.001	.001	.002	.001
pmover	.049	.002	.003	.002	.000	.002	.049	.002	.005	.002*	.002	.003
pinc0124	.205	.007	.003	.008	.006	.008	.201	.007	.016	.008**	.019	.009**
pinc2549	.221	.005	-.001	.005	.003	.005	.219	.005	.006	.005	.010	.005*
pinc5099	.299	.004	-.001	.006	-.001	.005	.299	.004	-.002	.005	-.002	.005
pinc100	.275	.009	-.001	.011	-.008	.011	.282	.009	-.020	.011*	-.028	.012**
ppov	.140	.006	.006	.007	.004	.007	.136	.006	.018	.007***	.016	.008**
medinc	65.7	1.6	.0	1.9	-1.3	2.0	67.0	1.6	-3.4	2.0*	-4.7	2.2**
medval	259.2	11.5	-3.0	12.3	-6.1	13.1	265.1	12.1	-15.6	13.1	-18.7	15.8

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019 and 2020 linked to each supplemental data source identified in the table.

Note: This table shows the mean value of each attribute among completed responses (complete interviews, all Type Bs, and Type C ineligible), the difference between nonresponses (Type As) and responses, and the change in these differences from 2019 to 2020, as well as the standard errors for each estimate. .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. Asterisks are shown only for the differences between nonresponses and responses and for the change in these differences from 2019 to 2020. Significance is calculated using OLS regression models with replicate weights.

Table 6: Nonresponse Analyses Comparing the Attributes of Nonrespondents and Respondents, 2020 Q3 and 2020 Q4 versus 2019.

	2020 Q3				2020 Q3 – 2019		2020 Q4				2020 Q4 - 2019	
	Responses		Nonresponses - Responses		Difference in Differences		Responses		Nonresponses - Responses		Difference in Differences	
	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)
<i>Current Population Survey & Housing Vacancy Survey</i>												
mis1	.115	.008	.056	.016***	.039	.017**	.122	.007	.044	.018**	.027	.020
mis2	.117	.007	.030	.015**	.033	.016**	.121	.005	.017	.015	.019	.017
mis3	.119	.008	.018	.014	.026	.016	.123	.005	.002	.012	.011	.014
mis4	.122	.009	.006	.014	.015	.016	.123	.008	-.002	.014	.007	.016
mis5	.129	.008	-.014	.012	-.029	.014**	.124	.007	.007	.015	-.008	.016
mis6	.132	.007	-.026	.013**	-.027	.016*	.127	.005	-.013	.012	-.014	.014
mis7	.132	.009	-.031	.012***	-.030	.014**	.129	.005	-.022	.011**	-.020	.014
mis8	.134	.009	-.038	.013***	-.027	.016*	.131	.007	-.034	.012***	-.023	.015
metro1	.311	.027	.052	.030*	-.006	.035	.319	.029	.053	.031*	-.005	.035
metro2	.518	.035	-.008	.035	-.016	.033	.511	.037	.002	.036	-.006	.037
metro3	.170	.044	-.044	.028	.022	.026	.170	.044	-.055	.032*	.011	.025
<i>Black Knight Inc.</i>												
bkmis	.367	.021	.092	.029***	.052	.031	.378	.022	.061	.031*	.021	.034
bkowner	.504	.022	-.096	.028***	-.068	.029**	.491	.021	-.056	.026**	-.027	.029
bkrenter	.129	.014	.004	.018	.016	.020	.131	.014	-.005	.020	.007	.022
<i>2010 Census</i>												
decmis	.096	.012	.007	.016	.003	.018	.099	.013	.013	.022	.009	.024
vacant	.099	.013	-.015	.014	.008	.014	.097	.012	-.025	.020	-.002	.019
vactype1	.025	.005	.010	.008	.005	.010	.025	.005	.007	.010	.002	.011
vactype2	.001	.001	.001	.002	.001	.003	.001	.001	.000	.002	.000	.002
vactype3	.013	.004	.000	.006	-.001	.007	.013	.003	-.001	.006	-.002	.007
vactype4	.003	.002	-.001	.002	.000	.003	.003	.001	-.001	.002	-.001	.003
vactype5	.035	.012	-.023	.011**	.001	.008	.034	.010	-.024	.011**	-.001	.008
vactype6	.000	.000	.000	.001	.000	.001	.000	.000	.000	.001	.000	.001
vactype7	.022	.004	-.002	.006	.003	.007	.021	.004	-.005	.008	-.001	.008
blds	.660	.021	-.084	.028***	-.028	.033	.652	.020	-.074	.031**	-.018	.033
bldm	.192	.018	.083	.025***	.008	.028	.194	.017	.081	.027***	.006	.029
bldto	.053	.010	-.005	.011	.018	.012	.055	.010	-.019	.012	.004	.013
tenure1	.383	.018	-.050	.023**	-.042	.028	.375	.016	-.024	.027	-.016	.029
tenure2	.171	.012	-.049	.018***	-.002	.019	.168	.012	-.049	.019**	-.002	.020
tenure3	.237	.016	.107	.023***	.031	.027	.246	.015	.088	.029***	.011	.031
tenure4	.014	.003	-.001	.005	.002	.006	.015	.003	-.003	.005	.000	.006
hht1	.407	.016	-.054	.025**	-.016	.028	.402	.016	-.042	.028	-.005	.032
hht2	.036	.005	.010	.010	.006	.013	.038	.005	.007	.011	.002	.013
hht3	.097	.008	.033	.016**	.007	.019	.098	.009	.027	.019	.001	.021
hht4	.093	.008	.012	.015	.001	.017	.093	.008	.013	.018	.002	.019
hht5	.031	.005	.005	.008	-.002	.010	.032	.005	.003	.010	-.003	.012
hht6	.120	.009	-.003	.017	-.009	.019	.117	.009	.003	.018	-.003	.021
hht7	.023	.004	.004	.007	.001	.009	.024	.004	.002	.009	-.002	.010
age0134	.148	.011	.060	.019***	.012	.022	.156	.012	.047	.021**	-.001	.024
age3549	.223	.013	.027	.020	-.016	.024	.224	.012	.037	.024	-.007	.028
age5064	.242	.013	-.025	.020	-.009	.023	.239	.013	-.020	.023	-.004	.025
age6599	.192	.013	-.054	.018***	.002	.021	.186	.012	-.051	.022**	.005	.024
hispanic	.083	.010	.036	.017**	.021	.018	.089	.010	.024	.021	.008	.023
white	.593	.021	-.073	.024***	-.028	.027	.582	.020	-.050	.029*	-.005	.031

black	.087	.012	.041	.016**	-.002	.020	.091	.010	.032	.019*	-.011	.021
aian	.007	.003	.001	.004	.001	.005	.007	.002	.001	.006	.001	.006
asian	.032	.006	.002	.009	-.002	.011	.032	.006	.006	.011	.002	.013
nhopi	.001	.001	.000	.002	.000	.002	.001	.001	.000	.002	.000	.002
other	.002	.001	.000	.002	-.001	.002	.001	.001	.000	.002	-.001	.003

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acsmis	.015	.006	-.001	.006	-.003	.008	.014	.005	-.002	.006	-.004	.008
pusf	.745	.014	-.040	.015***	.007	.017	.745	.013	-.050	.018***	-.003	.020
pu24	.076	.005	.011	.006*	-.004	.007	.077	.005	.014	.007**	.000	.008
pumf	.179	.012	.029	.013**	-.003	.015	.178	.011	.036	.016**	.003	.018
pvac	.122	.011	-.011	.008	.006	.007	.121	.010	-.016	.007**	.002	.007
pown	.650	.012	-.050	.013***	-.016	.014	.645	.012	-.041	.015***	-.007	.016
pa0114	.181	.003	.007	.003*	.003	.004	.182	.003	.003	.004	.000	.004
pa1524	.127	.004	.006	.005	.004	.005	.128	.004	.004	.005	.001	.005
pa2534	.137	.004	.010	.004**	-.001	.004	.139	.003	.010	.005**	.000	.005
pa3554	.255	.003	.001	.003	-.003	.004	.256	.002	.002	.003	-.001	.004
pa5574	.229	.006	-.015	.005***	-.003	.005	.226	.005	-.013	.005***	.000	.005
pa7599	.071	.003	-.008	.003***	.000	.003	.069	.003	-.006	.003**	.001	.003
phis	.146	.011	.030	.013**	.017	.014	.149	.011	.024	.015	.010	.017
pnhw	.656	.016	-.069	.018***	-.019	.019	.650	.016	-.056	.021***	-.006	.021
pnhb	.114	.011	.036	.012***	.006	.014	.118	.010	.022	.014	-.008	.015
pnha	.049	.004	.002	.006	-.004	.006	.049	.004	.008	.006	.002	.007
pnho	.034	.003	.001	.005	.001	.004	.034	.003	.002	.005	.001	.005
pcol	.325	.010	-.017	.012	-.027	.013**	.319	.009	.002	.013	-.008	.013
pcit	.928	.005	-.014	.007*	-.004	.007	.926	.005	-.014	.007*	-.004	.008
ppho	.021	.001	.001	.001	.002	.001	.022	.002	.001	.002	.001	.002
pmover	.050	.002	.005	.002*	.002	.003	.050	.002	.003	.002	.000	.003
pinc0124	.201	.007	.015	.008**	.019	.009**	.205	.007	.002	.009	.005	.009
pinc2549	.219	.004	.008	.005	.012	.005**	.221	.004	-.002	.005	.002	.005
pinc5099	.298	.004	-.001	.005	-.001	.006	.299	.004	.000	.005	.000	.006
pinc100	.282	.009	-.022	.010**	-.030	.012**	.276	.008	.000	.011	-.007	.011
ppov	.137	.006	.018	.007**	.016	.008*	.140	.006	.007	.008	.005	.008
medinc	66.8	1.5	-3.8	1.8**	-5.1	2.0**	65.9	1.5	0.0	2.1	-1.3	2.0
medval	265.3	11.5	-20.1	13.0	-23.1	14.1	259.4	8.9	0.3	13.2	-2.8	13.3

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019 and 2020 linked to each supplemental data source identified in the table.

Note: This table shows the mean value of each attribute among completed responses (complete interviews, all Type Bs, and Type C ineligible), the difference between nonresponses (Type As) and responses, and the change in these differences from 2019 to 2020, as well as the standard errors for each estimate. .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. Asterisks are shown only for the differences between nonresponses and responses and for the change in these differences from 2019 to 2020. Significance is calculated using OLS regression models with replicate weights.

Table 7: Nonresponse Analyses Comparing the Attributes of Nonrespondents and Respondents, 2021 Q1 and 2021 Q2 versus 2019.

	2021 Q1				2021 Q1 – 2019		2021 Q2				2021 Q2 - 2019	
	Responses		Nonresponses - Responses		Difference in Differences		Responses		Nonresponses - Responses		Difference in Differences	
	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)
<i>Current Population Survey & Housing Vacancy Survey</i>												
mis1	.123	.008	.035	.016**	.018	.018	.126	.009	.024	.018	.007	.019
mis2	.122	.008	.012	.013	.015	.015	.124	.008	.006	.013	.009	.015
mis3	.123	.006	.002	.012	.011	.014	.124	.008	.002	.013	.010	.015
mis4	.124	.006	-.001	.014	.008	.015	.124	.010	-.003	.013	.006	.015
mis5	.124	.009	.010	.016	-.005	.017	.122	.011	.009	.014	-.006	.016
mis6	.127	.007	-.010	.011	-.011	.014	.124	.008	-.003	.013	-.004	.016
mis7	.128	.007	-.022	.012*	-.020	.014	.126	.008	-.009	.012	-.008	.014
mis8	.129	.007	-.027	.012**	-.016	.014	.130	.010	-.025	.013**	-.014	.014
metro1	.310	.026	.063	.036*	.004	.041	.315	.027	.054	.033	-.004	.040
metro2	.522	.036	-.009	.038	-.017	.041	.516	.036	-.001	.038	-.009	.039
metro3	.169	.044	-.054	.034	.013	.029	.169	.044	-.053	.032*	.013	.028
<i>Black Knight Inc.</i>												
bkmis	.378	.025	.059	.031*	.019	.034	.377	.022	.054	.029*	.014	.034
bkowner	.489	.023	-.052	.029*	-.024	.033	.492	.021	-.042	.030	-.014	.032
bkrenter	.132	.015	-.007	.019	.005	.022	.132	.014	-.012	.018	.000	.022
<i>2010 Census</i>												
decmis	.104	.013	.010	.020	.007	.021	.100	.012	.015	.024	.011	.026
vacant	.095	.012	-.028	.015*	-.004	.016	.097	.014	-.024	.018	-.001	.019
vactype1	.026	.004	.004	.009	-.001	.010	.025	.005	.005	.009	.001	.010
vactype2	.001	.001	-.001	.001	.000	.002	.001	.001	.000	.002	.000	.002
vactype3	.012	.003	-.001	.006	-.002	.007	.013	.003	.000	.007	-.001	.008
vactype4	.003	.001	-.002	.002	-.001	.003	.003	.001	-.001	.002	.000	.003
vactype5	.032	.010	-.023	.010**	.001	.009	.033	.012	-.023	.011**	.000	.010
vactype6	.000	.000	.000	.001	.000	.001	.000	.000	.000	.000	.000	.000
vactype7	.021	.004	-.006	.007	-.002	.008	.022	.004	-.004	.008	.000	.010
blds	.653	.020	-.066	.030**	-.010	.034	.656	.019	-.067	.033**	-.011	.038
bldm	.189	.016	.072	.029**	-.003	.032	.193	.017	.069	.027**	-.006	.032
bldto	.054	.010	-.017	.012	.006	.014	.052	.010	-.017	.012	.006	.013
tenure1	.373	.018	-.021	.026	-.013	.030	.373	.018	-.015	.030	-.007	.034
tenure2	.166	.011	-.043	.018**	.004	.021	.169	.012	-.043	.019**	.004	.024
tenure3	.248	.016	.083	.028***	.006	.031	.247	.015	.069	.026***	-.008	.031
tenure4	.014	.003	-.002	.006	.001	.007	.014	.003	-.002	.006	.001	.007
hht1	.400	.015	-.037	.025	.001	.033	.400	.016	-.035	.026	.002	.033
hht2	.036	.004	.010	.010	.005	.012	.037	.005	.009	.011	.004	.014
hht3	.100	.008	.029	.017*	.003	.018	.102	.010	.022	.020	-.004	.023
hht4	.090	.007	.012	.018	.002	.019	.092	.007	.007	.016	-.004	.019
hht5	.032	.005	.001	.011	-.005	.012	.030	.005	.004	.010	-.002	.012
hht6	.119	.010	-.001	.017	-.007	.021	.120	.009	-.003	.019	-.008	.023
hht7	.023	.004	.003	.008	-.001	.010	.023	.004	.004	.010	.001	.012
age0134	.154	.011	.038	.022*	-.010	.026	.149	.011	.046	.022**	-.002	.027
age3549	.223	.012	.039	.025	-.004	.031	.225	.012	.035	.024	-.008	.030
age5064	.238	.013	-.013	.023	.003	.027	.239	.012	-.020	.023	-.004	.029
age6599	.186	.013	-.047	.019**	.009	.021	.190	.013	-.053	.021**	.003	.025
hispanic	.088	.012	.028	.020	.013	.022	.087	.011	.022	.019	.007	.022
white	.580	.021	-.050	.029*	-.005	.033	.583	.021	-.049	.030	-.004	.035

black	.091	.011	.034	.019*	-.009	.022	.092	.011	.032	.019*	-.011	.021
aian	.007	.003	.002	.004	.001	.005	.007	.003	.000	.004	-.001	.006
asian	.032	.005	.003	.011	-.002	.013	.032	.006	.002	.011	-.002	.013
nhopi	.001	.001	.000	.001	.000	.002	.001	.001	.000	.002	.000	.003
other	.002	.001	.001	.003	.000	.003	.002	.001	.001	.003	.000	.003

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acsmis	.011	.004	-.001	.006	-.003	.009	.009	.004	-.001	.006	-.003	.009
pusf	.750	.012	-.050	.020**	-.003	.023	.748	.014	-.047	.019**	.000	.022
pu24	.075	.005	.016	.008*	.001	.009	.076	.005	.014	.007*	-.001	.008
pumf	.175	.011	.034	.018*	.002	.019	.177	.012	.033	.017*	.001	.019
pvac	.121	.011	-.015	.008*	.003	.007	.122	.011	-.015	.009*	.003	.008
pown	.648	.011	-.041	.017**	-.007	.019	.647	.012	-.037	.016**	-.003	.018
pa0114	.182	.003	.005	.004	.001	.005	.182	.004	.004	.004	.000	.004
pa1524	.128	.004	.003	.004	.000	.005	.127	.004	.003	.004	.001	.005
pa2534	.138	.003	.009	.004**	-.001	.005	.138	.003	.009	.005*	-.002	.006
pa3554	.256	.003	.003	.003	.000	.004	.256	.003	.003	.003	-.001	.004
pa5574	.227	.005	-.013	.005**	.000	.006	.227	.006	-.012	.006**	.001	.006
pa7599	.070	.003	-.007	.003**	.001	.003	.070	.003	-.007	.003**	.001	.004
phis	.150	.012	.029	.015**	.016	.017	.151	.011	.019	.015	.006	.018
pnhw	.651	.017	-.063	.022***	-.013	.024	.649	.017	-.052	.020***	-.002	.022
pnhb	.117	.011	.026	.014*	-.004	.016	.118	.011	.029	.014**	-.001	.015
pnha	.048	.004	.007	.006	.001	.007	.049	.004	.003	.006	-.003	.007
pnho	.034	.003	.001	.003	.000	.003	.034	.004	.001	.003	.000	.003
pcol	.320	.010	-.002	.013	-.012	.013	.320	.010	.001	.013	-.009	.015
pcit	.927	.005	-.014	.008*	-.004	.009	.926	.005	-.009	.006	.001	.007
ppho	.022	.001	.001	.001	.001	.001	.022	.001	.000	.001	.000	.002
pmover	.050	.002	.002	.002	-.001	.003	.050	.002	.002	.003	-.001	.003
pinc0124	.204	.007	.003	.009	.006	.010	.205	.007	.001	.008	.004	.009
pinc2549	.220	.005	-.001	.006	.003	.006	.220	.005	-.002	.005	.002	.007
pinc5099	.299	.004	.000	.005	.000	.006	.298	.004	.000	.005	.000	.005
pinc100	.278	.009	-.002	.012	-.009	.013	.277	.010	.001	.011	-.007	.013
ppov	.139	.006	.007	.008	.005	.008	.140	.006	.005	.007	.003	.008
medinc	66.1	1.6	-0.2	2.1	-1.5	2.3	66.1	1.7	0.1	1.9	-1.3	2.3
medval	260.0	11.4	-0.5	13.3	-3.5	14.7	260.2	12.2	-3.3	13.3	-6.3	15.7

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019 and 2021 linked to each supplemental data source identified in the table.

Note: This table shows the mean value of each attribute among completed responses (complete interviews, all Type Bs, and Type C ineligible), the difference between nonresponses (Type As) and responses, and the change in these differences from 2019 to 2021, as well as the standard errors for each estimate. .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. Asterisks are shown only for the differences between nonresponses and responses and for the change in these differences from 2019 to 2021. Significance is calculated using OLS regression models with replicate weights.

Table 8: Nonresponse Analyses Comparing the Attributes of Nonrespondents and Respondents, 2021 Q3 and 2021 Q4 versus 2019.

	2021 Q3				2021 Q3 – 2019		2021 Q4				2021 Q4 - 2019	
	Responses		Nonresponses - Responses		Difference in Differences		Responses		Nonresponses - Responses		Difference in Differences	
	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)	Mean	(S.E.)	Diff	(S.E.)	Diff	(S.E.)
<i>Current Population Survey & Housing Vacancy Survey</i>												
mis1	.126	.008	.023	.017	.006	.020	.126	.007	.025	.016	.008	.018
mis2	.125	.007	.002	.013	.005	.015	.124	.006	.007	.012	.010	.013
mis3	.125	.009	-.002	.013	.007	.015	.125	.005	-.002	.012	.007	.014
mis4	.126	.009	-.004	.015	.005	.016	.126	.007	-.013	.013	-.004	.014
mis5	.122	.008	.011	.015	-.004	.017	.123	.007	.010	.014	-.005	.015
mis6	.124	.008	-.002	.012	-.003	.014	.124	.005	-.001	.013	-.002	.015
mis7	.125	.008	-.008	.014	-.006	.016	.125	.005	-.007	.013	-.006	.013
mis8	.127	.009	-.020	.013	-.009	.015	.127	.007	-.019	.013	-.008	.014
metro1	.317	.028	.053	.030*	-.005	.035	.316	.030	.038	.030	-.020	.037
metro2	.514	.039	.000	.036	-.008	.039	.516	.038	.009	.035	.001	.041
metro3	.169	.044	-.053	.029*	.013	.026	.168	.044	-.047	.032	.020	.030
<i>Black Knight Inc.</i>												
bkmis	.379	.023	.050	.029*	.010	.035	.384	.023	.043	.030	.003	.036
bkowner	.493	.022	-.041	.031	-.013	.034	.487	.022	-.038	.033	-.009	.037
bkrenter	.129	.014	-.009	.017	.002	.021	.129	.014	-.005	.020	.006	.022
<i>2010 Census</i>												
decmis	.099	.012	.016	.020	.012	.023	.106	.013	.009	.019	.005	.022
vacant	.098	.012	-.022	.017	.001	.018	.097	.013	-.024	.018	-.001	.019
vactype1	.025	.005	.006	.010	.001	.011	.025	.005	.006	.009	.001	.011
vactype2	.002	.001	.000	.002	.000	.003	.001	.001	.000	.002	.000	.002
vactype3	.013	.003	.000	.006	-.001	.007	.012	.003	.001	.006	-.001	.008
vactype4	.003	.001	.000	.003	.001	.004	.003	.001	-.001	.002	.000	.003
vactype5	.034	.011	-.023	.011**	.001	.009	.035	.012	-.025	.013	-.002	.011
vactype6	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.000	.001
vactype7	.023	.004	-.005	.007	.000	.009	.021	.004	-.005	.007	.000	.009
blds	.652	.022	-.065	.031**	-.009	.038	.646	.022	-.052	.029*	.004	.037
bldm	.195	.019	.069	.028**	-.006	.033	.195	.017	.062	.027**	-.013	.032
bldto	.055	.010	-.020	.010*	.003	.012	.054	.010	-.019	.011	.004	.013
tenure1	.375	.018	-.017	.027	-.010	.031	.371	.017	-.007	.029	.001	.032
tenure2	.166	.012	-.039	.019**	.008	.023	.165	.012	-.041	.020**	.006	.024
tenure3	.249	.016	.064	.027**	-.013	.030	.247	.014	.065	.027**	-.012	.030
tenure4	.014	.004	-.002	.006	.002	.007	.014	.003	-.003	.006	.001	.007
hht1	.400	.016	-.028	.024	.010	.031	.397	.017	-.027	.028	.011	.032
hht2	.037	.005	.006	.011	.001	.013	.037	.005	.004	.010	-.001	.012
hht3	.101	.009	.017	.017	-.009	.020	.099	.008	.023	.015	-.003	.020
hht4	.093	.008	.011	.017	.000	.021	.091	.007	.008	.017	-.003	.020
hht5	.030	.005	.005	.009	-.002	.010	.032	.005	.005	.010	-.001	.011
hht6	.120	.010	-.005	.016	-.011	.020	.119	.010	-.003	.018	-.009	.021
hht7	.023	.004	.002	.008	-.002	.010	.023	.004	.004	.007	.000	.009
age0134	.153	.013	.040	.019**	-.008	.024	.153	.012	.040	.020**	-.008	.025
age3549	.226	.013	.033	.025	-.010	.029	.223	.012	.037	.022*	-.006	.028
age5064	.236	.012	-.014	.025	.002	.029	.235	.013	-.014	.024	.003	.025
age6599	.189	.013	-.053	.020***	.003	.025	.186	.012	-.049	.020**	.007	.023
hispanic	.089	.011	.018	.018	.003	.022	.088	.010	.015	.017	.000	.020
white	.582	.018	-.043	.029	.002	.035	.575	.019	-.037	.029	.008	.035

black	.090	.011	.027	.020	-.016	.023	.091	.010	.030	.017*	-.013	.022
aian	.007	.002	.001	.006	.000	.008	.007	.003	.002	.007	.001	.008
asian	.033	.006	.004	.011	-.001	.013	.033	.006	.005	.011	.000	.012
nhopi	.001	.001	.000	.002	-.001	.002	.001	.001	.000	.002	.000	.002
other	.001	.001	.001	.002	.000	.003	.001	.001	.000	.002	.000	.003

2014-2018 American Community Survey 5-Year Estimates

acsmis	.007	.003	.001	.005	-.001	.008	.011	.005	-.003	.006	-.004	.008
pusf	.746	.015	-.048	.019**	-.001	.020	.746	.013	-.040	.020**	.007	.021
pu24	.076	.005	.014	.008*	-.001	.008	.076	.005	.011	.008	-.003	.009
pumf	.178	.013	.034	.016**	.002	.018	.178	.011	.029	.017	-.004	.019
pvac	.121	.011	-.014	.008*	.004	.008	.122	.011	-.016	.008**	.002	.008
pown	.645	.013	-.035	.016**	-.001	.017	.645	.011	-.032	.016**	.002	.018
pa0114	.182	.003	.003	.004	-.001	.005	.181	.003	.005	.004	.001	.005
pa1524	.128	.005	.003	.004	.000	.005	.128	.004	.003	.004	.000	.005
pa2534	.138	.004	.009	.005**	-.002	.005	.138	.004	.009	.004**	-.002	.005
pa3554	.256	.003	.003	.003	-.001	.004	.256	.003	.003	.003	.000	.004
pa5574	.227	.006	-.011	.005**	.002	.006	.227	.005	-.013	.005***	.000	.006
pa7599	.070	.004	-.006	.003**	.001	.003	.070	.003	-.007	.003**	.001	.003
phis	.151	.011	.016	.014	.003	.018	.150	.009	.021	.013	.008	.017
pnhw	.648	.017	-.047	.019**	.003	.023	.650	.015	-.049	.018***	.001	.022
pnhb	.117	.011	.025	.014*	-.005	.016	.118	.010	.023	.012*	-.007	.015
pnha	.050	.004	.005	.006	-.001	.008	.049	.004	.004	.006	-.002	.007
pnho	.034	.003	.001	.003	.000	.004	.034	.003	.002	.006	.001	.006
pcol	.320	.012	.004	.013	-.007	.015	.319	.010	-.001	.011	-.011	.013
pcit	.926	.005	-.010	.007	.000	.009	.926	.005	-.011	.007	-.001	.009
ppho	.022	.001	.000	.001	.001	.002	.022	.002	.000	.001	.001	.001
pmover	.050	.002	.002	.002	-.001	.003	.050	.002	.003	.002	.000	.003
pinc0124	.204	.007	.002	.008	.005	.009	.205	.007	-.001	.007	.002	.009
pinc2549	.221	.004	-.003	.005	.001	.006	.220	.004	-.001	.005	.004	.006
pinc5099	.298	.004	-.001	.005	-.001	.006	.299	.004	.001	.005	.001	.006
pinc100	.277	.009	.002	.012	-.006	.014	.277	.008	.001	.010	-.006	.013
ppov	.140	.006	.006	.008	.004	.008	.140	.006	.004	.007	.002	.008
medinc	65.9	1.6	0.3	2.1	-1.0	2.4	65.9	1.5	0.3	1.8	-1.0	2.1
medval	261.3	11.8	-0.7	15.3	-3.7	17.0	259.6	9.3	-2.4	12.8	-5.4	14.8

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019 and 2021 linked to each supplemental data source identified in the table.

Note: This table shows the mean value of each attribute among completed responses (complete interviews, all Type Bs, and Type C ineligible), the difference between nonresponses (Type As) and responses, and the change in these differences from 2019 to 2021, as well as the standard errors for each estimate. .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. Asterisks are shown only for the differences between nonresponses and responses and for the change in these differences from 2019 to 2021. Significance is calculated using OLS regression models with replicate weights.

Table 9: Logistic Regressions Modeling Nonresponse Versus Response on Selected Covariates (1=Nonresponse; 0=Response).

	Q2 2019		Q2 2020		Q2 2021	
	Coef.	(S.E.)	Coef.	(S.E.)	Coef.	(S.E.)
Intercept	-1.562	2.128	-1.366	1.988	-.763	2.097
decmis	.178	.305	.219	.228	.256	.274
vactype1	.173	.385	.389	.291	.156	.349
vactype2	-.238	2.044	.284	1.084	-.255	1.876
vactype3	.198	.508	.080	.407	.120	.565
vactype4	-.196	1.306	.067	.919	-.372	1.077
vactype5	-.775	.669	-.662	.480	-.812	.523
tenure2	-.133	.200	-.035	.158	-.061	.200
tenure3	.049	.210	.218	.159	.027	.177
tenure4	-.256	.539	-.013	.450	-.087	.516
bldm	.136	.217	.103	.161	.140	.185
bldto	-.158	.340	-.010	.278	-.143	.330
hht2	.062	.308	.184	.254	.161	.290
hht3	.110	.181	.152	.161	.108	.225
hht4	.137	.212	.133	.179	.094	.202
hht5	.145	.326	.109	.268	.034	.307
hht6	.182	.226	.083	.187	.085	.204
hht7	.121	.370	.090	.332	.066	.410
age	-.010	.004**	-.010	.004***	-.009	.004**
hispanic	.036	.266	.093	.191	.082	.222
black	.200	.262	.067	.201	.060	.233
aian	.177	.797	.098	.588	.009	.620
asian	-.054	.347	.017	.273	.011	.363
nhopi	.079	1.511	.002	1.409	.094	1.724
other	.349	1.286	.258	1.187	.116	1.261
bkmis	.033	.240	.028	.183	.047	.177
bkowner	.055	.210	-.184	.194	-.007	.194
acsmis	.070	.502	-.220	.525	-.225	.723
medval	.000	.000	.000	.000	.000	.000
medinc	.000	.000	.000	.000	.000	.000
ppov	-.142	1.591	.373	1.417	.062	1.513
pinc0124	-.573	2.229	.431	1.736	-.513	1.819
pinc2549	.010	1.749	.544	1.483	.040	1.606
pinc5099	.074	1.671	.747	1.365	.239	1.357
pvac	-.991	.991	-.717	.688	-.808	.885
pmover	.923	2.788	.644	2.292	-.054	2.668
pown	-.092	.739	-.079	.585	-.399	.696
pa0114	-.338	2.463	.069	2.009	-.649	2.316
pa1524	-.892	1.747	-.609	1.619	-.742	1.814
pa2534	-.156	1.930	-.374	1.934	-.821	2.145
pa5574	-.335	2.232	-.505	1.918	-.101	2.225
pa7599	-1.144	2.326	-.947	2.193	-1.138	2.694
phis	.256	.530	.059	.485	.135	.580
pnhb	.539	.466	.339	.450	.593	.453
pnha	.307	1.007	.332	.925	-.138	1.063
pnho	.569	1.413	.877	1.149	.697	1.109
State x Metro FE	Yes		Yes		Yes	
MIS x Metro FE	Yes		Yes		Yes	

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019-2021 linked to the supplemental data sources identified in Table 3.

Note: This table reports the results of logistic regressions that model an indicator for Type A nonresponse on the set of covariates identified in the table. The dependent variable is defined so that positive coefficients correspond to increased likelihood of response (0=Type A Nonresponse; 1=Completed interview, Type B, or Type C). Separate logistic regressions are estimated for each quarter. .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. Asterisks are reported for all estimates.

Table 10: Estimates of the Homeownership Rate and Vacancy Rates Using Alternative Weighting Approaches.

	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2	2021 Q3	2021 Q4
<i>Homeownership Rate</i>												
NEW Estimates	.655	.652	.657	.661	.661	.673	.672	.664	.662	.663	.662	.661
(S.E.)	.019	.018	.019	.018	.020	.018	.019	.017	.022	.019	.021	.021
BW Estimates	.664**	.661**	.667***	.673***	.675***	.705***	.699***	.679***	.677***	.676***	.676***	.675**
(S.E.)	.020	.018	.019	.018	.020	.017	.019	.017	.021	.018	.021	.020
CUR Estimates	.661*	.660*	.665**	.670**	.673***	.702***	.698***	.677***	.674**	.673**	.673**	.673**
(S.E.)	.020	.018	.019	.019	.020	.017	.019	.017	.021	.019	.022	.020
<i>Gross Vacancy Rate</i>												
NEW Estimates	.139	.140	.140	.132	.136	.138	.133	.131	.134	.133	.131	.131
(S.E.)	.013	.014	.013	.014	.014	.016	.014	.014	.015	.015	.014	.015
BW Estimates	.142	.143*	.142	.134	.139	.139	.135	.133	.137	.136	.135	.135*
(S.E.)	.014	.015	.014	.014	.016	.017	.015	.015	.015	.016	.015	.017
CUR Estimates	.120***	.121***	.121***	.115***	.113***	.098***	.100***	.108***	.109***	.109***	.106***	.104***
(S.E.)	.012	.013	.012	.013	.013	.013	.012	.012	.013	.013	.013	.013
<i>Rental Vacancy Rate</i>												
NEW Estimates	.086	.084	.084	.080	.085	.088	.093	.084	.090	.082	.077	.076
(S.E.)	.014	.012	.013	.013	.015	.018	.016	.014	.015	.014	.013	.013
BW Estimates	.086	.084	.083	.080	.085	.087	.093	.084	.089	.082	.077	.077
(S.E.)	.015	.013	.013	.014	.016	.017	.015	.013	.015	.014	.013	.013
CUR Estimates	.072***	.070***	.070***	.067***	.069***	.060***	.068***	.067***	.070***	.064***	.060***	.058***
(S.E.)	.012	.011	.011	.012	.013	.012	.012	.011	.012	.012	.010	.010
<i>Homeowner Vacancy Rate</i>												
NEW Estimates	.016	.015	.017	.016	.014	.013	.013	.012	.011	.011	.011	.011
(S.E.)	.004	.004	.004	.004	.004	.004	.004	.004	.003	.003	.003	.004
BW Estimates	.016	.015	.017	.016	.014	.012	.013	.012	.011	.011	.011	.011
(S.E.)	.004	.004	.004	.004	.004	.004	.004	.004	.003	.003	.003	.003
CUR Estimates	.013***	.013***	.014***	.014***	.011***	.008***	.009***	.010***	.009***	.008***	.008***	.008***
(S.E.)	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.002	.003

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019-2021 linked to the supplemental data sources in Table 3.

Note: This table reports estimates of each outcome using the propensity-score-based nonresponse adjustment developed in this paper (NEW), the CPS base weights (BW), and the CPS base weights multiplied by the existing nonresponse adjustment factor (CUR). .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. The asterisks reflect significance tests that compare the BW and CUR Estimates, respectively, to the NEW Estimates for the same quarter.

Table 11: Change from 2019 Q1 in the Estimates of the Homeownership Rate and Vacancy Rates Using Alternative Weighting Approaches.

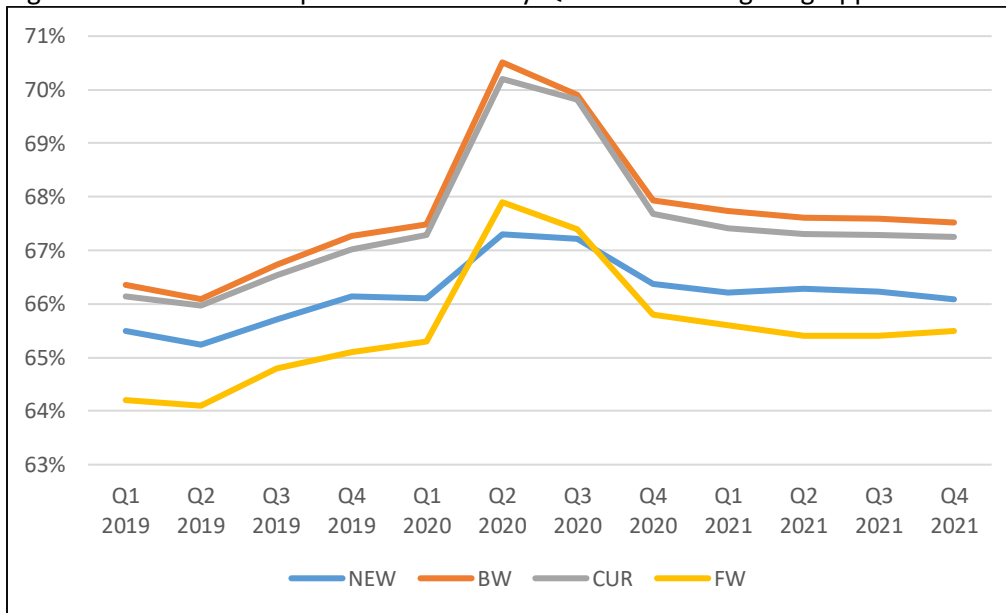
	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2	2021 Q3	2021 Q4
<u>Homeownership Rate</u>												
NEW Estimates	-	-.003	.002	.006	.006	.018	.017	.009	.007	.008	.007	.006
(S.E.)		.021	.025	.022	.018	.023	.025	.023	.027	.027	.027	.024
BW Estimates	-	-.003	.004	.009	.011	.042***	.036***	.016	.014	.013	.012	.012
(S.E.)		.021	.025	.022	.018	.023	.024	.024	.027	.027	.028	.024
CUR Estimates	-	-.002	.004	.009	.012	.041***	.037***	.016	.013	.012	.011	.011
(S.E.)		.021	.026	.022	.018	.023	.025	.024	.027	.027	.028	.024
<u>Gross Vacancy Rate</u>												
NEW Estimates	-	.001	.001	-.007	-.003	.000	-.006	-.008	-.005	-.006	-.007	-.008
(S.E.)		.011	.014	.013	.012	.013	.014	.013	.015	.015	.015	.014
BW Estimates	-	.001	.001	-.007	-.003	-.002	-.007	-.008	-.005	-.006	-.007	-.006
(S.E.)		.012	.014	.013	.012	.013	.015	.014	.015	.015	.016	.014
CUR Estimates	-	.001	.001	-.006	-.007**	-.022***	-.020***	-.012	-.011*	-.011*	-.014**	-.016***
(S.E.)		.010	.012	.012	.010	.010	.012	.012	.013	.013	.013	.012
<u>Rental Vacancy Rate</u>												
NEW Estimates	-	-.003	-.003	-.007	-.001	.002	.007	-.003	.003	-.005	-.009	-.010
(S.E.)		.016	.019	.019	.019	.021	.020	.017	.020	.018	.019	.017
BW Estimates	-	-.003	-.003	-.007	-.001	.001	.006	-.003	.003	-.005	-.009	-.009
(S.E.)		.016	.019	.019	.019	.021	.020	.017	.020	.018	.019	.017
CUR Estimates	-	-.002	-.002	-.005	-.004	-.012**	-.004**	-.005	-.002	-.008	-.013	-.014
(S.E.)		.014	.016	.016	.016	.016	.016	.014	.017	.015	.016	.014
<u>Homeowner Vacancy Rate</u>												
NEW Estimates	-	-.001	.001	.001	-.002	-.003	-.003	-.004	-.005	-.005	-.005	-.005
(S.E.)		.005	.006	.005	.005	.005	.005	.005	.005	.005	.005	.005
BW Estimates	-	-.001	.001	.000	-.002	-.004	-.003	-.004	-.005	-.005	-.005	-.005
(S.E.)		.005	.006	.005	.005	.005	.005	.005	.005	.005	.005	.005
CUR Estimates	-	-.001	.001	.000	-.002	-.005	-.004	-.004	-.005	-.005	-.005	-.005
(S.E.)		.004	.005	.005	.004	.004	.004	.004	.004	.004	.004	.004

Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019-2021 linked to the supplemental data sources in Table 3.

Note: This table reports the change in each outcome since 2019 Q1 using the propensity-score-based nonresponse adjustment developed in this paper (NEW), the CPS base weights (BW), and the CPS base weights multiplied by the existing nonresponse adjustment factor (CUR). .000 values indicate rounded to zero. The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

*** p<.01; ** p<.05; * p<.10. The asterisks reflect significance tests that compare the BW and CUR Estimates, respectively, to the NEW Estimates for the same quarter.

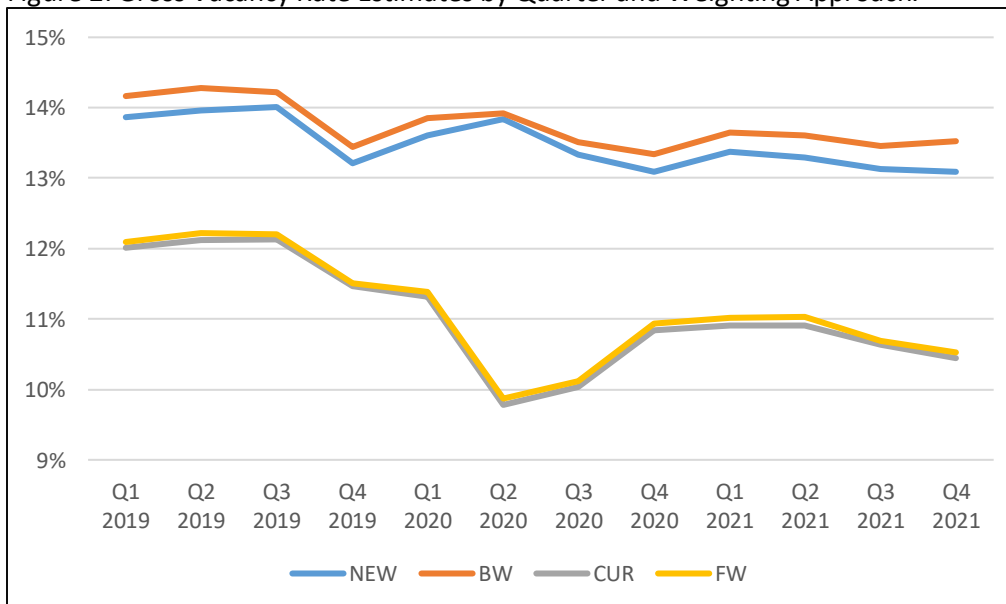
Figure 1: Homeownership Rate Estimates by Quarter and Weighting Approach.



Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019-2021 linked to the supplemental data sources identified in Table 3.

Note: This figure visualizes the alternative estimates reported in Table 10 using the propensity-score-based nonresponse adjustment developed in this paper (NEW Estimates), the CPS base weights (BW Estimates), and the CPS base weights multiplied by the existing nonresponse adjustment factor (CUR Estimates). It also plots the published CPS/HVS estimates using the final weights (FW). The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

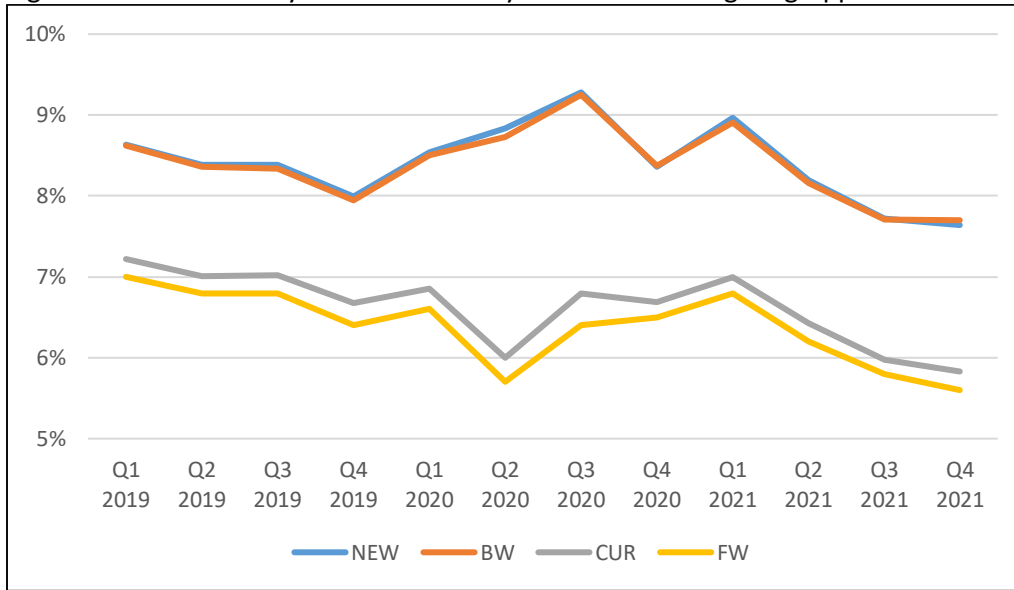
Figure 2: Gross Vacancy Rate Estimates by Quarter and Weighting Approach.



Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019-2021 linked to the supplemental data sources identified in Table 3.

Note: This figure visualizes the alternative estimates reported in Table 10 using the propensity-score-based nonresponse adjustment developed in this paper (NEW Estimates), the CPS base weights (BW Estimates), and the CPS base weights multiplied by the existing nonresponse adjustment factor (CUR Estimates). It also plots the published CPS/HVS estimates using the final weights (FW). The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

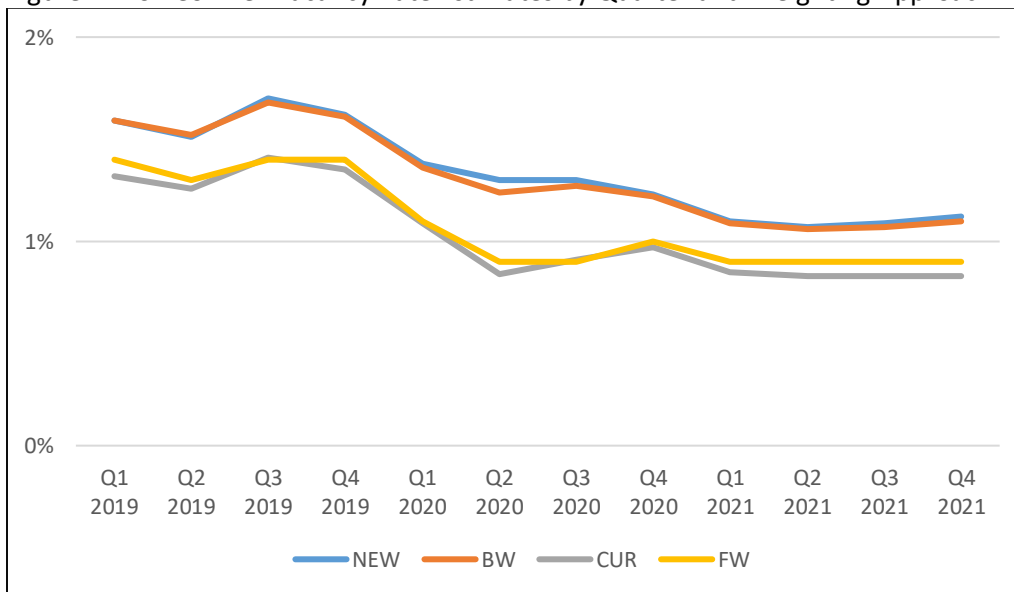
Figure 3: Rental Vacancy Rate Estimates by Quarter and Weighting Approach.



Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019-2021 linked to the supplemental data sources identified in Table 3.

Note: This figure visualizes the alternative estimates reported in Table 10 using the propensity-score-based nonresponse adjustment developed in this paper (NEW Estimates), the CPS base weights (BW Estimates), and the CPS base weights multiplied by the existing nonresponse adjustment factor (CUR Estimates). It also plots the published CPS/HVS estimates using the final weights (FW). The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.

Figure 4: Homeowner Vacancy Rate Estimates by Quarter and Weighting Approach.



Source: U.S. Census Bureau. Current Population Survey and Housing Vacancy Survey Supplement data for 2019-2021 linked to the supplemental data sources identified in Table 3.

Note: This figure visualizes the alternative estimates reported in Table 10 using the propensity-score-based nonresponse adjustment developed in this paper (NEW Estimates), the CPS base weights (BW Estimates), and the CPS base weights multiplied by the existing nonresponse adjustment factor (CUR Estimates). It also plots the published CPS/HVS estimates using the final weights (FW). The U.S. Census Bureau reviewed this data product for unauthorized disclosure of confidential information and approved the disclosure avoidance practices applied to this release. CBDRB-FY22-POP001-0085.