

# Comparing 2010 American Community Survey 1-Year Estimates of Occupancy Status, Vacancy Status, and Household Size with the 2010 Census - Preliminary Results

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## OBJECTIVE

The 2010 Census and the American Community Survey (ACS) both measure occupancy status, vacancy status, and household size. This report will:

- (1) document comparisons of published information on these measures from the 2010 ACS with the 2010 Census
- (2) discuss the design and methodology differences of the ACS and the 2010 Census that likely contribute to the observed measurement differences

We will highlight where differences exist and identify possible explanations for the differences. These differences do not necessarily imply errors exist in either the ACS or the 2010 Census results. To the extent interviewers and enumerators misclassified housing units, this report will not try to determine if the ACS or the Census was more correct.

## BACKGROUND

Both the decennial census and the ACS provide information to meet the nation's legal and programmatic needs. The different purposes and relative sizes of these two data collection efforts guided the methodologies used to collect and process data. We expected these differences in methods could result in differences in the published results.

The 2010 Census enumerated the nation's entire population as required by the Constitution. The results are used for apportionment, redistricting, and to support important legislation. Securing a complete count of the U.S. population is the primary goal of the decennial census and it is designed to produce this count and ensure key information can be produced by the legal deadlines. While the 2010 Census benefitted from the publicity and perceived importance of a decennial census, its design had to accommodate a tremendous workload and tight operational scheduling constraints. To produce accurate and fair census counts, a single reference date had to be used. The 2010 Census results therefore attempt to describe the population and housing (including the vacancy rate) on April 1, 2010.

The Census Bureau, in meeting its Constitutional mandate, is committed to achieving a complete enumeration. Given this goal and the large number of temporary staff that must be hired to conduct the enumeration, the Census Bureau has chosen to use special coverage improvement procedures, including a follow up on housing units classified as vacant. The Census Bureau has found these procedures improve both the completeness of the housing unit inventory and the count of the population.

The ACS is designed to collect detailed data to measure the nation's population and housing characteristics in a survey setting. The primary goal of the ACS is to provide survey estimates every year

instead of once a decade -- giving communities the current information they need between censuses to plan investments and services. Information from the survey helps determine how to distribute more than \$400 billion in federal and state funds each year. The ACS estimates the nation's characteristics over the course of a year, requiring responses be collected continuously with a floating reference date based on the date of interview. The 2010 ACS 1-year estimates therefore describe population and housing characteristics (including vacancy rates) throughout calendar year 2010, not as of any specific day in 2010.

Although coverage of the entire population is critical in a census, many additional efforts used in a census to improve coverage are impractical and cost prohibitive in a survey like the ACS. The need for such procedures may also be less important in a survey setting with more experienced staff.

## INTRODUCTION

The national-level differences in the 2010 ACS 1-year estimates of total occupied housing units and total vacant housing units relative to the 2010 Census are statistically significant.<sup>1</sup> These differences resulted in the 2010 ACS 1-year gross vacancy rate being about 1.7 percentage points higher than the gross vacancy rate of the 2010 Census.<sup>2</sup> See Table 1 for a summary of these comparisons.

Table 1. Comparison of 2010 ACS 1-Year and 2010 Census Housing Unit Occupancy Status and Average Household Size – U.S. Total

|                                          | 2010 Census        | 2010 ACS 1-Year Estimate | 2010 ACS Margin of Error (+/-) | Difference (ACS - Census) |
|------------------------------------------|--------------------|--------------------------|--------------------------------|---------------------------|
| <b>Total Housing Units</b>               | <b>131,704,730</b> | <b>131,791,065</b>       | <b>5,741</b>                   | <b>86,335</b>             |
| Total Occupied Housing Units             | 116,716,292        | 114,567,419              | 163,249                        | -2,148,873                |
| Total Vacant Housing Units               | 14,988,438         | 17,223,646               | 167,247                        | 2,235,208                 |
| Gross Vacancy Rate                       | 11.4               | 13.1                     | 0.1                            | 1.7                       |
| <b>Total Population in Housing Units</b> | <b>300,758,215</b> | <b>301,362,366</b>       | <b>(X)</b>                     | <b>604,151</b>            |
| Average household size                   | 2.58               | 2.63                     | 0.01                           | 0.05                      |

Every year the Census Bureau uses the most recent housing unit and population estimates from the Population Estimates Program (PEP) as survey controls to improve the quality of the ACS estimates.<sup>3</sup> In 2010 the total housing unit and total population estimates from the PEP were based on the 2010 Census results. Therefore, the 2010 ACS 1-year estimates of total housing units and total population are similar to the 2010 Census counts of total housing units and total population. However, the PEP does not provide estimates of total households so, unlike the estimate of total housing units, the proportion of ACS housing units classified as either occupied or vacant is determined by ACS survey interview results.

<sup>1</sup> Statistical significance means that there is statistical evidence that a true difference exists within the full population, and that the observed difference is unlikely to have occurred by chance due to sampling. All statistical tests in this paper use a 90 percent level of confidence. The numbers of occupied and vacant housing units from the 2010 Census are based on a complete enumeration and therefore they do not include any sampling error. The 2010 ACS estimates are based on a sample and any comparisons with the 2010 Census must therefore account for sampling variability in the ACS estimates.

<sup>2</sup> The gross vacancy rate is the proportion of the total housing inventory that is vacant.

<sup>3</sup> The use of survey controls is standard practice in household surveys and has been shown to reduce sampling variability and improve survey coverage. During the processing of the survey, the population and housing weights are adjusted so that they will sum to the survey control totals.

As a result of the difference in vacant housing units, a corresponding difference of slightly over 2.1 million fewer 2010 ACS occupied housing units or households exists. The combined effect of fewer 2010 ACS total households and similar 2010 ACS estimated total population means the 2010 ACS 1-year estimate of average household size is greater than the 2010 Census average household size.

Looking at vacant housing units by type of vacancy allows us to better understand these differences (see Table 2.) Comparing 2010 ACS and 2010 Census types of vacant housing units shows, with the exception of vacant housing units classified as “for sale only,” all other differences between the 2010 Census and the 2010 ACS were statistically significant. Note a large proportion of the vacant housing units in both the 2010 ACS and the 2010 Census are classified as “other vacant” or “for seasonal, recreational, or occasional use.” “Other vacant” units include all vacant housing units that are not “for sale or sold”, “for rent or rented”, “for migrant workers”, or “for seasonal, recreational, or occasional use.” Based on interviewer debriefings most of these “other vacant housing units” are units neither for sale nor for rent. They may be recent foreclosures, housing units owners or renters have “walked away from”, or housing units where the owners have not yet determined if they plan to sell or rent.

We see some of the greatest differences in the seasonal and the “other” vacant categories. The 2010 ACS estimated approximately 0.5 million more seasonal, recreational, occasional-use vacant housing units and about 1.6 million more “other vacant” housing units than the 2010 Census.

Table 2. Comparison of 2010 ACS 1-Year and 2010 Census Vacancy Status – U.S. Total

|                                                  | 2010 Census | 2010 ACS<br>1-Year Estimates | 2010 ACS Margin<br>of Error (+/-) | Difference<br>(ACS - Census) |
|--------------------------------------------------|-------------|------------------------------|-----------------------------------|------------------------------|
| For rent                                         | 4,137,567   | 3,587,148                    | 44,663                            | -550,419                     |
| Rented, not occupied                             | 206,825     | 610,827                      | 17,510                            | 404,002                      |
| For sale only                                    | 1,896,796   | 1,929,351                    | 34,885                            | 32,555                       |
| Sold, not occupied                               | 421,032     | 610,798                      | 15,083                            | 189,766                      |
| For seasonal, recreational, or<br>occasional use | 4,649,298   | 5,153,003                    | 56,603                            | 503,705                      |
| For migrant workers                              | 24,161      | 31,607                       | 3,768                             | 7,446                        |
| Other vacant                                     | 3,652,759   | 5,300,912                    | 67,127                            | 1,648,153                    |

## METHODOLOGY AND SELECTED RESULTS

We established a working group within the Census Bureau to determine the set of factors most likely to explain these observed differences. To assess the scope and define the issue our initial review included a comparison of gross vacancy rates and vacancy status at state and sub-state levels.

We found the national-level results do not hold for every state (see Figure 1.) In some states the 2010 ACS and the 2010 Census gross vacancy rates are not statistically different, while in other states the differences are statistically significant and quite large. The 2010 ACS and 2010 Census gross vacancy rate differences were not statistically significant in Minnesota, Vermont, Iowa, Utah, Wisconsin, Nebraska, North Dakota, and New Hampshire. In all other states the differences were statistically significant with some of the greatest observed differences in the District of Columbia, Florida, Delaware, Alabama, New Mexico, Mississippi, and Georgia.

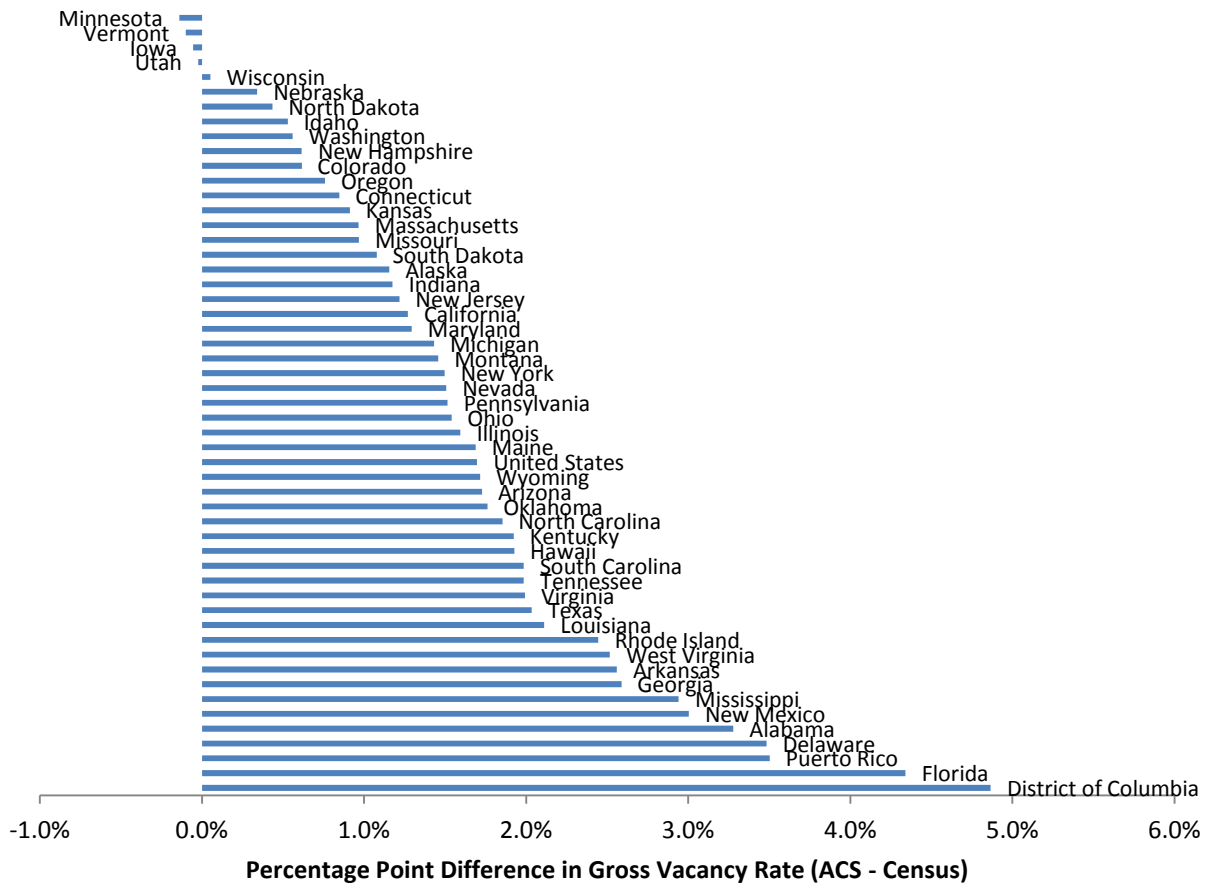


Figure 1. Comparison of 2010 ACS 1-Year and 2010 Census Gross Vacancy Rates— State Level

The national finding that these differences were driven by a greater number of “other vacants” holds for many states but this is not true in every state. Alabama, Illinois, Ohio, Pennsylvania, Nebraska, and the District of Columbia have some of the greatest differences in the percentages of housing units classified as “other vacant.” Some of the largest differences in the percentages of “for seasonal, recreational, or occasional use” were observed in New Mexico, Florida, North Dakota, and Nevada.

These results suggest different scenarios contribute to the 2010 ACS and the 2010 Census gross vacancy rate differences. Different environments for interviewing (e.g., challenges in seasonal areas and in inner-city, hard-to-count areas) could also influence how interviewers and enumerators ultimately classify a housing unit. This observed variability in the levels and types of differences support later findings that these differences do not appear to be due to systematic variations in how the ACS and the 2010 Census defined occupied versus vacant housing units.

Differences in gross vacancy rates are concentrated in the South Region and in states with the lowest levels of mail response in both the 2010 ACS and the 2010 Census. The classifications of occupied housing units in these areas rely much more on interviewers and enumerators as opposed to self response which tends to be more accurate. The “hardest-to-survey” areas tend to have the largest differences in gross vacancy rates between the ACS and the 2010 Census.

To help assess if the 2010 ACS results were reasonable we conducted a demographic analysis of historical trends in vacancy rates from the ACS, the Census, and the Housing Vacancy Survey (HVS). The HVS is the official source of information on vacant housing units and has been conducted since 1985 for the U.S. Department of Housing and Urban Development.<sup>4</sup> Figure 2 compares the gross vacancy rates for these three different measures over the 1990 to 2010 period.

Some consistent patterns are clear. All measures (the ACS, HVS and Census) show an appreciable rise in the vacancy rate from 2000 to 2010. Figure 2 demonstrates the ACS gross vacancy rate was higher than the Census gross vacancy rate in 2000 (9.6 versus 9.0) as well as 2010 (13.1 versus 11.4), though the difference is wider in 2010. Likewise, the ACS estimates are consistently below the HVS across the time series from 2000 to 2010. These systematic differences between the sets of estimates are attributable in large part to the way the ACS, HVS, and the Census interview occupied and vacant housing units.<sup>5</sup>

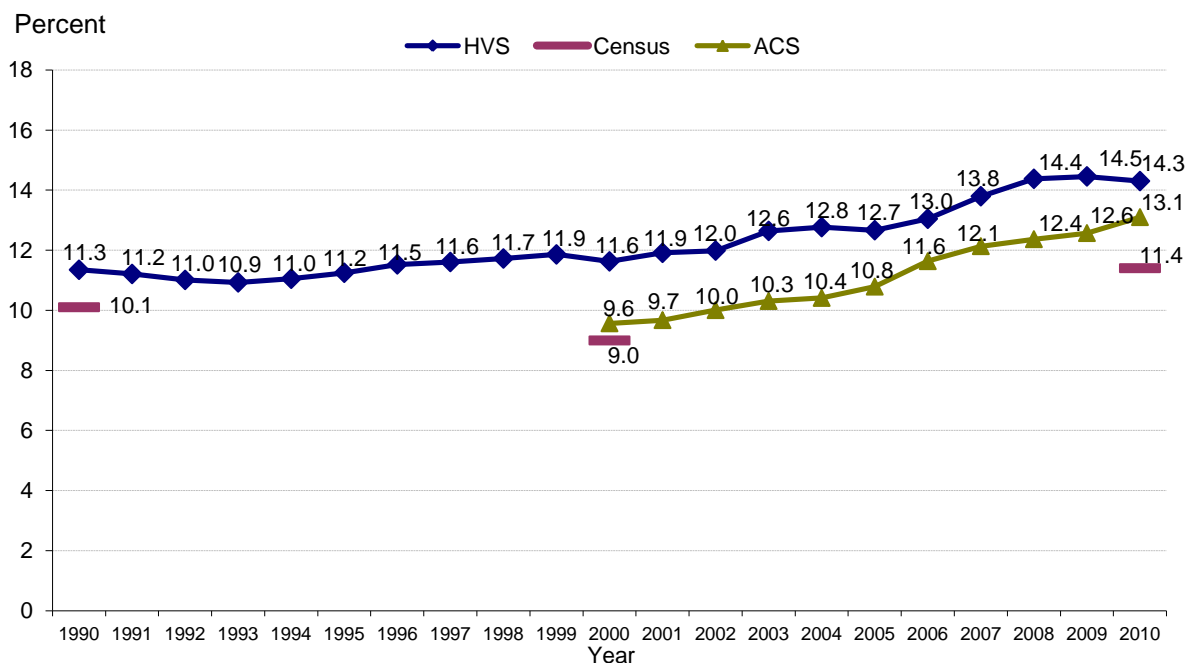


Figure 2. Gross Vacancy Rates Since 1990 by Data Source: Decennial Census, Housing Vacancy Survey (HVS), and ACS 1-Year Estimates

To rule out the possibility that 2010 Census and ACS staff may have used different concepts or definitions when classifying housing units as occupied versus vacant, we conducted a detailed review and comparison of the written procedures and training materials provided to ACS field representatives and census enumerators. We also conducted a structured set of debriefing calls with current ACS field representatives from four regional offices, including staff who had worked on the 2010 Census. While we identified a few minor issues and the need to clarify a few procedures, we concluded the ACS and 2010 Census definitions and methods used to determine if a housing unit was occupied versus vacant were essentially the same. We expect to release a detailed summary of these findings in early 2012.

<sup>4</sup> Information about the HVS can be found at <http://www.census.gov/hhes/www/housing/hvs/hvs.html>.

<sup>5</sup> A fact sheet with comparisons of the ACS and HVS design and methods can be found at <http://www.census.gov/hhes/www/housing/vacanciesfactsheet.html>.

To better understand if specific methods used in the 2010 Census and the 2010 ACS contributed to these differences, we obtained summary data from 2010 Census operational assessments and accessed ACS operational data. We plan to issue summaries of the methods and findings from each of these assessments in early 2012.

We reviewed the following 2010 Census operational assessments and research:

1. Results from the 2010 Census Nonresponse Follow up (NRFU) operation and the 2010 Census Vacant Delete Check (to assess if the conversion rates of vacant and deleted units to occupied units could be attributed to this coverage improvement operation).
2. 2010 Census qualitative and ethnographic research (to better understand enumerator behavior during NRFU).
3. Tabulations of count imputation (to understand the possible impact of incomplete information on housing status, occupancy status, and household size).
4. Results from the 2010 Census duplicate study (to assess if some census occupied units could be duplicated households that moved between April 1<sup>st</sup> and when they were enumerated).

We also reviewed or produced the following ACS operational data:

1. Gross vacancy rates by mode of data collection (to understand how often 2010 ACS vacant units were interviewed without an in-person visit).
2. Reinterview data (to assess the quality of vacant classifications by ACS field representatives).
3. Vacancy rates by month (sample panel) and by main versus supplemental sample (to assess the impact of ACS year round data collection and determine if vacancy rates increased over time).
4. Master Address File changes during the time period for selecting the main and supplemental ACS samples and changes after ACS sample selection that reflect 2010 Census findings (to assess the differences in the 2010 Census and the 2010 ACS housing unit frames).
5. ACS gross vacancy rates at various stages of ACS weighting and estimation (to assess the possible effects of weighting on the estimates).

We also conducted a detailed match study comparing the specific 2010 Census and 2010 ACS classifications for all 2010 ACS sample addresses. We added operational data from the 2010 Census and the ACS to the match study results to identify the characteristics of the ACS and 2010 Census housing units with classification differences. This analysis includes looking at the mode and timing of ACS and Census interviews. In addition, this study allows us to identify the Local Census Offices (LCOs) with the greatest differences in gross vacancy rates along with some LCO characteristics such as participation rates, proxy rates, and hard-to-count scores. We also reviewed information on areas with high levels of seasonal (not year-round) housing. We are producing detailed reports summarizing this research.

## FINDINGS

We believe the following factors explain the 2010 ACS and the 2010 Census differences in occupied and vacant housing unit classifications. We observed differences in 2000 ACS and Census 2000 occupancy status and some of the same factors identified in 2000 were likely contributors this decade as well (U.S. Census Bureau, 2004).

- Different reference periods, residence rules, and interview periods
- Different address frames
- 2010 Census coverage improvement procedures
- Problems finding knowledgeable respondents and determining occupancy status

## Different Reference Periods, Residence Rules, and Interview Periods

### Reference Periods

The 2010 ACS 1-year estimates do not measure characteristics for the same time frame as the 2010 Census. Although implementation may be imperfect, census data collection procedures direct enumerators to classify the vacant status of addresses as of April 1 and not as of the day they are enumerated. In contrast, the ACS conducts interviews throughout the year and directs interviewers to collect information based on the day each sample unit is interviewed. The ACS reference date for occupancy status is therefore the full year - January 1, 2010 through December 31, 2010. When the Census Bureau produces annual ACS estimates of gross vacancy, they describe the vacancy rate throughout the full calendar year.

In some parts of the country vacancy rates vary across the year and a vacancy rate as of April 1 may not be the same as an annual average vacancy rate. We do not believe this difference in reference period was a major contributor to the overall gross vacancy rate difference. The 2010 ACS gross vacancy rates measured throughout the year were stable.

### Residence Rules

The ACS and the Census impose different residence rules to determine if a specific housing unit is occupied or vacant. The ACS uses a concept of “current residence” given the monthly samples distributed throughout the year, rather than the census concept of “usual residence” as of April 1<sup>st</sup>. The ACS will classify a unit as occupied if someone staying in the unit has stayed or plans to stay there for more than two months. The 2010 Census classified a unit as occupied if it was a person’s usual place of residence, meaning the place where they live or stay most of the time.

Unlike the Census, the ACS allows temporary residents to be interviewed. Therefore, housing units that are correctly classified as vacant under the Census usual residence rule may be correctly classified as occupied in the ACS. This difference in residence rules was expected to result in fewer ACS housing units being classified as vacant. While this is the opposite direction of the observed national-level difference, we did find evidence that areas with high concentrations of seasonal housing were more likely to have ACS gross vacancy rates that were similar to, or lower than, the 2010 Census. The different residence rules do not appear to explain the higher gross vacancy rates in other areas.

### Interview Periods

The ACS and the 2010 Census interview periods can also influence the occupancy classification of an address. The ACS uses a 3-month interview period for all sample addresses. In the first two months attempts are made to collect data by mail and telephone with personal visit contact made in the third month. Vacant housing units are almost always identified in this third month and therefore the address has an opportunity to change status between month 1 and month 3. Theoretically this 3-month interview period should depress the true vacancy rate (Fronczek and Savage, 1998.) The April 1<sup>st</sup> reference date should eliminate the impact of an interview period in the 2010 Census. However, if census enumerators classify units as of the date of interview, rather than the reference date, similar effects would be expected since nonresponse follow up for the census (when vacants are enumerated) occurs several months after Census Day.

Problems can arise when implementing reference periods and residence rules. In the 2010 Census, vacant housing units were enumerated in either Nonresponse Follow up or the Vacant Delete Check

which was at least two months after census day. This enumeration of the Census Day reference date can make the classification of vacant units problematic, especially for movers. Interviewers and respondents in both the ACS and the 2010 Census can also misunderstand or misapply residence rules and reference periods which can lead to errors in unit classification.

## Different Address Frames

The address frame used to select the sample for the 2010 ACS differs in important ways from the 2010 Census address frame. We did not draw the 2010 ACS sample from the list of 2010 Census addresses. The ACS sample is always selected from the most up to date information about the housing unit addresses across the nation at the time of sample selection. The ACS selects a main sample of addresses each summer. We supplement and adjust that sample early in the calendar year to reflect updates to the MAF.

In preparation for the 2010 Census many changes were made to the address list in 2009 and 2010. Given the timing of many of those changes, the frame for the 2010 ACS did not reflect some the housing unit addresses that were added to, and dropped from, the 2010 Census frame. For example, we selected the 2010 ACS main sample during August and September 2009 while 2010 Census address canvassing operations were still underway and the MAF did not reflect the results of the 2010 Census address canvassing operation. This was the address frame for the January through April ACS sample panels. The updated frame used to select the supplemental sample of housing unit addresses and adjust the main sample for deleted housing units was based on the MAF as of February 2010. At that point the MAF reflected the results of the 2010 Census address canvassing operation. Therefore the address frame for the May through December sample panels was quite different. None of the 2010 ACS sample panels benefitted from the full 2010 Census enumeration of housing units.

In addition, by design the ACS does not include some 2010 Census categories of housing units. Specifically, the ACS never includes transitory units at transitory locations such as tents and boats. They are not a part of the address frame. However, if census enumerators found individuals at these locations they enumerated these transitory units as occupied housing units. Enumerators never classified these locations as 2010 Census vacant housing units so their inclusion reduced the 2010 Census vacancy rate.<sup>6</sup>

## 2010 Census Coverage Improvement Procedures

To ensure a complete population count, the 2010 Census included special methods to review and confirm the status of housing units initially classified as vacant. We include this review in the Census because research has shown some level of misclassification can occur in these initial census enumerations that can be reduced given a second contact.

In pretests conducted prior to the 1970 Census, the Census Bureau found occupied housing units incorrectly classified as vacant to be a significant factor in the population undercount (U.S. Census Bureau, 1974). The 1970 Census included a National Vacancy Check for a sample of addresses and detected a misclassification rate of 11.4 percent among units initially classified as nonseasonal vacant (U.S. Census Bureau, 1974). Starting in the 1980 Census, a comprehensive review of all units classified as vacant was added as a coverage improvement mechanism. In 1980 this check converted about 10.1 percent of initially classified vacant units to occupied units and found that after all coverage

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<sup>6</sup> The number of occupied housing units resulting from transitory locations in the 2010 Census was very small.



improvement efforts, about 0.9 percent of all occupied housing units were over enumerated (U.S. Census Bureau, 1985.)

The 1990 and 2000 censuses used similar methods with similar findings – improvements in population coverage could be achieved with some added level of duplication, over enumeration. Census evaluation studies each decade support the decision to include this follow up operation in the 2010 Census. The 2010 Census Vacant Delete Check reviewed the status of some housing units that had been classified as either vacant or deletes in Nonresponse Follow up. This operation converted about 6 percent of the housing units initially classified as vacant to occupied (Heimel et al, 2011).

No equivalent review of the status of all ACS vacant housing units occurs although the ACS subjects a small sample of vacant interviews to a reinterview procedure. We designed this reinterview operation to monitor interviewer performance and identify interviewers who may need additional training. In 2010 this ACS reinterview found about 2 percent of the vacant housing unit classifications should have been classified as either occupied housing units, temporarily occupied housing units, or as noninterviews.

## **Problems Finding Knowledgeable Respondents and Determining Occupancy Status**

The 2010 Census and ACS interviewers faced a difficult task. Despite common procedures, differences in interpretation of what is an occupied housing unit can occur, especially in hard to count areas and, in general, in areas experiencing large numbers of foreclosures. It is challenging to determine the occupancy status of a unit in some areas when no household members can be contacted and neighbors are unwilling to provide information. Classifications can differ based on who can be contacted, what can be observed from outside the housing unit, the efforts and approaches taken to resolve cases, and the experience of interviewing staff in dealing with uncooperative households.

These challenges can also lead to interviewer errors when they make assumptions based on limited information. The ACS and the 2010 Census found similar numbers of housing units classified as “vacant for sale only.” This may be the easiest type of vacant to identify. In contrast, units classified as “other vacants” had large differences and tend to be the harder cases to resolve.

We analyzed state-level data on 2010 Census mail participation rates and percentage point differences in gross vacancy rates (see Figure 3.) States with the highest 2010 Census mail participation rates (Wisconsin, Minnesota, and Iowa) had some of the lowest differences in gross vacancy rates. Future research will explore measures of respondent cooperation at lower geographic levels.

Our focus groups with field representatives found that when no one was available to confirm the status of a unit, when after repeated efforts no one answered the door, and when no obvious clues existed to flag the case as occupied versus vacant, they had problems determining if a unit was occupied or vacant. As noted earlier, in many instances the vacancy status of “other vacant” was associated with foreclosures. We believe the risk of inconsistent assessments increased when the occupancy status of a housing unit was not obvious and knowledgeable respondents were not available.

This is not a new problem. This challenge confronts every survey and census. In her review of gross vacancy rates in decennial censuses, Love (2001) noted, “the vacant housing unit count is obviously a very volatile statistic - identifying places where no one is living has always been problematic.”

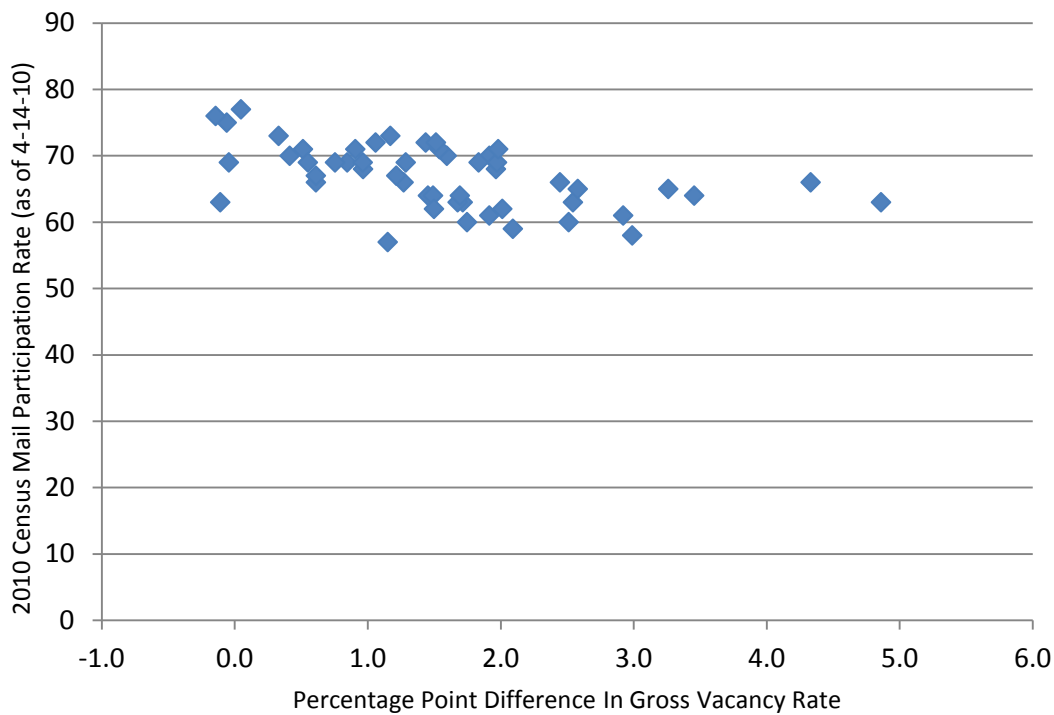


Figure 3. Relationship of 2010 Census Mail Participation Rates and Percentage Point Differences in ACS and Census Gross Vacancy Rates

## CONCLUSIONS AND NEXT STEPS

At this time, despite observed differences, we have confidence in the information on occupancy status and vacancy status released from the 2010 Census and the 2010 ACS. Our review to better understand those differences did not reveal any systematic errors or implementation issues. While this document does not include the detailed methods or results used in our analysis, we are producing those reports and plan to release them over the next few months. They will provide greater detail for data users with a keener interest in this issue.

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