

# **American Housing Survey**

## **Weighting Strategy for 2004–2009 New Orleans CINCH Analysis**

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Office of Policy Development & Research**

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**Contract No. C-CHI-01030  
Order No. CHI-T0001  
Project No. 1031-000**

**July 2011**

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# **Weighting Strategy for 2004–2009 New Orleans CINCH Analysis**

This paper adapts the weighting strategy used by Econometrica, Inc., in its components of inventory change (CINCH) analysis of changes in the national housing stock for use in analyzing changes in the New Orleans metropolitan area between 2004 and 2009, a period that includes the devastation wrought by Hurricane Katrina.<sup>1</sup> This analysis is a joint effort of the Census Bureau and Econometrica, Inc.

To protect the confidentiality of respondents, the Census Bureau drew a new sample of housing units in the central city portion of the New Orleans metropolitan area for the 2009 survey, and it interviewed the old sample, as well. Only the results from interviews with the new sample are included in the public use file (PUF). Results for the entire sample of respondents are available in the internal use file (IUF) at all of the Census Bureau’s Research Data Centers. The IUF also includes the backward- and forward-looking weights detailed in this CINCH analysis. CINCH analysis compares information from the 2004 and 2009 surveys and therefore can use only the housing units that are in both samples. For this reason, the construction of weights, as well as all the CINCH analysis, was conducted at the Census Bureau so that all cases could be linked between surveys.<sup>2</sup>

## ***Differences between the 2009 New Orleans Survey and Regular AHS Surveys***

At HUD’s request, the Census Bureau designed the 2009 American Housing Survey (AHS) of New Orleans to report on how Hurricane Katrina affected the New Orleans housing stock and its inhabitants and on recovery efforts. The Census Bureau created a special series of questions to collect this information.<sup>3</sup> It also changed some of its procedures. These new questions and the corresponding changes in procedures call for revisions to the approaches used in previous CINCH analyses.

## **The CINCH Objective**

Figure 1 on the next page illustrates the question that CINCH analysis seeks to answer and how this analysis has been conducted previously on both the national housing stock and the housing stock in selected metropolitan areas.

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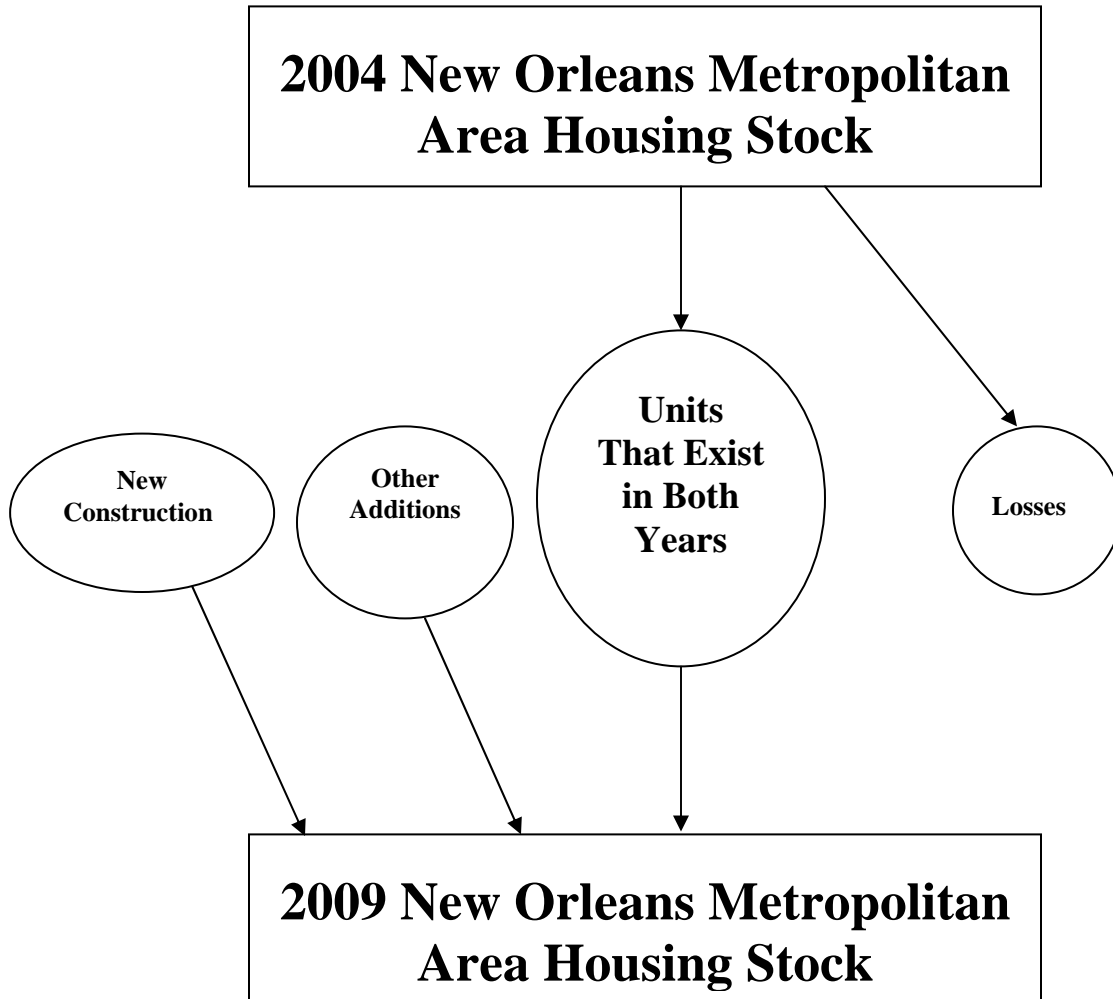
<sup>1</sup> See <http://www.huduser.org/datasets/cinch.html> for previous CINCH analyses.

<sup>2</sup> Kwame Donaldson carried out the weighting at the Census Bureau and showed great patience in helping us move from the earlier versions of the weighting algorithms to the final versions.

<sup>3</sup> See the special section on New Orleans in the latest AHS Codebook, version 2.0, <http://www.huduser.org/portal/datasets/ahs/ahsprev.html#codebooks>.

CINCH tries to explain how the housing stock evolves from one period to the next. Figure 1 contains four ovals and two rectangles. The Census Bureau provides estimates for both rectangles and one oval (units added through new construction between 2004 and 2009). No one estimates the other three ovals: the number of units that belong to both the 2004 and 2009 housing stock, units lost to the housing stock between 2004 and 2009, and other additions to the housing stock between 2004 and 2009.

**Figure 1: The CINCH Objective**



Losses can be either permanent or temporary. Units destroyed by natural disasters or intentionally demolished are permanent losses. Temporary losses include units that are used for nonresidential purposes or as institutional housing.<sup>4</sup> Besides new construction, additions can include units resulting from splitting up larger units, mobile home move-ins, and units that had been used formerly for nonresidential purposes.

<sup>4</sup> “Potentially reversible” might be a better term than “temporary” for these types of losses.

In addition to determining the size of each oval, housing analysts find information about the characteristics of the units in the different ovals useful. Interesting characteristics include structure type, age of the unit, size of the unit, location by region, location by metropolitan status, tenure, household size and composition, resident income, and resident race and ethnicity.

CINCH analysis has three goals:

- To provide estimates for all six components of Figure 1.
- To disaggregate losses and other additions into relevant component parts.
- To characterize the units that survive from one period to the next and the units that are added or lost between periods.

The AHS has four features that make CINCH analysis possible:

- Each unit has weights that can be used to estimate its share of the overall stock.
- The AHS tracks new construction and the various types of losses and other additions.
- The AHS has detailed information about the characteristics of each unit and its occupants.
- The AHS tracks the same unit from one period to the next so that changes in status and characteristics can be observed directly.

## **CINCH for New Orleans**

In other CINCH analyses, we relied on the variable NOINT to identify losses to the housing stock. NOINT (no interview) reports the reasons that a unit in the AHS sample was not interviewed in a particular survey. These reasons are classified into three types:

- Type A noninterviews (NOINT values from 1 through 6): In these cases, the unit exists and is part of the housing stock, but the Census Bureau was unable to complete an interview because it could not contact the household, there were language difficulties, the household refused to be interviewed, or there were similar problems completing the interview.
- Type B noninterviews (NOINT values from 10 through 17): In these cases, the unit exists but is not part of the housing stock because it is not completed, it is vacant land only for use of a mobile home, it is being used for commercial purposes, it is being used as a group home, it is uninhabitable because of physical deficiencies, or it is not in stock for similar reasons.
- Type C noninterviews (NOINT values equal to or greater than 30): In these cases, the unit no longer exists because it has been demolished or destroyed, it has been moved, it has been radically transformed by splitting it into more than one unit or merging it with another unit, it was eliminated for sampling reasons, or it has permanently left the sample for similar reasons.

In CINCH analysis, Type B and Type C noninterviews are considered losses to the stock, and the analysis uses the value of NOINT to categorize the type of loss.

Because we are particularly concerned in the case of New Orleans with losses due to Hurricane Katrina, we will illustrate how other CINCH analyses would treat losses from, for example, damage from a tornado. If the tornado damaged the structure to the point that it was uninhabitable but still repairable, the Census Bureau would assign a value of 16 to NOINT. If the tornado destroyed the structure or damaged it beyond repair, the Census Bureau would assign a value of 30 to NOINT. In subsequent surveys, units that received a NOINT value of 16 could take one of three values of NOINT: if the unit were repaired and returned to the stock, NOINT would take a value of B (not applicable);<sup>5</sup> if the unit were still uninhabitable, then NOINT would still have the value 16; or, if the damage were so extensive that the owner eventually demolished the unit, NOINT would take a value of 30. Once a unit becomes a Type C noninterview (NOINT=30 or more), it retains the same NOINT value in all future surveys. If a new unit is constructed on the same land, the Census Bureau does not include that unit in the AHS sample. Instead, it is treated as entirely different unit.<sup>6</sup>

For the 2009 metropolitan AHS survey of New Orleans, the Census Bureau added new variables to detect disaster losses and changed the coding of NOINT. Two of the new variables are particularly relevant to the CINCH analysis for New Orleans:

- HKDAMGY1: Was the damage so severe that the home was leveled, condemned, or had to be demolished? 1=YES and 2=NO
- HKDAMGY2: Unit was rebuilt due to Hurricane Katrina damage? 1=YES and 2=NO (HKDAMGY2 is asked only if the answer to HKDAMGY1 is YES.)

Units for which the answer to HKDAMGY1 is YES and the answer to HKDAMGY2 is NO are given NOINT values of 17 (a Type B loss, not classified in any of the Type B categories). In other AHS surveys, these units would have been classified as NOINT=16 (uninhabitable) or NOINT=30 (demolished or destroyed).

Units for which the answer to HKDAMGY2 is YES fall into two classes. The first class consists of those units where the damage is so severe as to have made them uninhabitable, but the units were repaired and placed in service prior to the 2009 survey. In normal CINCH analyses, we would group these in the Figure 1 oval called “units that exist in both years.” Because of the interest in Hurricane Katrina’s impact on the housing stock, it seems appropriate to treat these cases differently.

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<sup>5</sup> This presumes the unit was interviewed. If the Census Bureau could not obtain an interview, then NOINT would take a Type A noninterview value.

<sup>6</sup> The Census Bureau takes a sample of housing permits to add newly constructed units to the AHS survey. It is possible that a unit constructed on the land formerly occupied by a unit with an NOINT value of 30 would be selected by chance for inclusion in the AHS sample to represent newly constructed units. Despite the fact that the unit replaced a unit formerly in the sample, it would be treated as a different unit and given a different control number.

The second class consists of those units where the damage is so severe as to have resulted in the razing of the old unit and the construction of a new unit prior to the 2009 survey. Normally these units would have received a NOINT value of 30 and would have been classified as permanent losses to the stock. In normal CINCH analyses, we would group these in the Figure 1 oval called “losses” and further classify them as permanent losses. However, in this special case, the Census Bureau assigns the same control number to the replacement unit as to the original unit. If we ignored the information in HKDAMGY2, we would have grouped these cases in the Figure 1 oval called “units that exist in both years.” It is clearly not appropriate to do this. They form a special class, units that were destroyed by Hurricane Katrina and rebuilt before the 2009 AHS survey.

We cannot distinguish between these two subclasses of units that have YES responses to HKDAMGY2. Therefore, we will have to treat both groups similarly. These two groups form a set that is a new possibility for CINCH analysis involving New Orleans.

There is a second new possibility. It is possible that units that have YES responses to HKDAMGY2 were not in the 2004 housing stock. A unit may have been constructed or added to the housing stock by other means after the 2004 survey, severely damaged or destroyed by Hurricane Katrina, and subsequently rebuilt. It seems appropriate to treat these units differently from normal new construction or normal other additions to the housing stock.

A third new possibility exists. Units that answer YES to HKDAMGY1 may include units constructed or added to the stock in other ways after 2004. However, these units are not germane to CINCH analysis since they were never part of either the 2004 or 2009 housing stocks. CINCH is concerned only with the status of units in the beginning and end years. The path between the beginning and ending status is normally irrelevant.

In the case of New Orleans, Figure 1 needs to be revised to incorporate the two relevant new possibilities described above. Figure 2 on the following page contains these revisions.

In normal CINCH analysis, losses are further broken down into following five categories:

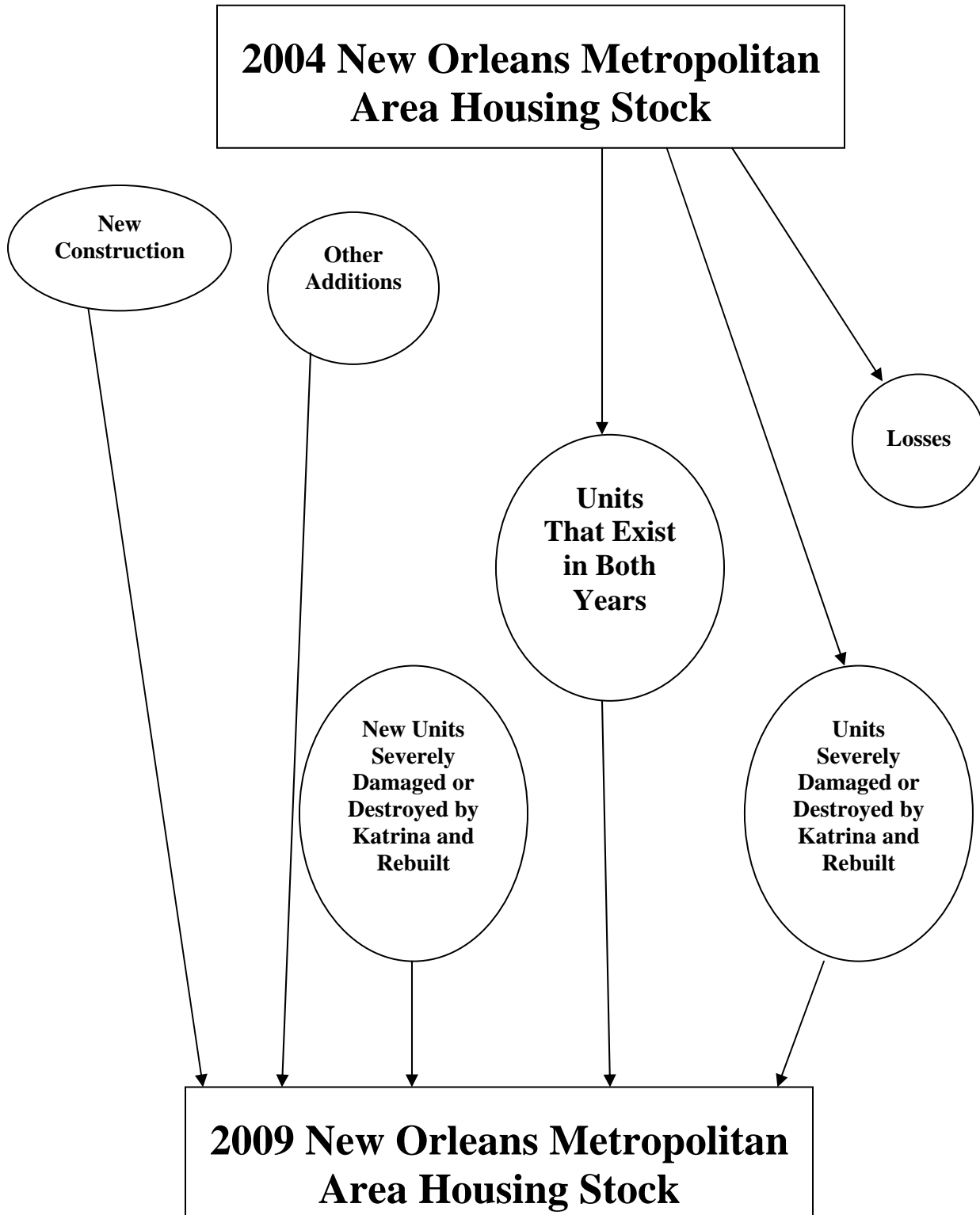
- In the 2004 stock but a loss in 2009 due to house or mobile-home move out.
- In the 2004 stock but a loss in 2009 due to nonresidential use.
- In the 2004 stock but a loss in 2009 due to demolition or disaster.
- In the 2004 stock but a loss in 2009 due to damage or condemnation.
- In the 2004 stock but a loss in 2009 for other reasons.

In the New Orleans case, we will break losses down using one additional category:

- In the 2004 stock but a loss in 2009 due to being severely damaged or destroyed by Hurricane Katrina.
- In the 2004 stock but a loss in 2009 due to house or mobile-home move out.
- In the 2004 stock but a loss in 2009 due to nonresidential use.
- In the 2004 stock but a loss in 2009 due to demolition or disaster, resulting from causes other than Hurricane Katrina.

- In the 2004 stock but a loss in 2009 due to damage or condemnation, resulting from causes other than Hurricane Katrina.
- In the 2004 stock but a loss in 2009 for other reasons.

**Figure 2: The CINCH Framework for New Orleans**





In normal CINCH analysis, additions to the housing stock are further broken down into the following six categories:

- In the 2009 stock but not in the 2004 stock; added by conversion or merger.
- In the 2009 stock but not in the 2004 stock; added by house or mobile home move in.
- In the 2009 stock but not in the 2004 stock; added from nonresidential use.
- In the 2009 stock but not in the 2004 stock; added by new construction.
- In the 2009 stock but not in the 2004 stock; added from temporary losses in the 2004 stock.
- In the 2009 stock but not in the 2004 stock; added for other reasons.

In the New Orleans case, we will break additions to the stock down using one additional category:

- In the 2009 stock but not in the 2004 stock; added before Hurricane Katrina, severely damaged or destroyed by Hurricane Katrina, and rebuilt.
- In the 2009 stock but not in the 2004 stock; added by conversion or merger.
- In the 2009 stock but not in the 2004 stock; added by house or mobile home move in.
- In the 2009 stock but not in the 2004 stock; added from nonresidential use.
- In the 2009 stock but not in the 2004 stock; added by new construction.
- In the 2009 stock but not in the 2004 stock; added from temporary losses in 2004 stock.
- In the 2009 stock but not in the 2004 stock; added for other reasons.

## ***Weighting***

Ideally, analysts would like to solve two simultaneous equations using CINCH analysis:<sup>7</sup>

(1) 2004 housing stock=

units that exist in both years (not severely affected by Hurricane Katrina)+  
2004 units severely damaged or destroyed by Hurricane Katrina and rebuilt+  
2004 units severely damaged or destroyed by Hurricane Katrina+  
other losses

(2) 2009 housing stock=

units that exist in both years (not severely affected by Hurricane Katrina)+  
2004 units severely damaged or destroyed by Hurricane Katrina and rebuilt+  
new construction+  
other additions+  
new (after 2004) units severely damaged or destroyed by Hurricane Katrina and rebuilt

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<sup>7</sup> The equations are “simultaneous” because the term “units that exist in both years not severely affected by Hurricane Katrina)” appears in each equation.

Unfortunately, previous experience with CINCH analysis has shown it is difficult to construct weights that permit satisfactory simultaneous solutions to the equations. For this reason, Econometrica solved the two equations separately in previous CINCH studies.

Solving equation (1) is termed forward-looking analysis because it tracks what happened to the units in the 2004 housing stock. In terms of Figure 2, forward-looking analysis deals with the top rectangle and the three ovals on the right. Solving equation (2) is termed backward-looking analysis because it tracks where units in the 2009 housing stock came from. In terms of Figure 2, backward-looking analysis deals with the bottom rectangle and the four ovals on the left. In analytical terms, backward-looking analysis reverses the arrows at the bottom of Figure 1 by taking the 2009 housing stock as its starting point.

Separating the analysis into forward-looking and backward-looking components results in each observation having two weights: a weight for the forward-looking analysis (FLCINCHWT) and a weight for the backward-looking analysis (BLCINCHWT).

### ***Issues Affecting Rental Dynamics Analyses Involving Metropolitan Areas Surveyed in 2009***

Several issues affect the quality of rental dynamics analyses involving metropolitan areas surveyed in the 2009 AHS. Reconstitution of the manufactured housing sample in 2005 and a reduction in overall sample sizes in 2007 make the estimates less precise than those in previous CINCH and rental dynamics analyses. When Econometrica conducted a CINCH analysis for the metropolitan areas in the 2007 AHS, the paucity of mobile homes that were in both surveys made it impossible in five of the seven metropolitan areas to carry out an adjustment to the weights used in the national CINCH weighting.

#### **Manufactured (Mobile) Homes**

One concern in preparing new algorithms based on the old algorithms is the reconstitution of the manufactured (mobile) home sample in 2005. The Census Bureau added new mobile home units in metropolitan surveys after 2005 and dropped some mobile-home units that had been in previous AHS samples. Approximately half the mobile homes in the pre-2005 samples were dropped in the 2007 and subsequent samples and replaced by different mobile homes. Step 4 in both algorithms was added to correct this problem.

The logic of the mobile home adjustment is as follows. The general algorithms attempt to adjust the pure weight of each sample unit sequentially for: (1) deviations between the aggregate of the pure weights and the published total stock, (2) the loss of sample due to Type A noninterviews, and (3) deviations between the sum of the adjusted pure weights and key published subtotals. The step 4 adjustment occurs as part of stage 1 and changes the pure weights of the mobile-home units from previous samples that were retained in the 2009 sample so that they sum to the published totals of all the mobile-home units (except newly manufactured mobile homes). This means that mobile-home units enter stages 2 and 3 with the correct aggregate count.

We adjusted the weights only for mobile homes built prior to 2000 because the Census Bureau did not drop any units built in 2000 or later. The Census Bureau used the address list for the 2000 census to update the mobile-home sample and therefore could not replace units built in 2000 or later with other units built in 2000 or later.

Step 4 should allow us to obtain reasonable counts of mobile homes in both years. Using the mobile homes available in both the 2004 and the 2009 surveys and sampled mobile homes manufactured after 2000, we will provide estimates of losses and additions to the stock by type of loss and type of addition. In principle, the estimates of losses and additions and the estimates of type of loss and type of addition depend upon the extent to which the retained mobile homes are a representative sample of all mobile homes in both 2004 and 2009. We can correct for the decline in the sample, but not for any biases introduced by dropping and adding mobile homes. In the case of New Orleans, we discovered that none of the mobile homes in the 2004 sample was considered a Type B or Type C loss, a puzzling finding.

## **Sample Sizes**

HUD reduced the size of both the national AHS sample and the metropolitan AHS samples in 2007. The smaller sample sizes in 2009, the reconstitution of the mobile-home sample in metropolitan AHS samples after 2002, and the addition of two additional categories to be estimated (the new two ovals in Figure 2) combine to create problems when applying the weighting algorithms developed for the national sample to the metropolitan samples. For this reason, we simplify the algorithm in steps 11 and 12 in the forward-looking and backward-looking algorithms. As a result, these adjustments result in an incomplete step 4, as described on the preceding page.

## **Use of SAMEDU**

In developing new weighting algorithms for the national 2007 PUF, we incorporated a number of changes that sought to make better use of the information in SAMEDU and that revised the treatment of cases added as sample adjustments (IN09\_REUAD=11).

The national weighting algorithms incorporated SAMEDU in two steps: (1) efforts were made to categorize the reasons why units in 2009 were different from units in 2007 (SAMEDU=2), and (2) once classified, units were incorporated into the analysis in accordance with the classification. Units that were permanent losses in 2007 were dropped, units that differed in 2009 because of probable structural changes were treated both as losses in 2007 and additions in 2009, and units classified as probable interviews of wrong units in 2007 or unclassified were dropped as potentially being interviews of the wrong unit.

The classification system used in the national algorithms involved incorporating data from the 2003 PUF as well as the 2005 and 2007 PUFs. This approach is not practicable for CINCH analysis involving the New Orleans metropolitan 2009 census file. Prior to the 2004 survey of New Orleans, a survey was conducted in 1995 using a different sample. Therefore, the only use of SAMEDU in the New Orleans CINCH analysis is to eliminate all cases where SAMEDU=2

because, for these units, we cannot distinguish (a) major structural changes between the 2004 and the 2009 surveys from (b) situations where the Census Bureau interviewed the wrong unit in 2004.

### ***Forward-Looking: From 2004 to 2009***

The following steps are necessary to prepare the data to analyze what happened between 2004 and 2009 to units that existed in the 2004 housing stock. We give AHS variables their codebook names and present them in capital letters. We refer to the 2004 variables by the prefix IN04\_, and we label 2009 variables as IN09\_. This discussion is not precise in places because the strategy was developed by Econometrica but implemented by the Census Bureau.

1. Merge the 2004 and 2009 Census versions of the NOLA files (not the PUFs), using the flat files.
  - a. Eliminate non-matches. The forward-looking analysis tracks what happened to the units that were in the 2004 stock. It is not interested in newly constructed units or units added through other means, e.g., mobile homes that were moved in, because these were not part of the 2004 stock. The forward-looking analysis cannot use units added to the sample in 2009 for sampling reasons because we do not know their status in 2004.
  - b. Eliminate cases where IN09\_NOINT GE 38. This eliminates losses from sample changes. CINCH should ignore these losses because they are not physical losses and because we cannot say anything useful about what happened to these units. However, do not eliminate cases that are left off the PUF but are still on the Census version of the files, even if they have NOINT values GE 38.
  - c. Eliminate cases where IN09\_SAMEDU=2. This eliminates cases where it is possible that the Census Bureau went to the wrong unit in the 2004.
2. Eliminate all observations that were Type B or Type C losses (10 LE IN04\_NOINT) in 2004. These units were not part of the housing stock in 2004 and therefore are not tracked in the forward-looking analysis.

The following steps involve the use of pure weights (PWT in the PUF). The Census Bureau created two variants of pure weights for New Orleans, BASICWEIGHT and FINBWGT. The final basic weights (FINBWGT) on the Census version of the file reflected the oversample of units in the central city and therefore are smaller than the probability of selection (BASICWEIGHT). If the FINBWGT were used, the estimate of new construction since 2004 would be too small. The mathematical statistician who works on AHS data recommended we use one weight (BASICWEIGHT) when STATUS=20 (units added through the permit frame/new construction) and another weight (FINBWGT) for all other cases. We used the appropriate substitute for PWT in the actual weighting.

3. For all units, let  $MPWT = \max(\text{IN09\_PWT}, \text{IN04\_PWT})$ . (PWT is the pure weight.) In the 2007 metropolitan CINCH analysis, IN07\_PWT was uniformly greater than the previous PWT because of the cases dropped for budgetary reasons. That may not be the case in New Orleans.
  - a. As a check, define:
 
$$\begin{aligned} \text{CHPWT} &= 1 \text{ if } \text{IN09\_PWT} > \text{IN04\_PWT} \\ &= 0 \text{ if } \text{IN09\_PWT} = \text{IN04\_PWT} \\ &= -1 \text{ if } \text{IN09\_PWT} < \text{IN04\_PWT} \end{aligned}$$
4. Adjust the pure weights of manufactured (mobile) homes.
  - a. From the published report, compute a pure weight count of mobile homes built before 2000 ( $\text{IN04\_PUBMHOLD} = 26,100$ ) and in 2000 or later ( $\text{IN04\_PUBMHNEW} = 1,700$ ).
  - b. From the merged file, compute a pure weight count of mobile homes built before 2000 ( $\text{IN04\_MHKEPTOLD}$ ) and in 2000 or later ( $\text{IN04\_MHKEPTNEW}$ ) that are in both surveys by summing  $MPWT$  for cases where  $\text{IN04\_NUNIT2} = 4$  AND  $\text{IN04\_BUILT} \leq 1999$  and  $\text{IN04\_NUNIT2} = 4$  AND  $\text{IN04\_BUILT} > 1999$ , respectively.
  - c. Adjust the pure weights of all manufactured (mobile) homes.
    1. IF  $\text{IN04\_NUNIT2} = 4$  AND  $\text{IN04\_BUILT} > 1999$  THEN  
 $MPWT = MPWT * 1,700 / \text{IN04\_MHKEPTNEW}$  (This ratio may not exist because  $\text{IN04\_MHKEPTNEW}$  might be zero.)
    2. IF  $\text{IN04\_NUNIT2} = 4$  AND  $\text{IN04\_BUILT} \leq 1999$  THEN  
 $MPWT = MPWT * (26,100 / \text{IN04\_MHKEPTOLD})$
5. Obtain from the published report an estimate of the housing stock (BASECOUNT) in 2004.  $\text{BASECOUNT} = 561,000$ 
  - a. Compute  $\text{SOTHMPWT} = \text{sum of } MPWT \text{ after step 4 for } \text{IN04\_NUNIT2} \neq 4$ . This sum is a first estimate of the size of the non-mobile home housing stock based on the units retained for analysis.
  - b. Compute a  $\text{FLCINCHWT}$  where:
    1. IF  $\text{IN04\_NUNIT2} = 4$  THEN  $\text{FLCINCHWT} = MPWT$
    2. IF  $\text{IN04\_NUNIT2} \neq 4$  THEN  $\text{FLCINCHWT} = MPWT * ((\text{BASECOUNT} - \text{IN04\_PUBMHOLD} - \text{IN04\_PUBMHNEW}) / \text{SOTHMPWT})$

Note that  $MPWWT*((BASECOUNT- IN04\_PUBMHOLD- IN04\_PUBMHNEW)/SOTHMPWWT)$  becomes  $MPWWT*((561,000-26,100- 1,700)/SOTHMPWWT)$  when the 2004 published data are substituted, which further reduces to  $MPWWT*533,200/SOTHMPWWT$

This computation completes ratioing the weights up so that they sum to the housing stock in 2004.

6. Identify *sames*, *rebuilt*, *losses*, and *interviewed losses*:
  - a. SAME=1 if IN04\_ISTATUS=1, 2, or 3 AND IN09\_ISTATUS=1, 2, or 3 AND IN09\_HKDAMGY2 NE 1
  - b. REBUILT=1 if IN04\_ISTATUS=1, 2, or 3 AND IN09\_ISTATUS=1, 2, or 3 AND IN09\_HKDAMGY2=1
  - c. LOSS=1 if IN04\_ISTATUS=1, 2, 3, or 4 AND [(10 LE IN09\_NOINT LT 38) OR (IN09\_HKDAMGY1=1 AND IN09\_HKDAMGY2 NE 1)]
  - d. INTLOSS=1 if IN04\_ISTATUS=1, 2, or 3 AND LOSS=1
7. Calculate:
  - a. SSAME=sum of FLCINCHWT for all SAME=1
  - b. SREBUILT=sum of FLCINCHWT for SREBUILT for REBUILT=1
  - c. SHKDAMGY2=sum of FLCINCHWT for IN09\_HKDAMGY2=1 AND IN04\_ISTATUS=1, 2, 3, or 4
  - d. SLOSS=sum of FLCINCHWT for all LOSS=1
  - e. SINTLOSS=sum of FLCINCHWT for INTLOSS=1
8. For CINCH analysis, we need information on the characteristics of units and their occupants in both 2004 and 2009 for all units that were part of the stock in both 2004 and 2009. For units that were part of the stock in only 2004, we need information on the characteristics of the units and their occupants in 2004 only. Up to this point, we retained units that failed to meet these conditions so that we can get good estimates of the number of losses (SLOSS) and of units that were rebuilt (SHKDAMGY2).  
  
Keep for future analysis only those units where SAME=1 OR REBUILT=1 OR INTLOSS=1.

9. Calculate:

- a.  $\text{Ratio1} = (\text{BASECOUNT} - \text{SHKDAMGY2} - \text{SLOSS}) / \text{SSAME}$
- b.  $\text{Ratio2} = \text{SLOSS} / \text{SINTLOSS}$
- c.  $\text{Ratio3} = \text{SHKDAMGY2} / \text{SREBUILT}$

10. Recalculate FLCINCHWT as follows:

- a. For  $\text{SAME} = 1$ ,  $\text{FLCINCHWT} = \text{Ratio1} * \text{FLCINCHWT}$
- b. For  $\text{INTLOSS} = 1$ ,  $\text{FLCINCHWT} = \text{Ratio2} * \text{FLCINCHWT}$
- c. For  $\text{REBUILT} = 1$ ,  $\text{FLCINCHWT} = \text{Ratio3} * \text{FLCINCHWT}$

11. From published reports, obtain estimates from the 2004 counts for all owner-occupied units, all renter-occupied units, all vacant units, and all seasonal units. Calculate new adjustment ratios using the formulas in columns C and D of Table 1:

**Table 1 for Forward-Looking Step 11**

	A	B	C	D
		2004 published	Sum of FLCINCHWT	Ratio Adjustment
1	Housing Stock	561,000		
2	Occupied	498,200		
3	Owner-occupied	323,300	IN04_ISTATUS="1" AND IN04_TENURE=1	D3=B3/C3
4	Renter-occupied	174,900	IN04_ISTATUS="1" AND (2 LE IN04_TENURE LE 3)	D4=B4/C4
5	Vacant	58,900	(IN04_ISTATUS='2' OR IN04_ISTATUS='3') AND NOT(8 LE IN04_VACANCY LE 11)	D5=B5/C5
6	Seasonal	4,000	(IN04_ISTATUS='2' OR IN04_ISTATUS='3') AND (8 LE IN04_VACANCY LE 11)	D6=B6/C6

12. Use the new adjustment ratios to make final adjustment in the FLCINCHWT.

- a. If  $\text{IN04\_ISTATUS} = "1"$  (occupied units) AND  $\text{IN04\_TENURE} = 1$  (owner-occupied units)),  $\text{FLCINCHWT} = \text{D3} * \text{FLCINCHWT}$ .

This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for owner-occupied homes.

- b. If IN04\_ISTATUS="1" (occupied units) AND (2 LE IN04\_TENURE LE 3) (renter-occupied units),  $FLCINCHWT=D4*FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for renter-occupied mobile homes.
- c. If FLCINCHWT in which (IN04\_ISTATUS='2' OR IN04\_ISTATUS='3') AND NOT(8 LE IN04\_VACANCY LE 11) (URE and vacant units),  $FLCINCHWT=D5*FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for vacant homes.
- d. If FLCINCHWT in which (IN04\_ISTATUS='2' OR IN04\_ISTATUS='3') AND (8 LE IN04\_VACANCY LE 11) (Seasonal units),  $FLCINCHWT=D6*FLCINCHWT$ .  
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for seasonal homes.

13. Calculate the sum of FLCINCHWT after final weighting for cases with SAME=1, cases where REBUILT=1, cases with LOSS=1, cases with INTLOSS=1, and for all cases:

**Table 2 for Forward-Looking Step 13**

	New Orleans	
A	SUM SAME=1	482,883
B	SUM REBUILT=1	8,801
	SUM LOSS=1	69,415
C	SUM INTLOSS=1	69,415
	TOTAL A+B+C	561,099
	BASECOUNT	561,000

14. Check on the estimate of mobile homes (IN04\_NUNIT2=4) and single-unit, detached homes (IN04\_NUNIT2=1):

In previous work, a persistent problem was overestimating single-family, detached homes and underestimating manufactured housing. Here we are simply checking to see how well we did this time.

**Table 3 for Forward-Looking Step 14**

Metropolitan Area	Manufactured Housing			Single-Unit Detached		
	Published	Estimated	Percent different	Published	Estimated	Percent different
New Orleans	27,800	33,350	20.0%	349,100	349,100	-0.8%



## ***Backward-Looking: From 2009 to 2004***

The following steps are necessary to prepare the data to analyze where 2009 units came from. We give the AHS variables their codebook names and present them in capital letters. We label 2009 variables as IN09\_, and we refer to variables in 2004 by the prefix IN04\_.

1. Merge the 2004 and 2009 Census files, using the flat files. Keep units that appear in both years and in the 2009 file only.
2. Delete cases where:
  - a. (IN09\_NOINT GE 38) The units may still be part of the housing stock, but the AHS provides no information on them in 2009. They are not part of the sample that is traced backwards. Do not eliminate cases that are left off the PUF but are still on the Census version of the files, even if they have NOINT values GE 38.
  - b. (10 LE IN09\_NOINT LT 38) These are Type B or Type C losses in 2009. These units are not part of the 2009 stock, and therefore we do not track them backwards.
  - c. (IN09\_SAMEDU=2) These are cases where it is possible that the Census Bureau interviewed the wrong unit in 2004.
  - d. (IN09\_REUAD=11) These are cases added as sample adjustments. They are part of the 2009 housing stock, but we know nothing about their status or characteristics in 2004.
  - e. (IN09\_NUNIT2='4' AND IN09\_BUILT LE 1999 AND NOT (IN04\_ISTATUS='1' OR IN04\_ISTATUS='2' OR IN04\_ISTATUS='3' OR IN04\_ISTATUS='4')) These cases are the mobile homes added to the sample after 2004 as part of the improvement of the mobile-home sample. We cannot use them for CINCH analysis because we have no information on their status in 2004. (Note that there may be no additional deletion here if REUAD=11 picks up these cases.)
3. For all units, let  $MPWT = \max(\text{IN09\_PWT}, \text{IN04\_PWT})$ . (PWT is the pure weight.) In the 2007 metropolitan CINCH analysis, IN07\_PWT was uniformly greater than the previous PWT because of the cases dropped for budgetary reasons. That may not be the case here. See note in this step of forward-looking weights about BASICWEIGHT or FINBWGT.
  - a. As a check, define:
$$\begin{aligned} \text{CHPWT} &= 1 \text{ if } \text{IN09\_PWT} \text{ GT } \text{IN04\_PWT} \\ &= 0 \text{ if } \text{IN09\_PWT} = \text{IN04\_PWT} \\ &= -1 \text{ if } \text{IN09\_PWT} \text{ LT } \text{IN04\_PWT} \end{aligned}$$

4. Adjust the pure weights of manufactured (mobile) homes.
  - a. From the published report, compute a pure weight count of mobile homes built before 2000 (IN09\_PUBMHOLD=13,300) and in 2000 or later (IN09\_PUBMHNEW=4,400).
  - b. From the merged file, compute a pure weight count of mobile homes built before 2000 (IN09\_MHKEPTOLD) and in 2000 or later (IN09\_MHKEPTNEW) that are in both surveys by summing MXPWT for cases where IN09\_NUNIT2=4 AND IN09\_BUILT LE 1999 and IN09\_NUNIT2=4 AND IN09\_BUILT GT 1999, respectively. (Of course, either IN09\_MHKEPTOLD or IN09\_MHKEPTNEW could be zero, which would truncate the following step.)
  - c. Adjust the pure weights of all manufactured (mobile) homes.
    1. IF IN09\_NUNIT2=4 AND IN09\_BUILT GT 1999 THEN  
MXPWT=MXPWT\*4,400/IN09\_MHKEPTNEW
    2. IF IN09\_NUNIT2=4 AND IN09\_BUILT LE 1999 THEN  
MXPWT=MXPWT\*(13,300/IN09\_MHKEPTOLD)
5. Obtain from the published report an estimate of the housing stock (CURRENTCOUNT=512,500) in 2009.
  - a. Compute SOTHMXPWT=sum of MXPWT after step 5 for IN09\_NUNIT2 NE 4; this sum is a first estimate of the size of the non mobile home housing stock based on the units retained for analysis.
  - b. Compute a BLCINCHWT where:
    1. IF IN09\_NUNIT2=4 THEN BLCINCHWT=MXPWT
    2. IF IN09\_NUNIT2 NE 4 THEN BLCINCHWT=MXPWT\*  
((CURRENTCOUNT-IN09\_PUBMHOLD-IN09\_PUBMHNEW)  
/SOTHMXPWT)

Note that  $MXPWT*((CURRENTCOUNT-IN09_PUBMHOLD-IN09_PUBMHNEW)/SOTHMXPWT)$  becomes  $MXPWT*((512,500-13,300-4,400)/SOTHMXPWT)$  when the 2009 published data are substituted, which further reduces to  $MXPWT*494,800/SOTHMXPWT$

This computation completes ratioing the weights up so that they sum to the 2009 stock.

6. Identify *sames*, *rebuilt*, *new construction*, *interviewed new construction*, *other adds*, *interviewed other adds*, *reconadd*, and *interview reconadd*.<sup>8</sup>
- a. SAME=1 if IN04\_ISTATUS=1, 2, or 3 AND IN09\_ISTATUS=1, 2, OR 3 AND IN09\_HKDAMGY2 NE 1
  - b. REBUILT=1 if IN04\_ISTATUS=1, 2, or 3 AND IN09\_ISTATUS=1, 2, OR 3 AND IN09\_HKDAMGY2=1
  - c. NC=1 if IN09\_ISTATUS=1, 2, 3, or 4 AND ((IN09\_REUAD=3) OR (10 LE IN04\_NOINT LE 11)) AND IN09\_HKDAMGY2 NE 1
  - d. INTNC=1 IF NC=1 AND IN09\_ISTATUS=1, 2, or 3
  - e. ADD=1 if IN09\_ISTATUS=1, 2, 3, or 4 AND ((4 LE IN09\_REUAD LT 11) OR (12 LE IN04\_NOINT LE 17)) AND IN09\_HKDAMGY2 NE 1
  - f. INTADD=1 if ADD=1 AND IN09\_ISTATUS=1, 2, or 3
  - g. RECONADD=1 if IN09\_ISTATUS=1, 2, 3, or 4 AND ((3 LE IN09\_REUAD LT 11) OR (10 LE IN04\_NOINT LE 17)) AND IN09\_HKDAMGY2=1
  - h. INTRECONADD=1 if RECONADD=1 and IN09\_ISTATUS=1, 2, or 3
7. Calculate:
- a. SSAME=sum of BLCINCHWT for all SAME=1
  - b. SREBUILT=sum of BLCINCHWT for all REBUILT=1
  - c. SHKDAMGY2=sum of BLCINCHWT where IN09\_HKDAMGY2=1 AND IN04\_ISTATUS=1, 2, 3, or 4
  - d. SNC=sum of BLCINCHWT for NC=1
  - e. SINTNC=sum of BLCINCHWT for INTNC=1
  - f. SADD=sum of BLCINCHWT for ADD=1
  - g. SINTADD=sum of BLCINCHWT for INTADD=1
  - h. SRECONADD=sum of BLCINCHWT for RECONADD=1
  - i. SINTRECONADD=sum of BLCINCHWT for INTRECONADD=1

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<sup>8</sup> Other adds are units that were Type B losses in 2004 but are in the 2009 housing stock, plus new housing units that are not new construction, such as the conversion to residential use of a warehouse or mobile-home move ins. A reconstructed add (RECONADD) is a unit added to the stock after 2004, either newly constructed or added in other ways, that was destroyed by Hurricane Katrina and subsequently reconstructed.

8. For CINCH analysis, we need information on the characteristics of units and their occupants in both 2004 and 2009 for all units that were part of the stock in both 2004 and 2009. For units that are part of the stock in only 2009, we need information on the characteristics of the units and their occupants only in 2009. Up to this point, we retained units that failed to meet these conditions so that we can get good estimates of the number of rebuilt units, newly constructed units, other additions, and reconstructed additions (SREBUILT, SNC, SADD, & SRECONADD).

Keep for future analysis only those units where: SAME=1 OR REBUILT=1 OR INTNC=1 OR INTADD=1 OR INTRECONADD=1.

9. Calculate:

- a.  $\text{Ratio1} = (\text{CURRENTCOUNT} - \text{SHKDAMGY2} - (\text{SADD} + \text{SNC} + \text{SRECONADD})) / \text{SSAME}$
- b.  $\text{Ratio2} = \text{SHKDAMGY2} / \text{SREBUILT}$
- c.  $\text{Ratio3} = \text{SNC} / \text{SINTNC}$
- d.  $\text{Ratio4} = \text{SADD} / \text{SINTADD}$
- e.  $\text{Ratio5} = \text{SRECONADD} / \text{SINTRECONADD}$

10. Recalculate BLCINCHWT as follows:

- a. For SAME=1,  $\text{BLCINCHWT} = \text{Ratio1} * \text{BLCINCHWT}$
- b. For REBUILT=1,  $\text{BLCINCHWT} = \text{Ratio2} * \text{BLCINCHWT}$
- c. For INTNC=1,  $\text{BLCINCHWT} = \text{Ratio3} * \text{BLCINCHWT}$
- d. For INTADD=1,  $\text{BLCINCHWT} = \text{Ratio4} * \text{BLCINCHWT}$
- e. For INTRECONADD=1,  $\text{BLCINCHWT} = \text{Ratio5} * \text{BLCINCHWT}$

11. From published reports, obtain estimated 2009 counts for all owner-occupied units, all renter-occupied units, all vacant units, and all seasonal units.

**Table 4 for Backward-Looking Step 13**

	A	B	C	D
		2009	Sum of BLCINCHWT	Ratio Adjustment
1	Total housing stock	512,500		
2	Occupied	436,000		
3	Owner-occupied	290,400	IN09_ISTATUS="1" AND IN09_TENURE=1	D3=B3/C3
4	Renter-occupied	145,700	IN09_ISTATUS="1" AND (2 LE IN09_TENURE LE 3)	D4=B4/C4
5	Vacant	71,700	(IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND NOT(8 LE IN09_VACANCY LE 11)	D5=B5/C5
6	Seasonal	4,700	(IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND (8 LE IN09_VACANCY LE 11)	D6=B6/C6

The algorithm uses the ratios reported above to adjust the weights to match the bottom four rows in Table 4.

12. Use the new adjustment ratios to make final adjustment in the BLCINCHWT.

- a. If IN09\_ISTATUS="1" (occupied units) AND IN09\_TENURE=1 (owner-occupied units),  $BLCINCHWT=D3*BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for owner-occupied homes.
- b. If BLCINCHWT in which IN09\_ISTATUS="1" (occupied units) AND (2 LE IN09\_TENURE LE 3) (renter-occupied units),  $BLCINCHWT=D4*BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for renter-occupied homes.
- c. If BLCINCHWT in which (IN09\_ISTATUS='2' OR IN09\_ISTATUS='3') AND NOT(8 LE IN09\_VACANCY LE 11) (URE and vacant units),  $BLCINCHWT=D5*BLCINCHWT$ .  
This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for vacant homes.

- d. If BLCINCHWT in which (IN09\_ISTATUS='2' OR IN09\_ISTATUS='3') AND (8 LE IN09\_VACANCY LE 11) (Seasonal units),  
 $BLCINCHWT = D6 * BLCINCHWT$ .

This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for seasonal homes.

13. Sum of weights after final adjustment:

**Table 5 for Backward-Looking Step 15**

Metropolitan Area	New Orleans
SAME=1	473,067
REBUILT=1	4,715
INTNC=1	18,566
INTADD=1	13,109
INTRECONADD=1	3,043
ALL	512,500
CURRENT COUNT	512,500

14. Check on the estimate of mobile homes:

**Table 6 for Backward-Looking Step 16**

Metropolitan Area	Manufactured housing			Single-unit detached		
	Estimated	Published	Percent different	Estimated	Published	Percent different
New Orleans	20,609	17,700	16.4%	331,215	334,600	-1.0%