



AMERICAN
HOUSING
SURVEY

Between-Survey Changes in the Number of Bedrooms in a Unit: How Often? Why? Effect on Measures of Rental Affordability?



American Housing Survey

Between-Survey Changes in the Number of Bedrooms in a Unit: How Often? Why? Effect on Measures of Rental Affordability?

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Executive Summary

This paper examines the extent to which bedroom counts for units in the American Housing Survey (AHS) change between surveys and how this variation affects the analysis of rental affordability.

For the 43,000 units in both the 2009 and 2011 AHS surveys, 18 percent had a different number of bedrooms, as reported by respondents, in the two surveys (Table 2). This level of survey-to-survey change is consistent with that found in previous research.

This paper examines three possible explanations of why bedroom counts change. First, structural alteration can result in more or fewer bedrooms. In this case, any change in bedroom counts is real and has no adverse effect on the measurement of rental affordability. Of the approximately 12,000 units that were rented in both surveys, only 13 underwent modifications to add a bedroom, and only an additional 18 underwent modifications to add a room other than a bedroom (Table 4). Of the 1,889 units that had a different reported number of bedrooms, only 12 had structural changes involving the addition of a room of any type. Also, no relationship appears to exist between modifications that could add a bedroom and the change in the count of bedrooms. Of the 31 units that added a room, 19 reported no change in the number of bedrooms and 3 reported a decline in the number of bedrooms. Structural modifications do not explain the observed variation in bedroom counts.

Second, households might use rooms differently from their intended use. For example, a large household might use a study as a bedroom. Such behavior muddies the sense of where a unit fits in the affordability spectrum, but (arguably), for units configured to allow for rooms to shift between bedroom and other room use, the affordability determination should depend on how the occupants choose to use the unit.

Because the AHS has no objective classification of rooms as bedrooms or other rooms, this paper looks at one unit characteristic—the number of *reported* other rooms in 2009—and two household characteristics—whether the 2011 household is a new household and whether the number of persons in the household changed between 2009 and 2011—to find evidence of households using other rooms as bedrooms. All three characteristics are related to the changes in bedroom counts in ways consistent with rational behavior; that is, using rooms in the most needed way. The observed patterns were weak, however. Table 7 indicates a positive relationship between changes in the number of persons in a household and changes in the reported number of bedrooms. This relationship displayed a statistically significant but low correlation of 0.14.

Third, households might simply answer the bedroom count question incorrectly or inconsistently. If changes in bedroom counts are attributable to survey errors, then our ability to classify rental units as affordable or unaffordable is compromised. To examine this possibility, the paper compares changes in the number of bedrooms and changes in the number of total rooms. If a change in bedroom count results from converting an extra room to a bedroom, we would expect to see a corresponding decrease in the number of extra rooms but no change in the number of total rooms. Table 8 reveals that only 21 percent of the rental units that had different bedroom counts had no change in the count of all rooms. Three-fourths of the change in bedroom counts

was accompanied by a same-direction change in room counts; this finding certainly introduces doubts about the validity of the bedroom counts. The correlation between change in bedroom count and change in the count of all rooms is 0.60.

The paper concludes that survey error is probably the most important explanation of survey-to-survey variation in bedroom counts.

The U.S. Department of Housing and Urban Development (HUD) advises Congress periodically on the affordability of rental housing in reports that have come to be known as *Worst Case Housing Needs* reports. HUD's measure of worst case needs does not take into account the number of bedrooms; that is, whether a household is overhoused or underhoused. The observed variation in bedroom counts, therefore, does not affect HUD's estimates of worst case housing needs. In recent *Worst Case Housing Needs* reports, however, HUD included an analysis of whether the number of affordable rental units is sufficient to house all very low-income renters. This analysis does take into account the number of bedrooms in a rental unit. In addition, HUD produces biennial reports on rental dynamics that examine the survey-to-survey movement of rental units into and out of various affordability categories that depend on the number of bedrooms in a unit.

This paper reproduces the rental dynamics results for 2009–2011 (Eggers and Moumen, forthcoming), assuming no change between surveys in bedroom counts. More than 90 percent of the market-rate rental units in the sample retained the same affordability classification when the bedroom counts from the 2009 survey were used to determine affordability in both 2009 and 2011 (Table 9).

The formal analysis in the rental dynamics reports uses weighted counts of units by affordability class. As noted, 90 percent of the sample units remained in the same class when bedroom counts were held constant from 2009 to 2011. With respect to the 10 percent of the sample units that changed affordability class, some sample units became more affordable in 2011, and some become less affordable. The combined effect of stability within class and offsetting flows across classes minimizes any effect that the variation in bedroom counts might have on the measures used in the rental dynamics analysis.

In fact, the notable survey-to-survey variation in the number of bedrooms has a negligible and statistically insignificant effect on the survey-to-survey movement of units among affordability classes (Table B-2). Variation in bedroom counts across surveys probably has a more detrimental effect on analyses that attempt to track a unit's affordability for a longer period, however.

Looking beyond the study of rental affordability, a more serious concern is that researchers have consistently used bedroom counts to classify units by size for all types of housing research and policy analysis. The usefulness of this measure is certainly undermined by year-to-year changes in bedroom counts that appear to be mainly errors.

We recommend that, as part of the redesign of the AHS accompanying the drawing of a new sample in 2015, the Census Bureau develop a set of questions designed to obtain an accurate count of bedrooms and, beginning with the 2017 AHS, incorporate flags and followup questions

to identify cases in which the number of bedrooms differs from the number in the previous survey. Because of the close relationship between the questions on the number of rooms and on the number of bedrooms, we recommend that the Census Bureau take similar steps to ensure that both questions are answered correctly.

In testing alternative questions, the Census Bureau should conduct site visits afterwards to obtain an objective count of bedrooms and rooms to verify the answers given on test questions. In addition, we recommend that HUD analysts examine how to classify, for affordability purposes, units with other rooms that reasonably can be converted into bedrooms as needed. Arguably, a one-bedroom apartment with a study that can be used as another bedroom is not the same as a one-bedroom apartment without an extra room. Studies of affordability should be conscious of the differences among these units.

1. Background

The American Housing Survey (AHS) has the unique feature of interviewing the same housing units in successive surveys. This feature enables researchers to track how the characteristics of a housing unit and its occupants change over time. One important application of the longitudinality of the AHS has been the study of the affordability of rental housing units.

For a long time, housing analysts and policymakers have shown interest in questions such as: What proportion of the rental housing stock is affordable to lower income households? Where do affordable rental units come from? What causes affordable rental units to be lost? The U.S. Department of Housing and Urban Development (HUD) added an analysis of whether the number of affordable rental units is sufficient to its annual reports to Congress on worst case housing needs. HUD has regularly commissioned studies of rental dynamics that use successive AHS surveys to track changes in the affordability of the rental stock. Taking full advantage of the longitudinality of the AHS, the MacArthur Foundation commissioned a study of the creation and loss of affordable rental stock from 1985 to 2011.

Affordability describes whether a unit's rent and associated utility costs allow for lower income households to rent the unit or preclude them from doing so. Whether a unit is affordable, however, depends not only on its rent but also on the size of the unit: a \$1,000-per-month three-bedroom unit might be considered affordable, whereas a \$1,000-per-month one-bedroom unit might be considered unaffordable. This paper looks at how frequently the bedroom counts in housing units change between AHS surveys and how that variation affects affordability analysis. The remainder of this paper is organized as follows.

- Section 2 shows that respondents reported a different number of bedrooms in the 2009 and the 2011 AHS surveys for 18 percent of all AHS sample units and that small and large units had the least consistent reporting.
- Section 3 attempts to explain why respondents report different bedroom counts in successive surveys. Although household size appears to affect how respondents report the number of bedrooms, respondent error appears to be the most important explanation of differences in bedroom counts.
- Section 4 uses a study of rental dynamics that the authors conducted for HUD (Eggers and Moumen, forthcoming) to show that this level of inconsistency in bedroom counts had an only minimal effect on the description of how rental affordability changed from 2009 to 2011.
- Section 5 presents our recommendations. We conclude that HUD and the Census Bureau should attempt to reduce survey-to-survey variation in the reported number of bedrooms.
- Appendix A contains Table A-1, a fuller version of Table 5, in Section 3.
- Appendix B repeats the weighted forward-looking analysis from the 2009–2011 report on rental dynamics (Eggers and Moumen, forthcoming) to show how the use of 2009 bedroom counts for both years would have changed the analysis.

2. Between-Survey Differences in Bedroom Counts

2.1. What Is a Bedroom?

From the perspective of a household, a bedroom is any room in which a member of the household sleeps or in which guests could sleep. The following stories illustrate the potential for other perspectives, however.

One of the authors and his wife refurbished the upstairs of a two-story, barn-like building, constructed in 1940, which had housed the original owners of the property before they built a separate single-family detached house in 1950. The original 1940 home had spring-fed water and a nearby outhouse. After 1950, the first floor of this structure was converted to a garage, and the second floor was used for storage. In 2004, the author completely remodeled the second floor and added a bathroom. The local building code required the construction of a deck with a separate outside staircase so that any occupants of the room would have two ways to get out of the second floor. The local health official was sympathetic to the author's desire to use the second floor as a place where visiting children could stay occasionally. She advised him not to add a closet because the local health code would then consider the room a bedroom, and his septic system was not verified to accommodate this additional bedroom.

Although building codes vary from state to state, many states follow, at a minimum, the provisions of the International Residential Code, which requires a bedroom to have two means of egress. This code translates into the need for a window, but a second door leading directly to the outside would also satisfy this requirement (Hardy, n.d.). For real estate agents to ethically describe a room as a bedroom, the National Association of REALTORS[®] (NAR) requires the room to have “a door that can be closed, a window, and a closet” (Hardy, n.d.). The author’s “studio” would meet the building code requirements for a bedroom but neither the health code nor the NAR requirements.

Earlier in his life, the same author rented an apartment advertised as a one-bedroom with den. When their first child arrived, the author and his wife used the den as the infant's bedroom. This room lacked both a door that could be closed and a closet, but it was large enough for an adult to sleep in. The same apartment contained a breakfast room separate from both the kitchen and the dining room. Although it would certainly have violated the lease, the den could have housed a third adult or older child, and the infant could have used the breakfast room.

These two stories demonstrate that rooms designed for one purpose can be used for another purpose. Single-family homes often contain rooms that might not meet the building code or the NAR requirements for a bedroom but are used as bedrooms. These rooms include dens, basement family rooms, and sitting rooms adjacent to the master bedroom. Although the opportunities for deviations between intended and actual use are not as frequent for units in multiunit structures, the second story shows that this option exists for these units as well.

Appendix B in the 2009 AHS national publication provides this explanation of what is considered a bedroom in the AHS.

Bedrooms. The number of bedrooms in a housing unit includes those rooms that are used mainly for sleeping or designed to be a bedroom, even if used for other purposes. A room reserved only for sleeping, such as a guest room, even if used infrequently, is considered a bedroom. A room built as a bedroom, although not used for that purpose, such as a room meant to be a bedroom but used as a sewing room, is counted as a bedroom. On the other hand, a room designed and used mainly for other purposes, such as a den with a sleep sofa used mainly for watching television, is not considered a bedroom. A housing unit consisting of only one room, such as a one-room efficiency apartment, is classified by definition as having no bedroom. (Census Bureau, 2011: B-2)

Although the AHS definition distinguishes between “designed” and “used,” the questions asked of respondents do not make this distinction. The phone interviewer from the Census Bureau asks the respondent—

The next few questions are about the number and kinds of rooms in ^your_that ^HTYPEFILL.

BEDRMS

? [F1]

^thinking_how many bedrooms are there ^in_that_your ^HTYPEFILL?¹

“^your_that ^HTYPEFILL” should be read this way: the interview chooses between “your” and “that” and HTYPEFILL is the type of structure (mobile home, house, or apartment) that is taken from the answer to a previous question.

This question is not followed up until questions about all the rooms in the unit have been asked, at which point the respondent is asked the following questions to verify the previous answers.

LISTRM I have listed

^Studio

^BEDRMS Bedroom(s),

^BATHS Bathroom(s),

^HALFB Half bathroom(s),

^KITCH Kitchen(s),

^DINING Separate dining room(s),

^LIVING Living room(s),

^FAMRM Family room(s)/“Great” room(s)/TV room(s),

^RECRM Recreation room(s),

¹ The real AHS questionnaire is computer code that uses the answers from previous questions to choose which questions to ask and how to word the questions. HUD has placed, on the AHS website, the “2011 Instrument Items Booklet,” which was “prepared for the Office of Management and Budget as part of the survey clearance process.” According to HUD, “[t]his is the closest equivalent to a paper version of the AHS questionnaire.” See http://www.huduser.org/datasets/ahs/English_Items_Booklet2011.pdf, pages 62, 65, and 66.

^DENS Den(s)/Libraries,
^LAUNDRY Laundry room(s)/Utility room(s)/Panttries,
^OTHFIN Other Finished room(s),
^OTHRUN Other Unfinished room(s)

Are there any other rooms ^Elsewhere?

(Have I mis-recorded the number of any rooms?)

1. Yes
2. No (Census Bureau, 2011: 65)

Unless we have overlooked some interactive text, the respondent receives little or no guidance in counting bedrooms. It is not surprising, therefore, that the difference between how a room is used and what a room is designed for might not enter into the answers provided by respondents. For example, a large family living in a five-bedroom house might actually report six or more bedrooms, depending on how other rooms are used, whereas a couple living in the same unit might report four or fewer bedrooms.

2.2. Comparison of Bedroom Counts in 2009 and 2011

The 2009 and 2011 AHS surveys contained 42,375 units for which the AHS reported the number of bedrooms in both years. Table 1 compares the reported number in the two surveys.

Table 1. Bedroom Counts for the Same Sample Units in the 2009 and 2011 Surveys

2009	2011									Total
	0	1	2	3	4	5	6	7	8	
0	264	149	22	9	4	0	1	0	0	449
1	180	4,405	533	118	30	8	4	0	0	5,278
2	43	537	9,661	1,178	184	26	7	0	0	11,636
3	6	110	1,190	14,873	1,099	116	31	1	0	17,426
4	10	14	156	1,049	5,126	342	48	2	0	6,747
5	1	7	21	110	312	888	54	5	0	1,398
6	0	4	5	20	40	77	105	4	0	255
7	0	0	1	1	10	8	33	5	0	58
8	1	0	0	1	5	1	3	2	1	14
9	0	0	1	3	2	0	2	0	0	8
10	0	1	0	0	3	1	1	0	0	6
Total	505	5,227	11,590	17,362	6,815	1,467	289	19	1	43,275

Some of the numbers in Table 1 are peculiar. One can imagine a unit being reported as an efficiency in one survey and as a one-bedroom unit in another survey. In the absence of major structural changes, it is difficult to conceive of the same unit being reported as an efficiency in one survey and as having two or more bedrooms in another survey. Of the 449 efficiencies in 2009, however, 36 were reported as having two or more bedrooms in 2011, and of the 505 efficiencies in 2011, 61 were reported as having two or more bedrooms in 2009.

Survey-to-survey variation in bedroom counts in larger units is easier to understand, because rooms can be used for different purposes. Even considering different use patterns and imprecise reporting, however, it is difficult to see how a unit can have 10 bedrooms in 2009 and only 4 in 2011.

Despite the appearance of some extreme reporting errors, bedroom counts are reasonably consistent between surveys. Using the data in Table 1, Table 2 examines the consistency in reporting between surveys. The percentage of units with the same bedroom count in both years was 81.6 percent; alternatively, 18.4 percent of units had different bedroom counts in 2009 and 2011. More than 97 percent of all units had either the same number of bedrooms or one more or one fewer bedroom in 2011 than in 2009. More than 99 percent of all units had the same number of bedrooms, one or two more bedrooms, or one or two fewer bedrooms in 2011 than in 2009.

Table 2. Consistency in Bedroom Counts for Sample Units From the 2009 to the 2011 Surveys

	Number	Percent
Number of sample units	43,275	
Sample units reported with ...		
Same bedroom count in both years	35,324	81.6
More bedrooms in 2011	3,975	9.2
Fewer bedrooms in 2011	3,972	9.2
Same or within 1 bedroom	42,067	97.2
Same or within 2 bedrooms	43,030	99.4

N = 43,275.

The percentage of units with the same bedroom counts in 2009 and 2011 (81.6 percent) is very similar to the percentage (Eggers, 2009) found when it analyzed the consistency in variables from the 2003 to the 2005 AHS surveys (84.5 percent).²

In work on rental affordability from 1985 to 2009 for the MacArthur Foundation, Eggers and Moumen (2012) examined 10,999 sample units that were always rented while they were in the housing stock. Of these units, 6,802 (67.4 percent) always reported the same number of bedrooms, and 8,659 (85.7 percent) had the same number of bedrooms in their first survey and in their last survey (either 2009 or when they left the housing stock). Note that the level of consistency between first reported and last reported is similar to the consistency from 2009 to 2011. This similarity suggests that how respondents count bedrooms is probably much more important than structural changes in determining changes in counts between surveys.

Table 3 examines consistency by number of bedrooms in 2009. As expected, the larger units have less consistency than the smaller units. Within-one-bedroom consistency (far right column) is from 96 to 99 percent for units with one through four bedrooms in 2009. This percentage falls off rapidly for units with more than four bedrooms. Although the lack of consistency in reporting

² This percentage was not included in the report but was part of the variable-by-variable analysis done for the report.

among efficiency units is still surprising, 92 percent of the 2009 efficiency units were reported as efficiencies or one-bedroom units in 2011.³

Finally, note that the discussion of survey-to-survey changes in bedroom counts in this section involved both owner- and renter-occupied housing stock. In Sections 3 and 4, the discussion focuses on the rental housing stock, because affordability is generally a concept applied to rental housing. When we consider only units that were rented in 2009, 86 percent had the same bedroom counts in 2009 and 2011, 4 percentage points more than the percentage for all units.

Table 3. Consistency in Bedroom Counts, by Number of Bedrooms in 2009

Number of Bedrooms in 2009	Sample Units	Percent With the Same Bedroom Count in 2011	Percent With the Same or Within One Bedroom Count in 2011
0	449	58.8	92.0
1	5,278	83.5	97.0
2	11,636	83.0	97.8
3	17,426	85.3	98.5
4	6,747	76.0	96.6
5	1,398	63.5	89.7
6	255	41.2	72.9
7	58	8.6	65.5
8	14	7.1	21.4
9	8	0.0	0.0
10	6	0.0	0.0
Total	43,275	81.6	97.2

³ In the MacArthur work, Eggers and Moumen (2012) found the same pattern: greater consistency between first reported and last reported bedroom counts for one- through four-bedroom units than for larger units. Efficiencies had substantially less consistency.

3. How Changes in Number of Bedrooms Relate to Other Housing Unit and Household Characteristics

The AHS gathers a wealth of information on both the housing unit and its occupants. In this section, we use that information to examine why bedroom counts change between surveys.

Survey-to-survey changes in the number of bedrooms are either real (the number of bedrooms has changed between surveys due to structural modifications) or artificial (the number of bedrooms has changed because the respondent or respondents have counted them differently). Respondents can count bedrooms differently because the use of rooms changes between surveys or because respondents interpret the question differently or erroneously. This section examines each of these three possibilities in turn: structural modification, use of other rooms as bedrooms or bedrooms as other rooms, and respondent or recording errors.

3.1. Structural Changes

Affordability analysis is not adversely affected if the landlord adds a bedroom to a unit or reconfigures rooms in a way that changes the bedroom count. If structural changes added or subtracted a bedroom from the 2009 to the 2011 AHS surveys, the bedroom count and gross rent from the 2009 AHS lead to an appropriate classification in 2009, and the bedroom count and gross rent from the 2011 AHS lead to an appropriate classification in 2011.

Structural modifications is not an important explanation of the change in bedroom counts, because the extent to which structures undergo modifications is substantially less than the observed changes in bedroom counts between surveys. Table 4 uses information from the 2011 AHS on modifications and repairs since the previous survey to examine how important modifications are. Of the approximately 12,000 sample units that were rental in both surveys, only 13 underwent modifications to add a bedroom and only an additional 18 underwent modifications to add a room other than a bedroom. Of the 1,889 sample units in which a different number of bedrooms was reported, only 12 had structural changes reported involving the addition of a room of any type.⁴

⁴ The count of units with structural modifications is probably an underestimate, because tenants are less likely than owners to know about such modifications. Because a unit is probably vacant during alteration, the 2011 household of an altered unit likely would not be the same as the 2009 household.

Table 4. Relationship Between Changes in Bedroom Counts and Structural Modifications (unweighted counts)

Change in Bedroom Count (2009 to 2011)	Sample Units With No Relevant Modifications	Modifications To Add a Bedroom ^a	Modifications To Add a Room Other Than a Bedroom ^b	Total
- 3 or more	21	0	0	21
- 2	96	0	0	96
- 1	817	1	2	820
0	10,008	6	13	10,027
+ 1	817	5	3	825
+ 2	102	1	0	103
+ 3 or more	24	0	0	24
Total	11,885	13	18	11,916

^aUses the first two modifications recorded by the AHS to determine if the work involved creating a finished bedroom from unfinished space, adding a bedroom onto a home, or creating a bedroom through structural changes.

^bUses the first two modifications recorded by the AHS to determine if the work involved creating another finished room from unfinished space, adding another room onto a home, or creating another room through structural changes.

Note: Includes only units that were market-rate rentals in both 2009 and 2011.

In Table 4, no relationship appears to exist between modifications to add a bedroom and the change in the bedroom count: 19 of the 31 sample units that added a room reported no change in the number of bedrooms, and 3 of the 31 reported a decline in the number of bedrooms. This finding might not be as strange as it seems; for example, before the addition of a bedroom, the household might have been using a room not designed as a bedroom for a bedroom. After the addition of a new bedroom, this room might have returned to its intended function.

3.2. Use of Other Rooms As Bedrooms or Bedrooms As Other Rooms

This second explanation assumes that residents have an interpretation of what is a bedroom that is different from the AHS definition. To a household, a bedroom might be any room in which members of the household sleep, regardless of whether that room was intended or designed to be a bedroom. For example, a couple in a one-bedroom apartment might use a study as a bedroom for their new infant, or a large family in a three-bedroom house might convert a basement recreation room into a fourth bedroom. In these cases, the units really do provide the services of a two-bedroom apartment or a four-bedroom house, respectively.

The use of other rooms as bedrooms introduces ambiguity into the measurement of affordability. The examples in the preceding paragraph show how different households might use a unit differently. Arguably, if a unit is large enough to allow for the multiple use of rooms, then affordability should depend on how the rooms are used and not on what purpose the rooms were designed to serve, but this argument has limits. One of the authors, who was never poor as a child, grew up in a one-bedroom apartment and slept every night on a fold-out sofa in the living room. One would not want to classify this apartment as a two-bedroom apartment for affordability purposes.

This section examines the extent to which changes in bedroom counts can be attributed to rational behavior rather than to data errors. We cannot determine whether the household in a sample unit is using a room intended for other purposes as a bedroom, because we do not know how the rooms in our sample units were intended to be used. Instead, we look at other data to determine whether this behavior is occurring.

3.2.1. Are Units With More Other Rooms More Likely To Have Changes in Bedroom Counts?

The AHS also records the number of rooms in a sample unit. The AHS publication containing the national data for 2009 includes the following explanation of what is counted as a room.

Rooms counted include whole rooms used for living purposes, such as bedrooms, living rooms, dining rooms, kitchens, recreation rooms, permanently enclosed porches that are suitable for year-round use, lodger's rooms, and other finished rooms. Also included are rooms used for offices by a person living in the unit ... (Census Bureau, 2011: B-27)

Bathrooms, laundry rooms, utility rooms, walk-in closets, pantries, and unfinished rooms are not counted as rooms.⁵

One would expect that units with more other rooms would provide more opportunities to use an other room as a bedroom. To test this supposition, we computed the number of other rooms in 2009 by subtracting the count of bedrooms in 2009 from the count of rooms in 2009. To isolate the effect of extra rooms that could be converted to bedrooms, we separated market-rate rental sample units by the number of total rooms in 2009.

Table 5 presents a cross-tabulation of the number of other rooms in 2009 versus the change in the bedroom count from 2009 to 2011 for market-rate rental sample units with four rooms. Table A-1 in Appendix A includes the information in Table 5 and also looks at rental sample units with three, five, and six rooms; 89 percent of the rental sample units in 2011 had three through six rooms. We report only the analysis for four rooms here because the results are similar for all four groups, and sample units with four rooms are the most common form of rental unit.

⁵ A dining room, to be counted, must be separated from adjoining rooms by built-in archways or walls that extend at least 6 inches from an intersecting wall. Half walls or bookcases count if built in. Movable or collapsible partitions or partitions consisting entirely of shelves or cabinets are not considered built-in walls.

Table 5. Changes in Bedroom Counts and the Number of Other Rooms

Change in Bedroom Count (2009 to 2011)	Number of Other Rooms in 2009			
	1	2	3 or More	Total
- 2	2	8	0	10
- 1	0	202	3	205
0	7	3,091	451	3,549
+ 1	1	153	68	222
+ 2	0	21	5	26
+ 3	0	4	2	6
Total	10	3,479	529	4,018
Percent adding bedrooms	10.0	5.1	14.2	

Note: Includes only units with four rooms in 2009 that were market-rate rentals in both 2009 and 2011.

Table 5 offers some support to the hypothesis that units with more other rooms are more likely to experience an increase in the number of bedrooms between surveys. Among four-room rental sample units, those with three or more other rooms in 2009 were approximately three times more likely to have at least one additional bedroom in 2011 than those with two other rooms, 14.2 percent versus 5.1 percent. Although these results are consistent with the presumed behavior, the effect is minimal; most of the sample units did not have a change in bedroom count regardless of how many other rooms they had.

The tabulations reported in Table 5 uncover some important features of the way rooms and bedrooms are counted in the AHS. As previously mentioned, the number of other rooms is simply the difference between the AHS count of rooms and count of bedrooms. None of the rental sample units tallied reported zero other rooms. We suspect that the AHS has an edit that requires that the number of rooms must exceed the number of bedrooms by at least one. On the other hand, no edit is apparent for the number of bedrooms.⁶

The reader might also wonder how sample units with two other rooms in 2009 can add three or more bedrooms from 2009 to 2011. We suspect the answer is that, for these sample units, the number of rooms increased from 2009 to 2011. Subsequent analysis in this paper will show that the number of rooms is also changeable.

Next, we look at the relationship between changes in bedroom counts and two household characteristics: (1) whether the household was new in 2011 and (2) whether the number of persons in the household changed between surveys.

⁶ We know that, in the case of efficiencies and studio apartments, the interviewer is not to check whether the respondent includes a bedroom or a kitchen as one of the rooms in his or her unit. Studio units have to be reported as having zero bedrooms; their one room is defined as an other room.

3.2.2. Do New Households Tend To Report a Different Number of Bedrooms?

Table 6 reports how changes in bedroom counts are related to a change in household. If the 2011 household contains no members that were in the 2009 household, the AHS classifies the household as a different household.⁷

Table 6. Relationship Between Changes in Bedroom Counts and Whether the 2011 Household Was the Same Household or a Different Household Than the 2009 Household (unweighted counts)

Change in Bedroom Count (2009 to 2011)	Same Household in 2009 and 2011	Different Household in 2011 Than in 2009	Total
- 3 or more	4	12	16
- 2	16	42	58
- 1	264	326	590
0	3,828	4,586	8,414
+ 1	256	378	634
+ 2	24	45	69
+ 3 or more	6	13	19
Total	4,398	5,402	9,800

Note: Includes only units that were market-rate rentals in both 2009 and 2011.

One would expect that a different household might be more likely than the same household to use rooms in the unit differently in the two surveys. Table 6 provides some support to this supposition. Among sample units with the same household, 13.0 percent reported a different number of bedrooms whereas, among sample units with different households, 15.3 percent reported a different number of bedrooms. Nevertheless, the differences are minor.

3.2.3. Does Room Usage Change With Changes in Household Size?

How households choose to use rooms likely depends on the number of persons in the households. Table 7 looks at how changes in bedroom counts are related to changes in the number of persons in the household.

⁷ For this analysis, we used the variable SAMEHH2 and classified units that were vacant or usual residence elsewhere in 2009 as new households.

Table 7. Relationship Between Changes in Bedroom Counts and Changes in the Number of Persons in the Household (unweighted counts)

	Change in Number of Persons (2009 to 2011)							Total
	- 3 or more	- 2	- 1	0	+ 1	+ 2	+ 3 or more	
Change in bedroom count (2009 to 2011)								
- 3 or more	2	0	3	3	1	1	1	11
- 2	7	4	6	19	4	2	3	45
- 1	41	41	79	256	51	19	7	494
0	218	326	970	4,102	1,026	380	222	7,244
+ 1	10	10	42	258	89	48	45	502
+ 2	0	5	3	17	9	10	6	50
+ 3 or more	0	0	3	3	3	2	3	14
Total	278	386	1,106	4,658	1,183	462	287	8,360
Percent with ...								
the same number of bedrooms	78.4	84.5	87.7	88.1	86.7	82.3	77.4	86.7
more bedrooms	3.6	3.9	4.3	6.0	8.5	13.0	18.8	6.8
fewer bedrooms	18.0	11.7	8.0	6.0	4.7	4.8	3.8	6.6

Note: Includes only units that were market-rate rentals in both 2009 and 2011.

The relationship in Table 7 is substantially stronger than the three previous relationships studied. Using the 0 change in bedroom count row and the 0 change in number of persons column to divide the Table 7 into quadrants, the upper left and lower right quadrants are significantly more populated than the other two quadrants.

The bottom three rows in Table 7 report relevant percentages. The percentage of cases with no change in bedroom counts (third row from the bottom of Table 7) is greatest in the column denoting no change in the number of persons in the household. As the change in number of persons becomes less or more, the percentage of cases with no change in bedroom count decreases monotonically in each direction.

The percentage of sample units reporting more bedrooms in 2011 than in 2009 increases monotonically from left to right as the change in household size becomes more positive. Similarly, the percentage of sample units reporting fewer bedrooms in 2011 than in 2009 decreases almost monotonically from left to right as the change in household size becomes more positive. Despite the clear pattern in Table 7, the correlation between the change in the bedroom count and the change in the number of persons in the household was only 0.14.⁸

⁸ Table 7 groups observations of 3 or greater in absolute value; the correlation was computed using ungrouped data. This correlation might be weak because the relationship is not strictly linear. For example, one or two additional children might result in the transformation of *one* other room into a bedroom.

3.3. Respondent or Recording Errors

The third alternative is that the observed change in number of bedrooms is the result of errors on the part of the respondent or the Census Bureau interviewer. From the perspective of researchers studying the affordability of rental units, this alternative is the most troubling. Errors in bedroom counts can introduce mistakes into the classification of sample units for affordability purposes.

We cannot detect reporting errors directly because, as noted, we do not know objectively how many bedrooms are in our sample units. Again, we must look at other data to infer whether reporting errors occurred. We know that both the bedroom and room counts change for sample units that underwent structural changes, but we also know that such sample units are few. We suspect that some changes in bedroom counts result from changes in the way certain rooms are used. To the extent that this explanation is true, we would *not* expect to see a corresponding change in the number of rooms—rooms are used differently, not added. Table 8 reports the relationship between the change in the number of bedrooms and the change in the number of rooms from 2009 to 2011.

Table 8. Relationship Between Changes in Bedroom Counts and Room Counts

	Number of Sample Units (N = 11,916)	Percent of Sample Units That Changed Counts
Change in bedroom count	1,889	NA
Change in bedroom count, no change in room count	398	21.1
Change in bedroom count, same-direction change in room count	1,437	76.1
Change in bedroom count, opposite-direction change in room count	54	2.9
Change in room count	4,684	NA
Change in room count, no change in bedroom count	3,193	68.2
Change in room count, same-direction change in bedroom count	1,437	30.7
Change in room count, opposite-direction change in bedroom count	54	1.2

NA = not applicable.

Note: Includes only units that were market-rate rentals in both 2009 and 2011.

Table 8 takes all the sample units that were market-rate rentals in 2009 and 2011 and reports on changes between surveys in the counts of bedrooms and rooms. Table 8 reveals that room counts vary even more than bedroom counts. In 2011, 39 percent (4,684 of 11,916) of the rental units had different room counts; 16 percent (1,889 of 11,916) had different bedroom counts.

The most disappointing aspect of Table 8 is that only 21 percent of the rental units that had different bedroom counts had no change in room counts. If a change in bedroom count results from a change in how rooms are used, then one would expect no change in the room count. Although it does not follow that a change in room count invalidates the assumption that a change in bedroom count results from a change in how rooms are used for sleeping purposes, the fact that three-fourths of the change in bedroom counts were accompanied by a same-direction

change in room counts certainly introduces doubts about the validity of the bedroom counts. The correlation between change in bedroom counts and change in room counts is 0.60.

Another way of looking at the same numbers is to focus on the relationship between changes in the number of bedrooms and changes in the number of other rooms. If household choice in room usage were the dominant explanation for variation in bedroom count, then one would expect that changes in the number of bedrooms would be associated with opposite-direction changes in the number of other rooms. In other words, if respondents were answering the questions related to the number of rooms and the number of bedrooms correctly, then increases in the bedroom count would be associated with a decrease in the count of other rooms, calculated as the difference between the number of rooms and the number of bedrooms. The correlation between changes in the number of bedrooms and changes in the number of other rooms is essentially 0, a positive 0.04.

Researchers have typically used bedroom counts rather than room counts to classify units by size. Table 8 shows that 68 percent of the sample units with reported changes in room counts had no reported change in bedrooms counts. Therefore, bedroom counts are a more stable, if still variable, measure of unit size.

3.4. Summary of Evidence Relating Changes in Bedroom Counts to Other Housing and Housing Characteristics

At the beginning of this section, we classified changes in the number of bedrooms between surveys as either real (the result of structural changes) or artificial (the result of how respondents answered the questions). Structural changes cannot account for the survey-to-survey variation in the number of bedrooms, because substantially more sample units had survey-to-survey changes in the number of bedrooms than underwent structural changes. In addition, for those sample units that underwent structural changes related to the addition of a room or bedroom, most reported no change in the number of bedrooms.

Thus, how respondents answer the AHS question on the number of bedrooms must account for the observed variation. This section sought to find rational explanations for why respondents answer the question on the number of bedrooms differently in different surveys. Our main supposition was that observed variation resulted from differences in how households use rooms rather than how households count rooms. Larger households might choose to use an other room as a bedroom. The data provide some support for this hypothesis. Changes in the number of persons in a household and changes in the number of bedrooms reported exhibit a slight positive correlation that, although statistically significant, is very low (0.14). In addition, a corollary of this hypothesis is that a negative correlation exists between the number of bedrooms and the number of other rooms, which presumes that the room count is correct and unchanged between surveys. On the contrary, the number of bedrooms and the number of other rooms exhibit a slight positive correlation.⁹

⁹ Double-counting is one possibility. The AHS asks how many bedrooms a unit has early in the inventory. Perhaps respondents give the “real estate” answer. Then the AHS asks a list of questions about other kinds of rooms. If someone is using a bedroom as an office, the respondent might say that the unit has an office. That would increase the total room count.

This finding leaves a third alternative: that respondents incorrectly answer the question on the number of bedrooms. This hypothesis has no direct test. Nevertheless, a substantial positive relationship between changes in the number of rooms and changes in the number of bedrooms suggests that respondents make consistent errors in the reporting of rooms and bedrooms.

4. Effect on Rental Dynamics Analysis

The observed variation in bedroom counts is a matter of concern in itself. The particular concern in this paper, however, is whether that variation has any significant effect on the analysis of affordability of rental housing.

At HUD's request, Eggers and Moumen (forthcoming)¹⁰ studied changes in the affordability of rental units from the 2009 to the 2011 AHS surveys. This study is part of a series of pairwise affordability studies, using successive AHS surveys, called *rental dynamics* analyses. Rental dynamics studies contain both forward-looking analysis (what happened by 2011 to rental units that were affordable in 2009?) and backward-looking analysis (where did the affordable 2011 rental units come from in terms of the 2009 stock?).

The forward-looking rental dynamics analysis classifies the 2009 rental units into eight affordability categories: (1) nonmarket (assisted or no cash rent), (2) extremely low rent, (3) very low rent, (4) low rent, (5) moderate rent, (6) high rent, (7) very high rent, and (8) extremely high rent (Eggers and Moumen, forthcoming).

The analysis then classifies these units in 2011 into the same eight affordability categories and three additional categories: owner-occupied stock, seasonal stock, or no longer in the housing stock. The additional categories recognize that some 2009 rental units might no longer be rental units in 2011.

The affordability of a unit is determined by the interaction of three factors: (1) the unit's gross rent (monthly tenant-paid rent plus utilities), (2) the unit's number of bedrooms, and (3) Area Median Income (AMI). AMI is used to create a matrix of gross rents by number of bedrooms crossed with the affordability classifications. A cell in this matrix reads, for example, that for a two-bedroom apartment to be affordable to a very low-income household, it must rent for \$562.50 or less.¹¹ Each rental unit can be placed into a cell in this matrix based on its gross rent and the number of bedrooms. In the rental dynamics report (Eggers and Moumen, forthcoming), rental units are classified rental units this way in both 2009 and 2011, and the analysis focused on the movement among affordability categories between surveys. Again, the analysis recognizes that some 2009 units might no longer be in the rental stock in 2011. From a policy perspective, the movements that are important are those generated by changes in gross rent or in AMI.

Table 9 compares the classification of 2009 rental sample units in 2011 based on two alternative approaches. The rows in Table 9 classify 2009 rental sample units in 2011 based on AMI in 2011, gross rent in 2011, and the reported number of bedrooms in 2011. The rental dynamics

¹⁰ To be published on HUD's AHS website on finalization of certain Census Bureau data.

¹¹ This example was computed as follows. If the AMI is \$50,000, then the median income for a three-person household would be 90 percent of \$50,000, or \$45,000. A three-person household would be expected to require a two-bedroom apartment. A very low-income three-person household would have an income of 50 percent of \$45,000, or \$22,500. This household would be expected to spend no more than 30 percent of its income for rent, which computes to a monthly rent of \$562.50.

report uses this approach. The columns in Table 9 classify 2009 rental sample units in 2011 based on AMI in 2011, gross rent in 2011, and the reported number of bedrooms in 2009.

Table 9. Affordability of 2009 Rental Units in 2011 Based on Two Alternative Sources of Bedroom Counts (unweighted sample counts)

Affordability in 2011 Determined by 2011 Bedroom Count	Affordability in 2011 Determined by 2009 Bedroom Count								
	Non-market	Extremely Low Rent	Very Low Rent	Low Rent	Moderate Rent	High Rent	Very High Rent	Extremely High Rent	Total
Nonmarket	2,581	0	0	0	0	0	0	0	2,581
Extremely low rent	0	628	31	0	0	0	0	0	659
Very low rent	0	50	3,062	138	9	1	0	0	3,260
Low rent	0	0	143	2,303	137	5	0	0	2,588
Moderate rent	0	1	19	134	3,032	78	19	5	3,288
High rent	0	0	1	5	88	1,026	53	5	1,178
Very high rent	0	0	0	1	16	35	488	49	589
Extremely high rent	0	0	0	1	8	1	32	714	756
Total	2,581	679	3,256	2,582	3,290	1,146	592	773	14,899

Note: Includes only units that were rentals in both 2009 and 2011.

For purposes of rental dynamics analysis, affordability is a characteristic of only rental units. Table 9 therefore looks only at sample units that were rentals in both years. After a rental unit is classified as nonmarket, the affordability of that sample unit is independent of the number of bedrooms in the sample units. Table 9 shows no change in this number.

For the rows and columns in which the number of bedrooms enters into the determination of a sample unit's affordability status in 2011, the shift in bedroom counts from 2009 to 2011 results in some movement among affordability categories. The number of rental sample units that change status is modest, however, and most changes are movement into an adjacent category. More than 90 percent of the market-rate rental sample units retained the same affordability classification when the bedroom count was taken from the 2009 survey rather than the 2011 survey. Less than 1 percent of the market-rate rental sample units experienced a change of more than one category in affordability.

Appendix B analyzes how changes in bedroom counts affect the affordability measures based on the weighted counts used in HUD's rental dynamics report for the 2009-to-2011 period. In the forward-looking rental dynamics analysis for 2009–2011 (Eggers and Moumen, forthcoming), the notable survey-to-survey variation in the number of bedrooms had a negligible and statistically insignificant effect on the survey-to-survey movement of units among affordability classes.

The conclusion that survey-to-survey variation in bedroom counts has minimal effect on affordability analysis applies only to analysis involving two points in time. Variation in bedroom counts is likely to have greater effects on an analysis that attempts to track the affordability of units across many surveys. In work funded by the MacArthur Foundation, Weicher, Eggers, and

Moumen (2010) attempted to track the affordability of units over time. In that analysis, the authors identified a subset of housing units that were always affordable from 1985 to 2005. Given that affordability depends on the number of bedrooms, it is possible that the number of always-affordable units is more than estimated. In particular, Weicher, Eggers, and Moumen (2010) noted a significant number of “blips” (that is, units that were always affordable except for one or two surveys). In the planned analysis covering the 1985-to-2011 period, the authors will have to investigate whether these blips resulted from changes in bedroom counts.

5. Recommendation

From our analysis of changes in the number of bedrooms from the 2009 to the 2011 AHS surveys, we believe that most of the observed variation is the result of incorrect responses rather than differences in how households use rooms. The variation in bedroom counts appears to have only modest effects on affordability analyses of the type done as secondary analysis in the *Worst Case Housing Needs* reports or in the rental dynamics reports, but it will cause analyses of rental affordability for longer periods to overestimate the extent to which units change affordability.

The lack of consistency in bedroom counts is troubling in itself. The most important concern is that analysts typically use the number of bedrooms to classify units by size. That 18 percent of units had different bedroom counts in successive surveys reduces the usefulness of this measure.

We recommend that, as part of the redesign of the AHS accompanying the drawing of a new sample in 2015, the Census Bureau develop a set of questions designed to obtain an accurate count of bedrooms and, beginning with the 2017 AHS, incorporate flags and followup questions to identify cases in which the number of bedrooms differs from the number in the previous survey. Because of the close relationship between the questions on the number of rooms and the number of bedrooms, we recommend that the Census Bureau take similar steps to ensure that both questions are answered correctly.

In testing alternative questions, the Census Bureau should conduct site visits afterwards to obtain an objective count of bedrooms and rooms to verify the answers given on test questions. In addition, we recommend that HUD analysts examine how to classify, for affordability purposes, units with other rooms that reasonably can be converted into bedrooms as needed. Arguably, a one-bedroom apartment with a study that can be used as another bedroom is not the same as a one-bedroom apartment without an extra room. Studies of affordability should be conscious of the differences among these units.

6. References

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Appendix A. Changes in Bedroom Counts and the Number of Other Rooms

Table A-1 presents a cross-tabulation of the number of other rooms in 2009 versus the change in the bedroom count from the 2009 to the 2011 AHS surveys for four categories of market-rate rental sample units. This table examines rental sample units with three, four, five, or six rooms; 89 percent of the rental sample units in 2011 had three through six rooms. The four-room panel in Table A-1 is identical to Table 5 in Section 3.2.1.

Table A-1 offers some support to the hypothesis that units with more other rooms are more likely to experience an increase in the reported number of bedrooms between surveys. Among three-room rental sample units, those with two other rooms in 2009 were more likely to have an additional bedroom in 2011 than those with only one other room, but the difference was minimal, 8.7 percent versus 6.3 percent. Among four-room rental sample units, those with three or more other rooms in 2009 were approximately three times more likely to have an additional bedroom in 2011 than those with two other rooms, 14.2 percent versus 5.1 percent. Among five-room rental sample units, those with three or more other rooms in 2009 were approximately twice as likely to have an additional bedroom in 2011 than those with two other rooms, 8.8 percent versus 3.7 percent. Finally, among six-room rental sample units, those with three or more other rooms in 2009 were three times more likely to have an additional bedroom in 2011 than those with two other rooms, 9.9 percent versus 3.1 percent.¹² Although the pattern is consistent with the presumed behavior, the effect is minimal; most of the sample units did not have a change in bedroom count regardless of how many other rooms they had.

¹² The correlations between the change in bedroom count and the number of other rooms in 2009 were 0.70 for three-room units, 0.14 for four-room units, 0.18 for five-room units, and 0.27 for six-room units; all the correlations were statistically significant at the 0.001 level. Table A-1 groups observations of three or more in absolute value; the correlation was computed using ungrouped data.

Table A-1. Changes in Bedroom Counts and the Number of Other Rooms

Change in Bedroom Count (2009 to 2011)	Number of Other Rooms in 2009			
	1	2	3 or More	Total
Market-rate rental sample units with 3 rooms in 2009				
- 1	7	63	0	70
0	23	2,237	3	2,263
+ 1	1	188	3	192
+ 2	1	23	0	24
+ 3	0	7	0	7
Total	32	2,518	6	2,556
Percent adding bedrooms	6.3	8.7	50.0	
Market-rate rental sample units with 4 rooms in 2009				
- 2	2	8	0	10
- 1	0	202	3	205
0	7	3,091	451	3,549
+ 1	1	153	68	222
+ 2	0	21	5	26
+ 3	0	4	2	6
Total	10	3,479	529	4,018
Percent adding bedrooms	10.0	5.1	14.2	
Market-rate rental sample units with 5 rooms in 2009				
- 2	0	19	2	21
- 1	1	142	70	213
0	1	1,079	1,188	2,268
+ 1	0	39	102	141
+ 2	0	7	16	23
+ 3	0	1	4	5
Total	2	1,287	1,382	2,671
Percent adding bedrooms	0.0	3.7	8.8	
Market-rate rental sample units with 6 rooms in 2009				
- 3 or more	0	4	0	4
- 2	0	19	15	34
- 1	0	46	94	140
0	0	148	927	1,075
+ 1	0	4	100	104
+ 2	0	3	11	14
+ 3	0	0	3	3
Total	0	224	1,150	1,374
Percent adding bedrooms	NA	3.1	9.9	

NA = not applicable. Note: Includes only units that were market-rate rentals in both 2009 and 2011.

Appendix B. Effect of Changes in Bedroom Counts on Weighted Rental Dynamics Analysis

Table B-1 is the summary table used in the rental dynamics analysis (Eggers and Moumen, forthcoming) to show how rental units changed in affordability from the 2009 to the 2011 AHS surveys. This analysis employs only weighted counts. Of the roughly 40 million rental units in 2009, only 19 million were in the same affordability category in 2011. Of the remaining approximately 21 million 2009 rental units, 8.3 million were more affordable in 2011, 8.1 million were less affordable in 2011, and 4.8 million had left the rental stock by 2011.

Table B-1. Forward-Looking Summary Table From Rental Dynamics Analysis (weighted counts)

Affordability Categories	2009 Rental Units	To More Affordable Categories in 2011	In Same Affordability Category in Both Years	To Less Affordable Categories in 2011	2009 Rental Units Not Rentals in 2011
Nonmarket	6,844,830	NA	4,313,759	1,608,488	922,583
Extremely low rent	1,693,921	211,427	381,140	798,921	302,433
Very low rent	9,503,143	1,031,161	4,787,330	2,581,288	1,103,364
Low rent	7,050,524	1,838,712	2,857,709	1,719,606	634,497
Moderate rent	8,708,592	2,585,481	4,198,799	1,010,047	914,265
High rent	2,995,909	1,142,487	1,156,718	248,070	448,634
Very high rent	1,648,485	804,301	438,594	179,339	226,251
Extremely high rent	1,868,041	720,314	878,231	NA	269,496
Total	40,313,444	8,333,884	19,012,280	8,145,758	4,821,522

NA = not applicable.

Source: Eggers and Moumen (forthcoming)

Table B-2 reports the changes that would result in Table B-1 if the 2011 affordability classification had been based on the bedroom counts from the 2009 survey. The increase in the number of units that have the same affordability classification in 2009 and 2011 is modest, only 92,000 units. This increase in stability results in a decrease of 61,000 units that were more affordable in 2011 and a decrease of 32,000 units that were less affordable. As explained in Section 4, the change in bedroom counts does not affect the number of units that were no longer rentals in 2011 or, for that matter, the number that are nonmarket.

Table B-2. Changes in the Forward-Looking Results When 2009 Bedroom Counts Are Used (weighted counts)

Affordability Categories	2009 Rental Units	Change From Table B-1			2009 Rental Units Not Rentals in 2011
		To More Affordable Categories in 2011	In Same Affordability Category in Both Years	To Less Affordable Categories in 2011	
Nonmarket	6,844,830	NA	0	0	922,583
Extremely low rent	1,693,921	0	+ 9,985	- 9,985	302,433
Very low rent	9,503,143	+ 515	+ 67,165	- 67,681	1,103,364
Low rent	7,050,524	+ 7,312	+ 17,592	- 24,905	634,497
Moderate rent	8,708,592	- 20,233	+ 28,565	- 8,332	914,265
High rent	2,995,909	- 13,943	- 3,368	+ 17,313	448,634
Very high rent	1,648,485	- 26,167	- 35,858	+ 62,025	226,251
Extremely high rent	1,868,041	- 8,121	+ 8,121	NA	269,496
Total	40,313,444	- 60,636	+ 92,202	- 31,564	4,821,522

NA = not applicable.

As one might have expected, fewer units change affordability category *overall* if the number of bedrooms in the unit is held constant, but this outcome is not preordained. Each row in Table B-2 must sum to 0. Five of the seven rows that can experience a change in counts show more units in the “Same Affordability” column. Fewer of the 2009 very high-rent units were very high-rent units in 2011, however, when bedroom counts were held constant; the weighted count of units that did not change category decreased by 36,000. This 36,000-unit decrease was accompanied by a 26,000-unit decrease in the number of units that were more affordable and a 62,000-unit increase in the number of units that were less affordable. These changes for very high-rent units suggest that some households choose units at the high end of the rental market so that they can use other rooms as bedrooms to make ends meet.

Table B-3 translates Table B-1 into row percentages. Table B-4 reports the changes in Table B-3 that would result if the 2011 affordability classification had been based on the bedroom counts from the 2009 survey. Throughout Table B-4, the reported changes are modest. The greatest percentage changes are in the very high-rent category, where the movement to a less affordable category increased by 3.8 percentage points.

Table B-3. Percentage of 2009 Rental Units That Were More Affordable, Were in the Same Affordability Category, Were Less Affordable, or Were No Longer Rentals in 2011, by Affordability Category in 2009 (weighted counts)

Affordability Categories	2009 Rental Units	To More Affordable Categories in 2011 (%)	In Same Affordability Category in Both Years (%)	To Less Affordable Categories in 2011 (%)	2009 Rental Units Not Rentals in 2011 (%)
Nonmarket	6,844,830	NA	63.0	23.5	13.5
Extremely low rent	1,693,922	12.5	22.5	47.2	17.9
Very low rent	9,503,143	10.9	50.4	27.2	11.6
Low rent	7,048,019	26.1	40.5	24.4	9.0
Moderate rent	8,708,592	29.7	48.2	11.6	10.5
High rent	2,995,909	38.1	38.6	8.3	15.0
Very high rent	1,648,485	48.8	26.6	10.9	13.7
Extremely high rent	1,868,041	38.6	47.0	NA	14.4
Total	40,310,940	20.7	47.2	20.2	12.0

NA = not applicable.

Table B-4. Changes in the Forward-Looking Row Percentage Results When 2009 Bedroom Counts Are Used

Affordability Categories	2009 Rental Units	Change From Table B-3			2009 Rental Units Not Rentals in 2011 (%)
		To More Affordable Categories in 2011 (%)	In Same Affordability Category in Both Years (%)	To Less Affordable Categories in 2011 (%)	
Nonmarket	6,844,830	NA	0.0	0.0	0.0
Extremely low rent	1,693,922	0.0	+ 0.6	- 0.6	0.0
Very low rent	9,503,143	0.0	+ 0.7	- 0.7	0.0
Low rent	7,048,019	+ 0.1	+ 0.2	- 0.4	0.0
Moderate rent	8,708,592	- 0.2	+ 0.3	- 0.1	0.0
High rent	2,995,909	- 0.5	- 0.1	+ 0.6	0.0
Very high rent	1,648,485	- 1.6	- 2.2	+ 3.8	0.0
Extremely high rent	1,868,041	- 0.4	+ 0.4	NA	0.0
Total	40,310,940	- 0.2	+ 0.2	- 0.1	0.0

NA = not applicable.

Using the 2011 bedroom counts, 47.2 percent of units reported no change in affordability; using the 2009 bedroom counts, 47.4 percent of units reported no change in affordability. This 0.2-percentage-point difference is not statistically significant, even at the 20-percent significance level.

In tracking rental affordability, HUD focuses on changes in the very low-rent, extremely low-rent, and nonmarket categories. From the perspective of this paper, HUD would like to know how the use of the 2009 bedroom counts instead of the 2011 bedroom counts would affect the weighted count of units in each of these three categories. Table B-5 gives a partial answer to that

question.¹³ The table examines the 35,491,922 units that were rentals in both years and counts the number in each class in 2011 using 2011 bedroom counts and then 2009 bedroom counts.

Table B-5. Disposition of Units Among the Three Most Affordable Categories

Affordability Categories	2011 Bedroom Count	2009 Bedroom Count	Change	Percent Change
Nonmarket	6,208,616	6,208,616	0	0.0
Extremely low rent	1,467,654	1,492,422	+ 24,768	+ 1.7
Very low rent	7,953,385	7,997,680	+ 44,295	+ 0.6
Total	15,629,654	15,698,717	+ 69,063	+ 0.4

Note: Includes only units that were rentals in both 2009 and 2011.

Among units that were rentals in both years, using 2009 bedroom counts instead of 2011 bedroom counts would have increased the total count of units in these three categories by 69,000, or only 0.4 percent. Because the number of bedrooms does not enter into the determination of whether a unit is nonmarket (that is, subsidized or rented on a nonbasis), the count of units in this category is unchanged. The count of extremely low-rent units would be 1.7 percent more using 2009 bedroom counts, and the number of very low-rent units would be 0.6 percent more.

In the forward-looking rental dynamics analysis for 2009–2011, Eggers and Moumen (forthcoming) found that the notable survey-to-survey variation in the number of bedrooms has a negligible and statistically insignificant effect on the survey-to-survey movement of units among affordability classes overall. The effect on the three most affordable categories appears to be minor, as well.

Finally, note that changes in bedroom counts do not affect HUD’s primary measure of the affordability of rental housing, the count of households with worst case housing needs. That measure focuses primarily on the ratio of gross rent to income, without taking into account whether the number of bedrooms is appropriate given household size.

¹³ Three pieces are missing in finding out how different bedroom counts affect the three most affordable categories: (1) the number of rental units in these three categories added to the stock from 2009 to 2011; (2) the number of units in these three categories in 2011, based on 2011 bedroom counts, that were owner occupied, vacant or seasonal, or temporarily out of the stock in 2009; and (3) the number of units in these three categories in 2011, based on 2009 bedroom counts, that were owner occupied, vacant or seasonal, or temporarily out of the stock in 2009. Unfortunately, this backward-looking analysis has been delayed until the third version of the public use file becomes available.