American Housing Survey

Weighting Strategy for 2004–2009 Seattle CINCH Analysis

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Weighting Strategy for 2004–2009 Seattle 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 Seattle metropolitan area between 2004 and 2009.[1]

The CINCH Objective

Figure 1 on the next page illustrates the question that CINCH analysis seeks to answer.

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.

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.[2] 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.

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:

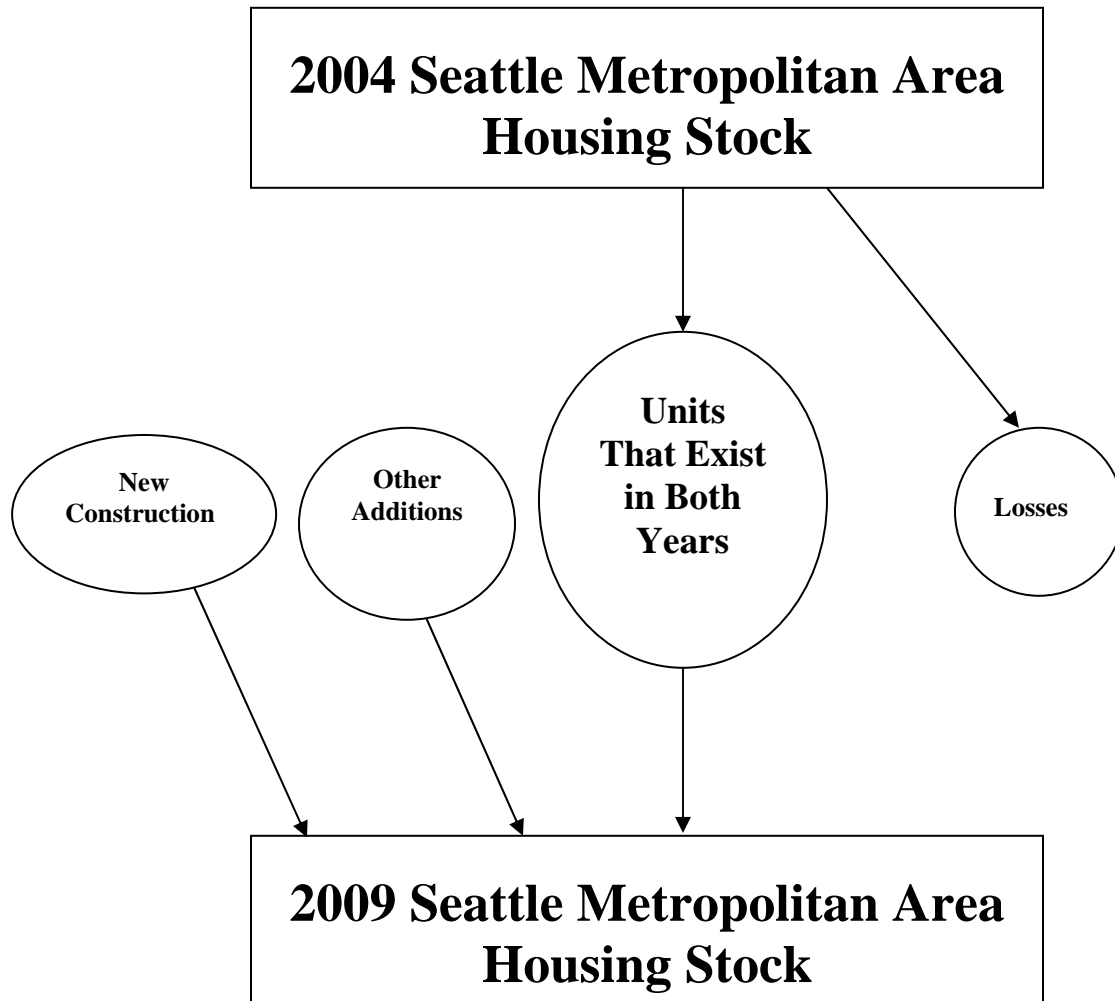- To provide estimates for all six components of Figure 1.
- To disaggregate losses and other additions into relevant component parts.
- To characterize the units that survive from one period to the next and the units that are added or lost between periods.

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[1] See http://www.huduser.org/datasets/cinch.html.
[2] "Potentially reversible" might be a better term than "temporary" for these types of losses.

Figure 1: The CINCH Objective

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┌──────────────────────────────────────────────────┐
│        2004 Seattle Metropolitan Area             │
│                Housing Stock                       │
└──────────────────────────────────────────────────┘

                                 Units
                              That Exist
   New          Other         in Both            Losses
 Construction   Additions       Years

┌──────────────────────────────────────────────────┐
│        2009 Seattle Metropolitan Area             │
│                Housing Stock                       │
└──────────────────────────────────────────────────┘
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The American Housing Survey (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.

Weighting

Ideally, analysts would like to solve two simultaneous equations using CINCH analysis:[3]

(1) 2004 housing stock=units that exist in both years+losses
(2) New construction+other additions+units that exist in both years=2009 housing stock

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 1, forward-looking analysis deals with the top rectangle and the two 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 1, backward-looking analysis deals with the bottom rectangle and the three 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 CINCH and 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. In addition, the CINCH and rental dynamics analysis for Seattle is complicated by the change in the definition of the Seattle metropolitan area between the 2004 and 2009 AHS surveys.

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.

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[3] The equations are "simultaneous" because the term "units that exist in both years" appears in each equation.

Step 4 in both algorithms was added to adjust for weighting problems caused by this change.

The logic of the mobile home adjustment is as follows. The general weighting 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 total for 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. 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.

Sample Sizes

HUD reduced the size of both the national AHS sample and the metropolitan AHS samples in 2007. The 2004 Seattle metropolitan sample contained 4,751 units, and the 2009 sample contained 6,201 units.

The smaller sample sizes in 2009 and the reconstitution of the mobile-home sample in metropolitan AHS samples after 2002 combine to create problems when applying the weighting algorithms developed for the national sample to the metropolitan samples.

Problems in the Forward-Looking Algorithm: Step 4 adjusts the pure weights of mobile homes that were built before 2000 and that appear in both the 2004 and 2009 samples. In the past, this adjustment has been large in some metropolitan areas, ranging up to 9.5 in Boston, where the 3 mobile homes retained in the 2007 sample were forced to carry the weight of 42 mobile homes in the 2004 sample. In Seattle, there were 28 sample mobile homes in the forward-looking analysis, representing 66,000 mobile homes, and 32 sample mobile homes in the backward-looking analysis, representing 53,000 mobile homes.

Problems for Both Algorithms: The national algorithms force the weights counts to equal eight published totals: owner-occupied units, renter-occupied units, vacant units, and seasonal units distinguished by manufactured housing (mobile homes) and all other structure types. For the

seven metropolitan areas surveyed in 2007, there are empty cells when the samples are divided in this way. The same problem required a revision of steps 11 and 12 in both algorithms. Unlike the national analysis, only the counts of owner-occupied and renter-occupied units are split by mobile homes and other types of units. Vacant and seasonal counts are not.

Changes in the Boundaries of the Seattle Statistical Area

In 2004, the AHS survey for Seattle covered three counties–King, Island, and Snohomish–and this area was called the Seattle-Everett metropolitan area. In 2009, the Census Bureau added Pierce County, which includes Tacoma, and changed the name of the area to the Seattle-Everett-Tacoma metropolitan area. Table 1 compares the areas surveyed in 2004 and 2009 using Census Bureau data and estimates.

Table 1: Coverage of the Seattle AHS in 2004 and 2009

AHS Seattle	Population	Housing units	Land area in square miles*
2004 (King, Island, Snohomish counties)	2,501,693	1,075,179	4,424
2009 (King, Island, Snohomish, Pierce counties)	3,488,902	1,481,505	6,102
Percent change	39.5%	37.8%	38.0%

* Omits area covered by water.

The impact of the budget reductions on the Seattle survey was magnified by the change in geography. The budget reduction decreased the total number of sample units available for Seattle. The change in geography meant that additional units had to be dropped from the 2004 survey in order to allow for additional units to represent Pierce County. Since 23 percent of the housing units in the four-county area are located in Pierce County, roughly 23 percent of the 2009 sample had to be new units from Pierce County.

Table 2 portrays the combined effects of the budget reductions and change in geography. The left panel traces out how the AHS sample changed, while the right panel shows the size and composition of the samples used for the CINCH analysis. The CINCH samples are smaller than the samples left in the AHS files because of various adjustments that filter out units prior to the CINCH analysis. The most binding constraint is the requirement that a unit can be used in the CINCH analysis only if it was interviewed in the year or years in which it was in the housing stock.[4]

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[4] CINCH analysis focuses on specific characteristics of units, such as owner-occupied vs. renter-occupied or having a Hispanic householder, and most of these characteristics are available only for units that were interviewed.

Table 2: AHS Sample Counts and Sample Available for CINCH Analysis

AHS sample counts		CINCH counts–after CINCH filters	
2004 sample	4,731	Sample units in both surveys	1,292
Dropped from 2009 PUF	2,879	In 2004 but lost	11
Left for CINCH analysis	1,852	Added after 2004	200
Not in housing stock either year[5]	182	Available for forward-looking analysis (1,292+11)	1,303
Left for forward-looking analysis (1,852–182)	1,670	Available for backward-looking analysis (1,292+200)	1,492
Legitimate additions to sample (not Pierce County sample units)	225		
Left for backward-looking analysis (1,852–182+225)	1,895		

The samples used in the CINCH analysis for Seattle are small, 1,303 cases in the forward-looking analysis and 1,492 cases in the backward-looking analysis. In particular, the analysis of losses is based on only 11 sample units.

Use of SAMEDU

In developing new weighting algorithms for the national 2007 Public Use File (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 (10 LE IN09_REUAD LE 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 2004 (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 2005 and additions in 2009, and units classified as probable interviews of wrong units in 2005 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 Seattle metropolitan 2009 census file. Prior to the 2004 survey of Seattle, a survey was conducted in 1995 using a different sample. Therefore, the only use of SAMEDU in the Seattle 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 2009 surveys from (b) situations where the Census Bureau interviewed the wrong unit in the 2004.

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[5] These are sample units that carried over from early surveys that were not in the stock in either 2004 or 2009 because they were either temporarily losses, e.g., used for residential purposes, or permanent losses, e.g., destroyed by fire or natural disaster.

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 the 2009 variables as IN09_.

1. Merge the 2004 and 2009 census files, 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 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.

    c. Eliminate cases where IN09_SAMEDU=2. This eliminates cases where it is possible that the Census Bureau went to the wrong unit in 2004.

2. Eliminate all observations that were Type B or Type C losses (10 LE IN04_NOINT LT 38) in 2004. These units were not part of the housing stock in 2004 and therefore are not tracked in the forward-looking analysis.

3. For all units, let MXPWT=max (IN09_PWT, 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.

    a. As a check, define:
        CHPWT=1 if IN09_PWT GT IN04_PWT
            =0 if IN09_PWT=IN04_PWT
            =-1 if IN09_PWT LT IN04_PWT

4. Adjust the pure weights of manufactured (mobile) homes.

    a. From <u>the published report</u>, compute a pure weight count of mobile homes built before 2000 (IN04_PUBMHOLD=66,000) and in 2000 or later (IN04_PUBMHNEW=900).

    b. From the <u>merged file</u>, compute a pure weight count of mobile homes built before 2000 (IN04_MHKEPTOLD) and in 2000 or later (IN04_MHKEPTNEW) that are in both surveys by summing MXPWT for cases where IN04_NUNIT2=4 AND

IN04_BUILT LE 1999 and IN04_NUNIT2=4 AND IN04_BUILT GT 1999, respectively.

   c. Adjust the pure weights of all manufactured (mobile) homes.

      1. IF IN04_NUNIT2=4 AND IN04_BUILT GT 1999 THEN MXPWT=MXPWT*900/IN04_MHKEPTNEW

      2. IF IN04_NUNIT2=4 AND IN04_BUILT LE 1999 THEN MXPWT=MXPWT*(66000/IN04_MHKEPTOLD)

5. Obtain from the published report an estimate of the housing stock (BASECOUNT) in 2004. BASECOUNT=1,075,600

   a. Compute SOTHMXPWT=sum of MXPWT after step 4 for IN04_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 FLCINCHWT where

      1. IF IN04_NUNIT2=4 THEN FLCINCHWT=MXPWT

      2. IF IN04_NUNIT2 NE 4 THEN FLCINCHWT=MXPWT*((BASECOUNT –IN04_PUBMHOLD–IN04_PUBMHNEW)/SOTHMXPWT)

      Note that MXPWT*((BASECOUNT–IN04_PUBMHOLD –IN04_PUBMHNEW)/SOTHMXPWT) becomes MXPWT*((1,075,600–900 –66,000)/SOTHMXPWT) when the 2004 published data are substituted, which further reduces to MXPWT*1,008,700/SOTHMXPWT.

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

6. Identify *sames*, *losses*, and *interviewed losses*:

   a. SAME=1 if IN04_ISTATUS=1, 2, or 3 AND IN09_ISTATUS=1, 2, or 3.

   b. LOSS=1 if IN04_ISTATUS=1, 2, 3, or 4 AND (10 LE IN09_NOINT LT 38)

   c. INTLOSS=1 if IN04_ISTATUS=1, 2, or 3 AND LOSS=1

7. Calculate:

SSAME=sum of FLCINCHWT for all SAME=1

SLOSS=sum of FLCINCHWT for all LOSS=1

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 2004 only, 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).

Keep for future analysis only those units where SAME =1 OR INTLOSS=1.

9. Calculate:

a. Ratio1=(BASECOUNT–SLOSS)/SSAME

b. Ratio2=SLOSS/SINTLOSS

10. Recalculate FLCINCHWT as follows:

a. For SAME=1, FLCINCHWT=Ratio1*FLCINCHWT

b. For INTLOSS=1, FLCINCHWT=Ratio2*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, distinguishing between mobile homes and all other structure types (non-mobile homes) for owner-occupied and renter-occupied units. Calculate new adjustment ratios using the formulas in columns C and D of Table 3:

Table 3 for Forward-Looking Step 11

	A	B	C	D
		2004 published	**Sum of FLCINCHWT**	**Ratio Adjustment**
1	Housing Stock	1,075,600		
2	Occupied	991,900		
3	Owner-occupied (mobile homes)	55,700	IN04_ISTATUS="1" AND IN04_TENURE=1 AND IN04_NUNIT2=4	D3=B3/C3
4	Owner-occupied (other)	605,400	IN04_ISTATUS="1" AND IN04_TENURE=1 AND IN04_NUNIT2 NE 4	D4=B4/C4
5	Renter (mobile homes)	7,000	IN04_ISTATUS="1" AND (2 LE IN04_TENURE LE 3) AND IN04_NUNIT2=4	D5=B5/C5
6	Renter (other)	323,800	IN04_ISTATUS="1" AND (2 LE IN04_TENURE LE 3) AND IN04_NUNIT2 NE4	D6=B6/C6
7	Vacant	78,200	(IN04_ISTATUS='2' OR IN04_ISTATUS='3') AND NOT(8 LE IN04_VACANCY LE 11)	D7=B7/C7
8	Seasonal	5,600	(IN04_ISTATUS='2' OR IN04_ISTATUS='3') AND (8 LE IN04_VACANCY LE 11)	D8=B8/C8

If any of C1 through C10 is zero, then we will have to switch to another method.

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

   a. If IN04_ISTATUS="1" (occupied units) AND IN04_TENURE=1 (owner-occupied units) AND IN04_NUNIT2=4 (mobile homes), FLCINCHWT=D3*FLCINCHWT. This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for owner-occupied mobile homes.

   b. If IN04_ISTATUS="1" (occupied units) AND IN04_TENURE=1 (owner-occupied units) AND IN04_NUNIT2 NE 4 (non-mobile home), FLCINCHWT=D4*FLCINCHWT. This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for owner-occupied non-mobile homes.

c. If IN04_ISTATUS="1" (occupied units) AND (2 LE IN04_TENURE LE 3) (renter-occupied units) AND IN04_NUNIT2=4 (mobile homes), FLCINCHWT=D5*FLCINCHWT.
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for renter-occupied mobile homes.

d. If FLCINCHWT in which IN04_ISTATUS="1" (occupied units) AND (2 LE IN04_TENURE LE 3) (renter-occupied units) AND IN04_NUNIT2 NE 4 (non-mobile homes), FLCINCHWT=D6*FLCINCHWT.
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for renter-occupied non-mobile homes.

e. If FLCINCHWT in which (IN04_ISTATUS='2' OR IN04_ISTATUS='3') AND NOT (8 LE IN04_VACANCY LE 11) (URE and vacant units), FLCINCHWT=D7*FLCINCHWT.
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for vacant units.

f. If FLCINCHWT in which (IN04_ISTATUS='2' OR IN04_ISTATUS='3') AND (8 LE IN04_VACANCY LE 11) (seasonal units), FLCINCHWT=D8*FLCINCHWT.
This step ratio adjusts the FLCINCHWT for these observations so that they sum to the published total for seasonal units.

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

Table 4 for Forward-Looking Step 13

Metropolitan Area	SAME=1 SUM	INTLOSS=1 SUM	All cases SUM	BASECOUNT
Seattle	1,067,214	8,486	1,075,700	1,075,600

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. Step 11 was expanded to correct this problem. Here we are simply checking to see how well it was done.

Table 5 for Forward-Looking Step 14

Metropolitan Area	Manufactured Housing			Single-Unit Detached		
	Published	Estimated	Percent different	Published	Estimated	Percent different
Seattle	66,900	62,700	-6.3%	619,000	624,674	0.9%

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 the 2004 sample 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.

   b. (10 LE IN09_NOINT LT 38) 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. (10 LE IN09_REUAD LE 11) These are cases added as sample adjustments.[6] 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={10,11} picks up these cases.)

3. For all units, let MXPWT=max (IN09_PWT, 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.

   a. As a check, define:
      CHPWT=1 if IN09_PWT GT IN04_PWT
           =0 if IN09_PWT=IN04_PWT
           =-1 if IN09_PWT LT IN04_PWT

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[6] In an April 28, 2011, email, Mousumi Sarkar clarified that most of the REUAD=10 cases were units added in response to an expansion in the geography for the Seattle AHS area: "140 of the 148 that were coded as 10 are in the new County (Pierce). Unfortunately, on the PUF there is no way to distinguish between the sample introduced because of the geography adjustment versus 'real' Others."

4. Adjust the pure weights of manufactured (mobile) homes.

   a. From <u>the published report</u>, compute a pure weight count of mobile homes built before 2000 (IN09_PUBMHOLD=50,600) and in 2000 or later (IN09_PUBMHNEW=2400).

   b. From <u>the merged file</u>, 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.

   c. Adjust the pure weights of all manufactured (mobile) homes.

      1. IF IN09_NUNIT2=4 AND IN09_BUILT GT 1999 THEN MXPWT=MXPWT*2400/IN09_MHKEPTNEW

      2. IF IN09_NUNIT2=4 AND IN09_BUILT LE 1999 THEN MXPWT=MXPWT*(50600/IN09_MHKEPTOLD)

5. Obtain from the published report an estimate of the housing stock (CURRENTCOUNT=1,457,800) in 2009.

   a. Compute SOTHMXPWT=sum of MXPWT after step 4 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*((1,457,800–50,600 –2,400)/SOTHMXPWT) when the 2009 published data are substituted, which further reduces to MXPWT*1,404,800/SOTHMXPWT.

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

6. Identify *sames*, *new construction, interviewed new construction*, *other adds*, and *interviewed other adds:*[7]

   a. SAME=1 if IN04_ISTATUS=1, 2, or 3 AND IN09_ISTATUS=1, 2, OR 3

   b. NC=1 if IN09_ISTATUS=1, 2, 3, or 4 AND ((IN09_REUAD=3) OR (10 LE IN04_NOINT LE 11))

   c. INTNC=1 IF NC=1 AND IN09_ISTATUS=1, 2, or 3

   d. ADD=1 if IN09_ISTATUS=1, 2, 3, or 4 AND ((4 LE IN09_REUAD LT 10) OR (12 LE IN04_NOINT LE 17))

   e. INTADD=1 if ADD =1 AND IN09_ISTATUS=1, 2, OR 3

7. Calculate: (Here is another place where we could run into problems, namely SNCMH or SINTNCMH equal to zero.)

   SSAME=sum of BLCINCHWT for all SAME=1

   SNC=sum of BLCINCHWT for NC=1

   SNCMH=sum of BLCINCHWT for NC=1 AND IN09_NUNIT2=4

   SNCOTH=sum of BLCINCHWT for NC=1 AND IN09_NUNIT2 NE 4

   SINTNC=sum of BLCINCHWT for INTNC=1

   SINTNCMH=sum of BLCINCHWT for INTNC=1 AND IN09_NUNIT2=4

   SINTNCOTH=sum of BLCINCHWT for INTNC=1 AND IN09_NUNIT2 NE 4

   SADD=sum of BLCINCHWT for ADD=1

   SINTADD=sum of BLCINCHWT for INTADD=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 are part of the stock in 2009 only, we need information on the characteristics of the units and their occupants in 2009 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 newly constructed units and other additions (SNC+SADD).

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

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[7] Other adds are units that were Type B losses in 2004 but were in the 2009 housing stock, plus new housing units that were not new construction, such as the conversion to residential use of a warehouse or mobile home move-ins.

9. Calculate: (Here we assume SINTNCMH is not equal to zero.)

   a. Ratio1=(CURRENTCOUNT–(SADD+SNC))/SSAME

   b. Ratio2=SNCMH/SINTNCMH

   c. Ratio3=SNCOTH/SINTNCOTH

   d. Ratio4=SADD/SINTADD

10. Recalculate BLCINCHWT as follows:

   a. For SAME=1, BLCINCHWT=Ratio1*BLCINCHWT

   b. For INTNC=1 AND IN09_NUNIT2=4, BLCINCHWT=Ratio2*BLCINCHWT

   c. For INTNC= 1 AND IN09_NUNIT2 NE 4, BLCINCHWT=Ratio3*BLCINCHWT

   d. For INTADD=1, BLCINCHWT=Ratio4*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, distinguishing between mobile homes and all other units for owner-occupied and renter-occupied units.

Table 6 for Backward-Looking Step 11

	A	B	C	D
		2009	**Sum of BLCINCHWT**	**Ratio Adjustment**
1	Housing Stock	1,457,800		
2	Occupied	1,331,700		
3	Owner-occupied (mobile homes)	43,200	IN09_ISTATUS="1" AND IN09_TENURE=1 AND IN09_NUNIT2=4	D3=B3/C3
4	Owner-occupied (other)	799,000	IN09_ISTATUS="1" AND IN09_TENURE=1 AND IN09_NUNIT2 NE 4	D4=B4/C4
5	Renter (mobile homes)	6,700	IN09_ISTATUS="1" AND (2 LE IN09_TENURE LE 3) AND IN09_NUNIT2=4	D5=B5/C5
6	Renter (other)	482,800	IN09_ISTATUS="1" AND (2 LE IN09_TENURE LE 3) AND IN09_NUNIT2 NE4	D6=B6/C6
7	Vacant (mobile homes)	3,100	(IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND NOT(8 LE IN09_VACANCY LE 11) AND IN09_NUNIT2=4	D7=B7/C7
8	Vacant (other)	118,500	(IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND NOT(8 LE IN09_VACANCY LE 11) AND IN09_NUNIT2 NE 4 ∑=	D8=B8/C8
9	Seasonal	4,500	(IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND (8 LE IN09_VACANCY LE 11) AND IN09_NUNIT2=4	D9=B9/C9

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

a. If IN09_ISTATUS="1" (occupied units) AND IN09_TENURE=1 (owner-occupied units) AND IN09_NUNIT2=4 (mobile homes), BLCINCHWT=D3*BLCINCHWT. This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for owner-occupied mobile homes.

b. If IN09_ISTATUS="1" (occupied units) AND IN09_TENURE=1 (owner-occupied units) AND IN09_NUNIT2 NE 4 (non-mobile home), BLCINCHWT=D4*BLCINCHWT. This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for owner-occupied non-mobile homes.

c. If IN09_ISTATUS="1" (occupied units) AND (2 LE IN09_TENURE LE 3) (renter-occupied units) AND IN09_NUNIT2=4 (mobile homes), BLCINCHWT=D5*BLCINCHWT. This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for renter-occupied mobile homes.

d. If BLCINCHWT in which IN09_ISTATUS="1" (occupied units) AND (2 LE IN09_TENURE LE 3) (renter-occupied units) AND IN09_NUNIT2 NE 4 (non-mobile homes), BLCINCHWT=D6*BLCINCHWT. This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for renter-occupied, non-mobile homes.

e. If BLCINCHWT in which (IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND NOT(8 LE IN09_VACANCY LE 11) (URE and vacant units) AND IN09_NUNIT2=4 (mobile homes), BLCINCHWT=D7*BLCINCHWT. This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for vacant mobile homes.

f. If BLCINCHWT in which (IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND NOT (8 LE IN09_VACANCY LE 11) (URE and vacant units) AND IN09_NUNIT2 NE 4 (non-mobile homes), BLCINCHWT=D8*BLCINCHWT. This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for vacant, non-mobile homes.

g. If BLCINCHWT in which (IN09_ISTATUS='2' OR IN09_ISTATUS='3') AND (8 LE IN09_VACANCY LE 11) (seasonal units), BLCINCHWT=D9*BLCINCHWT. This step ratio adjusts the BLCINCHWT for these observations so that they sum to the published total for seasonal units.

13. Sum of weights after final adjustment:

Table 7 for Backward-Looking Step 13

Metropolitan Area	Seattle
SAME=1	1,311,571
INTADD=1	14,201
INTNC=1	132,029
ALL	1,457,800
CURRENT COUNT	1,457,800

14. Check on the estimate of mobile homes:

Table 8 for Backward-Looking Step 14

Metropolitan Area	Manufactured housing			Single-unit detached		
	Estimated	Published	Percent different	Estimated	Published	Percent different
Seattle	53,000	53,000	0.0%	882,200	868,853	-1.5%