# Appendix D.
# **Errors**

All numbers in this book are estimates. As in other surveys, errors come primarily from wrong answers, incomplete data, and sampling.

## NONSAMPLING ERRORS

Nonsampling errors are usually the largest source of errors, larger than sampling errors. For example the changes in weighting in 1981 and 1991 (see appendix C) corrected some of the error due to incomplete data. Just that one correction averaged 2.5 percent in 1991. Worse errors from wrong answers and from incomplete data apply to some items, discussed in the next paragraphs.

**Wrong answers.** Wrong answers happen because people misunderstand questions, cannot recall the correct answer, or do not want to give the right answer. Table 1 shows which items have high inconsistency when people are reinterviewed after a few weeks. The actual survey cannot catch and reconcile these inconsistencies, so a high rate of wrong answers remains. Not all questions have been checked for inconsistencies. The ones checked were the questions where inconsistencies seemed likely. Questions measuring opinions were likely to have high inconsistencies.

The numbers in table 1 are percents. They are nearly the same as: 100 minus the correlation between answers in the original interview and the reinterview. For example, an inconsistency of 20 means a correlation of 80 percent, which is good. This is the correlation between answers to the same question, usually from the same respondents, a month apart. Wrong answers make results wrong, and mean that data on groups, for example income groups, are infected with data from people who really are not like the group at all. Readers should be wary of drawing firm conclusions from items with high inconsistency.

**Coverage errors.** Each home in the AHS-N sample represents a large number of other homes. However, because of incomplete sampling lists (i.e., undercoverage) the homes in the survey do not represent all homes in the country. Therefore, the raw numbers from the survey are raised proportionally so that the numbers published here match independent estimates of the total number of homes. These independent estimates are based on the 1990 Census of Housing, plus changes since then. Housing unit undercoverage is about 1.9 percent. Table A lists units that have known coverage deficiencies.

Table A. **Undercoverage Units**

| Type of unit | Reason for undercoverage |
|---|---|
| Mobile homes. . . . . | Poor coverage of new mobile home parks in address enumeration districts |
| Conventional new construction . . . . . | Permits issued fewer than 6 months before interviewing are not considered |
| New construction in special places . . . . . | Not covered in either permit or nonpermit areas |
| Whole structure additions . . . . . | These units are chosen with the aid of screening questions. Eligible units could be missed and ineligible units included because of incorrect answers to the screening questions. |
| Conversions from nonresidential units. . | Nonresidential units at the time of the 1980 census which converted to residential units were missed. |

**Incomplete data.** Incomplete data happen because sampling lists are incomplete; and because people refuse the interview or some of the questions, or do not know answers. Table 2 (at the end of this appendix) shows which items have the least complete data. These are primarily items that people forget or consider personal: mortgages, other housing costs, and income. The computer may assign or ''impute'' values for these items. We do not know how close the imputed values are to the actual values. Incompleteness can cause large errors, since when even 10 percent of homes are missed by a particular question, they represent about 10 million homes which have to be estimated, on little or no basis (100 million homes are in the U.S.). The survey estimates them by assuming that they are like some group of homes which did give data, an assumption which is never exactly true. Thus, it is not surprising that large nonsampling errors are possible when the survey has data for only 50 to 90 percent of homes for particular items, as

shown in table 3. Again readers should be wary of items with highly incomplete data.[1]

**Effect on income.** The nonsampling errors interact particularly badly for income. It is inconsistently answered (table 1), incompletely answered (table 2), and the totals fall short of totals known from the National Income Accounts, especially for the elderly.[2]

## SAMPLING ERRORS

**Definition.** Error from sampling reflects how estimates from a sample vary from the actual value. (Note: ''actual value'' means the value that would appear if all housing units had been interviewed, under the same conditions, rather than only a sample. A confidence interval is a range which contains our estimate with a specified probability.)

**Counts.** Most numbers in this book are counts of housing units (e.g., units with basements or units with an elderly person). These counts have error from sampling. Table B gives a convenient list of errors for a range of numbers. These errors are an overestimate for most items. To get a more accurate answer, use the appropriate formula shown in tables 4a and 4b (at the end of this appendix). As with the other types of errors, readers should be wary of numbers with large errors from sampling.

Table B. **Errors From Sampling to Compute a 90-Percent Confidence Interval**

| When this book lists one of the following numbers— | The chances are 90 percent that the actual value is inside the range of plus or minus— |
|---|---|
| 0 | 3 |
| 10 | 10 |
| 100 | 33 |
| 500 | 72 |
| 1,000 | 102 |
| 2,500 | 159 |
| 5,000 | 223 |
| 10,000 | 307 |
| 25,000 | 446 |
| 50,000 | 525 |
| 75,000 | 482 |
| 90,000 | 385 |
| 100,000 | 261 |

Source: These errors were computed based on a formula in table 4a or 4b with high error. This table represents a conservative example. The numbers are in thousands.

The error from sampling cannot be known exactly. We approximate it using the following formula for constructing a 90-percent confidence interval:

$$1.64 \times \sqrt{3.85 \times A - .000036 \times A^2}$$

where A is a number (a count of units) in this book.

This formula is an overestimate for most items. To get a more accurate estimate, use the appropriate formula in table 4a or 4b.

For example if A is 200:

$$1.64 \times \sqrt{3.85 \times 200 - .000036 \times 200 \times 200} = 45$$

The 90-percent confidence interval can then be formed by adding and subtracting this error to the survey estimate of 200 (i.e., 200 ± 45). Statements such as ''the actual value is in the range 200 ± 45 (155 to 245),'' are right 90 percent of the time and wrong 10 percent of the time.[3]

Numbers in the book are printed in thousands, so 200 means 200,000. The formulas are designed to use numbers directly from the book; do not add zeros. The result is also in thousands, so 45 means 45,000.

**Percents.** Any subgroup can be shown as a percent of a larger group. The error from sampling for a 90-percent confidence interval for this percent is:

$$1.64 \times \sqrt{3.85\ P\ (100 - P)\ /A}$$

where P is the percent; A is the denominator, or base of the percent.[4]

This formula is an overestimate for most items. To get a more accurate estimate, replace the first number under the square root sign with the first number under the square root sign of the appropriate formula in table 4a or 4b.

For example, the error from sampling for a 90-percent confidence interval for 40 percent of 200 (meaning 200,000) is:

$$1.64 \times \sqrt{3.85 \times 40 \times 60/200} = 11.1$$

Statements such as ''the actual percent is in the range 28.9 percent to 51.1 percent'' are right 90 percent of the time. This formula is an overestimate for most items. To get a more accurate estimate, change the first number under the square root sign here, 3.85, to the first number given under the square root sign of the appropriate formula in table 4a or 4b.

[1]Statistical note: The paper, *How Response Error, Missing Data and Undercoverage Bias Survey Data*, estimates that 90 percent of errors from incomplete data are less than: 200 + .58 x (lesser of A or 100,000 − A), where A is any count published in this book (in thousands, result also in thousands). Weights are adjusted to reduce these errors, but it is not known how much error remains. *How Response Error, Missing Data and Undercoverage Bias Survey Data* is available from HUD User at the address in the ''Explanations and Cautions'' section at the front of this book.

[2]Data are in the *Codebook for the American Housing Survey*, available from HUD User at the address in the ''Explanations and Cautions'' section at the front of this book.

[3]The formula in the text is based on 1.64 times the error from sampling. This formula gives ''90-percent confidence interval errors.'' For 95-percent confidence interval errors multiply by 1.96 instead of 1.64; for 99-percent confidence multiply by 2.58 instead of 1.64.

[4]This formula is actually $1.64 \times \sqrt{(p(100-p)/n)}$, since 3.85/A adjusts the data to the effective sample size.

Note that when a ratio C/D is computed where C is *not* a subgroup of D (for example, the number of Hispanics as a ratio of the number of Blacks) the error from sampling is different. The error from sampling for a 90-percent confidence interval for a ratio C/D[5] is:

$$(C/D)\sqrt{((\text{error for C})/C)^2 + ((\text{error for D})/D)^2}$$

**Medians.** The following steps calculate the error from sampling for a 90-percent confidence interval for medians.[6]

| Steps for calculations | The formula | An example | Your data |
|---|---|---|---|
| How many total units is the median based on (in thousands, exclude "not reported" and "don't know")? | A | 200 | ___ |
| What are the end-points of the category the median is in? | X - Y | $50-74 | ___ |
| What is the width of this category (in dollars, rooms, or whatever the item measures)? | W | $25 | ___ |
| How many housing units are in this median category (in thousands)? | B | 30 | ___ |
| Then the error from sampling for the median is approximately:[7] | $\frac{1.8x\ W\ x\ \sqrt{A}}{B}$ | $\frac{1.8\ x\ 25\ x\sqrt{200}}{30}$ = 21 | ___ |
| The 90-percent confidence interval for the median is: | median $\pm\frac{1.8x\ W\ x\ \sqrt{A}}{B}$ | median ± $21 | ___ |

[5]The error for C should be interpreted as the error for a 90-percent confidence interval for C. Likewise, the error for D should be interpreted as the error for a 90-percent confidence interval for D.

[6]For small bases use the more accurate approach in table 5.

[7]The factor 1.8 is a conservative estimate for most items. For a better approximation, find the appropriate formula in table 4 and divide the first number under the square root sign by 3.85. Take the square root of this answer and multiply by 1.8 to get your factor.

**Differences.** Two numbers from this book, like 34 and 40 or 40 percent and 45 percent have a "statistically significant difference" if their ranges of error from sampling for a 90-percent confidence interval do not overlap. When ranges of error for a 90-percent confidence interval do overlap, numbers are still statistically different if the result of subtracting one from the other is more than[8]:

$$\sqrt{(\text{error for 1st number})^2 + (\text{error for 2nd number})^2}$$

For example, if the first number is 34 and the second number is 40 with an error of 20, then the 90-percent confidence interval error for this difference of 6 is:

$$\sqrt{19^2 + 20^2} = 28$$

Since the difference is less than this error, these two numbers are not statistically different.

[8]Error for first number should be interpreted as the error for a 90-percent confidence interval for the first number. Likewise, error for second number should be interpreted as the error for a 90-percent confidence interval for the second number.

Table 1. **Different Answers a Month Apart**

| Item | When measured[1] | Level of inconsistency | Confidence interval[2] |
|---|---|---|---|
| Other kinds of heating equipment (central warm-air) | 89-MS | 91 | [73-100] |
| Mortgage payment include anything else (first mortgage) | 90-MS | 90 | [72-111] |
| Water came in from other places | 89-MS | 81 | [64-100] |
| Moved for other, financial/employment | 85-MS | 80 | (62-104) |
| Moved for other, housing related | 85-MS | 79 | (65-97) |
| Police protection problem in neighborhood | 89-MS | 78 | [63-95] |
| Poor city/county service in neighborhood | 89-MS | 78 | [63-95] |
| Moved for other reason | 85-MS | 73 | (64-85) |
| Moved for better quality house | 85-MS | 69 | (58-82) |
| Moved because other family/personal related | 85-MS | 68 | (54-86) |
| Cost for water supply and sewage disposal | 81-N | 68 | (61-76) |
| Other problem in neighborhood | 89-MS | 67 | [61-74] |
| Undesirable industries/businesses in neighborhood | 89-MS | 66 | [54-82] |
| Rats | 89-MS | 65 | [54-69] |
| Noise in neighborhood | 89-MS | 64 | [57-72] |
| Other kinds of heating equipment (none) | 89-MS | 63 | [60-67] |
| Peeling paint on the ceiling | 81-N | 63 | (49-80) |
| Other kinds of heating equipment (unvented room) | 89-MS | 62 | [45-86] |
| How LIKELY to move to place prefer to live in 5 years | 85-MS | 62 | (54-71) |
| How LIKELY to still be living in this unit in 5 years | 85-MS | 60 | (49-74) |
| Gross income | 82-MS | 59 | not available |
| Open cracks or holes in building | 81-N | 58 | (47-72) |
| Electric fuses or breaker switches blown | 81-N | 58 | (50-68) |
| Other major repairs over $500 each—repair done | 85-MS | 57 | (50-64) |
| People in neighborhood | 89-MS | 57 | [52-62] |
| Central air conditioning/dehumidifier | 80-N | 56 | not available |
| Satisfactory police protection | 77-N | 55 | (49-62) |
| Moved for lower rent or less expensive house to maintain | 85-MS | 55 | (43-70) |
| Broken plaster or peeling paint | 89-MS | 55 | [46-65] |
| Water came in from walls, doors, windows | 89-MS | 55 | [45-67] |
| A working electric wall outlet | 77-N | 55 | (42-71) |
| Other kinds of heating equipment (fireplace with no insert) | 89-MS | 54 | [49-59] |
| Shopping | 77-N | 54 | (47-61) |
| Broken plaster on the ceiling | 81-N | 53 | (40-70) |
| Water came in from roof | 89-MS | 53 | [46-60] |
| Payments the same during whole length of the mortgage | 85-MS | 52 | (46-59) |
| Litter in neighborhood | 89-MS | 51 | [44-60] |
| Main reason moved | 85-MS | 51 | (47-55) |
| Which best describes place at that time | 85-MS | 51 | (46-55) |
| Yearly cost for garbage | 81-N | 51 | (43-62) |
| Rate the place (10 categories) | 89-MS | 51 | [49-53] |
| Other major repairs over $500 each—someone in household do work | 85-MS | 51 | (36-72) |
| Other kinds of heating equipment (other built-in electric) | 89-MS | 50 | [38-66] |
| Holes in the floors | 81-N | 50 | (33-74) |
| Oil, coal, kerosene, wood and any other fuel cost | 81-N | 50 | (40-64) |
| Type of vacant | 81-N | 50 | (38-65) |
| Central air fuel | 85-N | 50 | (40-63) |
| At age 16, live in this area/different place | 85-MS | 50 | (44-57) |
| Public transportation | 77-N | 50 | (44-56) |
| Cookstove or range with oven | 85-N | 50 | (39-64) |
| Traffic in neighborhood | 89-MS | 49 | [43-54] |
| Moved to establish own household | 85-MS | 48 | (38-59) |
| Rate the place (categories 1-6 combined) | 89-MS | 48 | [46-51] |
| Other kinds of heating equipment (portable electric) | 89-MS | 47 | [41-54] |
| Real estate taxes | 81-N | 47 | (33-67) |

See footnotes at end of table.

Table 1. **Different Answers a Month Apart**—Con.

| Item | When measured[1] | Level of inconsistency | Confidence interval[2] |
|---|---|---|---|
| Central air conditioning/none | 80-N | 47 | not available |
| Crime in neighborhood | 89-MS | 47 | [41-53] |
| Any additions built—repair done | 85-MS | 46 | (35-61) |
| Water came in from basement | 89-MS | 45 | [38-55] |
| Moved to change from owner to renter/renter to owner | 85-MS | 44 | (36-55) |
| Number of living rooms | 85-N | 44 | (33-57) |
| Major equipment, such as furnace or central air replace/added—repair done | 85-MS | 44 | (35-55) |
| Five years from now, would you prefer living in this area or someplace else | 80-N | 44 | (32-60) |
| Water leaked into home from outdoors | 89-MS | 43 | [39-47] |
| Rate the place (four combined categories) | 89-MS | 43 | [41-46] |
| Other kinds of heating equipment (fireplace with insert) | 89-MS | 43 | [35-52] |
| Concealed wiring | 89-MS | 43 | [33-57] |
| Siding replaced or added in last 2 years—repair done | 85-MS | 42 | (32-56) |
| Heat breakdown | 89-MS | 41 | [30-56] |
| Yearly cost of insurance (reported in $100 increments to $1,000) | 89-MS | 41 | [38-44] |
| Moved to be closer to school/work | 85-MS | 41 | (32-53) |
| Heating equipment broke down for 6 hours or more | 89-MS | 41 | [30-56] |
| Cost for real estate taxes | 81-N | 40 | (35-46) |
| Central air conditioning/portable fan | 80-N | 40 | not available |
| Public elementary school satisfactory | 89-MS | 40 | [34-47] |
| Mice or rats or signs of | 76-N | 40 | not available |
| House/apartment cold for 24 hours | 89-MS | 40 | [36-45] |
| Current mortgage same year as bought home | 85-MS | 39 | (27-56) |
| Prefer to be living in another home in this area in 5 years | 85-MS | 38 | (31-48) |
| Anything about the neighborhood that bothers you | 89-MS | 38 | [35-41] |
| Change in taxes/insurance/principal balance | 85-MS | 37 | (28-51) |
| Other kinds of heating equipment (stove) | 89-MS | 36 | [28-47] |
| Bathrooms remodeled or added—repair done | 85-MS | 35 | (28-45) |
| Married, widowed, divorced, or separated | 85-MS | 35 | not available |
| Costs for gas for the month of August | 89-N | 35 | [24-54] |
| All or part of roof replaced in last 2 years—repair done | 85-MS | 35 | (29-42) |
| New storm doors or storm windows bought and installed—repair done | 85-MS | 33 | (27 41) |
| Moved because needed larger house or apartment | 85-MS | 33 | (26-41) |
| Number of other rooms | 85-N | 32 | (28-38) |
| Kitchen remodeled or added—repair done | 85-MS | 32 | (25-41) |
| Insulation added—repair done | 85-MS | 32 | (25-44) |
| House and lot sell on today's market | 90-MS | 31 | [29-34] |
| Moved for new job or job transfer | 85-MS | 30 | (22-39) |
| Average monthly cost for gas | 89-N | 29 | [23-37] |
| Average monthly cost for electricity | 89-N | 28 | [24-34] |
| Number of dining rooms | 85-N | 27 | (24-29) |
| Type of mortgage (for the first mortgage/loan) (non-CATI) | 89-N | 27 | [21-36] |
| Change based on interest rates | 85-MS | 26 | (18-38) |
| Year the building was built | 85-MS | 25 | not available |
| All or part of roof replaced in last 2 years—someone in household do work | 85-MS | 25 | (15-44) |
| Number of family rooms | 85-N | 25 | (21-30) |
| Mortgage payment include homeowner's insurance (first mortgage) | 90-MS | 24 | [21-27] |
| Prefer to be living in this house/apartment/someplace else | 85-MS | 24 | (20-29) |
| Clothes washer age | 85-N | 22 | (19-25) |
| Any other rooms | 85-N | 22 | (20-25) |
| How many years for mortgage | 85-MS | 22 | (17-29) |
| New storm doors/windows bought/installed—someone in household do work | 85-MS | 19 | (11-35) |
| Attend a public school or a private school | 89-MS | 19 | [15-25] |
| Oven/cooking burner age | 85-N | 18 | (16-21) |
| Heating equipment broke | 89-MS | 18 | [9-34] |

See footnotes at end of table.

Table 1. **Different Answers a Month Apart**—Con.

| Item | When measured[1] | Level of inconsistency | Confidence interval[2] |
|---|---|---|---|
| Clothes dryer age | 85-N | 18 | (15-21) |
| Refrigerator age | 85-N | 18 | (16-20) |
| Garbage disposal age | 85-N | 18 | (15-22) |
| Insulation added—someone in household do work | 85-MS | 16 | (8-33) |
| Monthly payment (first mortgage) | 90-MS | 16 | [14-18] |
| Number of half bathrooms | 85-N | 16 | (14-18) |
| New storm doors or storm windows bought and installed—job cost | 85-MS | 15 | (8-32) |
| New assumed mortgage | 85-MS | 15 | (11-22) |
| Mortgage payment include property tax (first mortgage) | 90-MS | 15 | [12-18] |
| How much was borrowed | 85-MS | 14 | (11-18) |
| Monthly payment (for first mortgage/loan) (non-CATI) | 89-N | 14 | [11-19] |
| Dishwasher age | 85-N | 14 | (11-17) |
| Where was mortgage borrowed (non-CATI) | 89-N | 13 | [7-28] |
| Mortgage on this house/apartment | 90-MS | 13 | [11-15] |
| How much was borrowed (for the first mortgage/loan)? (non-CATI) | 89-N | 13 | [10-17] |
| Have property insurance | 89-MS | 12 | [10-14] |
| Clothes dryer fuel | 85-N | 12 | (9-14) |
| Number of room air conditioners | 85-N | 11 | (9-15) |
| Interest rate on the mortgage (for the first mortgage/loan) (non-CATI) | 89-N | 10 | [7-15] |
| Room air conditioners | 85-N | 10 | (8-12) |
| Kitchen remodeled or added—someone in household do work | 85-MS | 9 | (3-26) |
| Living quarters | 85-N | 8 | (6-9) |
| Clothes washer | 85-N | 8 | (6-9) |
| Number of units in building | 85-N | 8 | (6-9) |
| Number of bedrooms | 85-N | 7 | (6-8) |
| Number of full bathrooms | 85-N | 6 | (5-8) |
| Dishwasher | 85-N | 6 | (5-7) |
| Cooking fuel | 85-N | 5 | (4-6) |
| Clothes dryer | 85-N | 5 | (4-7) |
| Number of apartments | 85-N | 5 | (4-8) |
| Garbage disposal | 85-N | 5 | (4-7) |
| Central air conditioning | 85-N | 5 | (4-6) |

[1]This notation consists of the year followed by the survey from which the item was measured. For example, 89-MS means that the item was measured during the 1989 AHS-Metropolitan Survey (MS) and 81-N means that the item was measured during the 1981 AHS-National (N) Survey.

[2]The confidence intervals enclosed by square brackets are at the 90-percent significance level, all others are at the 95-percent significance level. The confidence intervals for the years prior to 1989 have a significance level of 95 percent, since that time it has been the policy of the U.S. Bureau of the Census to publish a 90-percent significance level for all testing.

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# Table 2. Completeness Rates for Characteristics

[See completeness rates under nonsampling errors in appendix D for further details. ... means not applicable or sample too small. - means zero or rounds to zero.]

| | Characteristics | Total occupied units | Tenure | | Housing unit characteristics | | | | Household characteristics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Physical problems | | | | | | |
| | | | Owner | Renter | New construction 4 yrs | Mobile homes | Severe | Moderate | Black | Hispanic | Elderly (65+) | Moved in past year | Below poverty level |
| 1 | Total occupied housing units (000's) | 94 724 | 61 252 | 33 472 | 4 990 | 5 655 | 1 901 | 4 225 | 11 128 | 6 614 | 20 438 | 16 102 | 13 787 |
| 2 | Completeness of sampling lists (percent)[1] | 96 | 99 | 97 | 81 | 92 | 98 | 98 | 89 | 100 | 100 | 95 | 98 |
| 3 | All interviews[2,3] | 93 | 94 | 93 | 74 | 89 | 93 | 94 | 85 | 96 | 98 | 90 | 93 |
| 4 | Current total loan as percent of value | 39 | 39 | ... | 46 | 29 | 28 | 35 | 30 | 42 | 31 | 62 | 26 |
| 5 | Total outstanding principal amount | 41 | 41 | ... | 49 | 34 | 30 | 38 | 33 | 46 | 35 | 65 | 29 |
| 6 | Income sources of families and primary individuals | 52 | 49 | 56 | 54 | 59 | 47 | 58 | 47 | 55 | 57 | 63 | 59 |
| 7 | Land rent fee | 59 | 59 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 8 | Mobile home park fee | 66 | 66 | ... | ... | 66 | ... | ... | ... | ... | 89 | ... | ... |
| 9 | Lot size | 68 | 74 | 40 | 56 | 59 | 65 | 62 | 45 | 49 | 76 | 48 | 54 |
| 10 | Ratio of value to current income | 68 | 68 | ... | 55 | 59 | 61 | 64 | 56 | 68 | 61 | 65 | 47 |
| 11 | Annual taxes paid per $5000 value | 69 | 69 | ... | 50 | 54 | 62 | 59 | 51 | 60 | 68 | 49 | 51 |
| 12 | Mobile home site placement | 70 | 76 | 46 | 44 | 70 | 62 | 63 | 69 | 58 | 82 | 45 | 65 |
| 13 | Monthly housing costs as percent of income | 72 | 72 | 72 | 57 | 69 | 70 | 74 | 64 | 77 | 68 | 70 | 64 |
| 14 | Light fixtures in public halls | 73 | 74 | 72 | 61 | ... | 78 | 74 | 66 | 81 | 74 | 74 | 73 |
| 15 | Previous occupancy | 75 | 79 | 66 | 71 | 70 | 71 | 67 | 62 | 69 | 77 | 69 | 67 |
| 16 | Household income | 76 | 76 | 78 | 60 | 74 | 76 | 80 | 69 | 83 | 74 | 76 | 70 |
| 17 | Income of families and primary individuals | 76 | 76 | 77 | 60 | 74 | 75 | 79 | 69 | 82 | 74 | 75 | 69 |
| 18 | Square feet per person | 76 | 78 | 68 | 67 | 81 | 71 | 68 | 57 | 72 | 77 | 72 | 69 |
| 19 | Household income as percent of poverty level | 76 | 76 | 78 | 60 | 74 | 76 | 80 | 69 | 83 | 74 | 76 | 70 |
| 20 | Square footage of unit | 76 | 78 | 68 | 67 | 81 | 71 | 68 | 57 | 72 | 77 | 72 | 69 |
| 21 | Units using each fuel | 77 | 80 | 70 | 63 | 76 | 71 | 74 | 66 | 73 | 79 | 66 | 70 |
| 22 | Average monthly cost for real estate taxes | 77 | 77 | ... | 54 | 66 | 74 | 74 | 60 | 68 | 83 | 53 | 67 |
| 23 | Value | 79 | 79 | ... | 65 | 67 | 73 | 71 | 68 | 77 | 76 | 75 | 65 |
| 24 | Property insurance paid | 79 | 76 | 85 | 60 | 78 | 81 | 84 | 73 | 85 | 81 | 81 | 80 |
| 25 | Monthly payment for principal and interest | 79 | 79 | ... | 64 | 72 | 76 | 83 | 73 | 79 | 78 | 75 | 67 |
| 26 | Monthly cost paid for water | 80 | 77 | 83 | 61 | 81 | 84 | 76 | 70 | 80 | 83 | 75 | 78 |
| 27 | Monthly cost paid for piped gas | 81 | 82 | 78 | 64 | 79 | 80 | 79 | 71 | 79 | 85 | 71 | 77 |
| 28 | Monthly cost paid for bottled gas | 81 | 82 | 78 | 64 | 79 | 80 | 79 | 71 | 79 | 85 | 71 | 77 |
| 29 | Purchase price | 82 | 82 | ... | 68 | 77 | 78 | 79 | 71 | 81 | 81 | 79 | 71 |
| 30 | Remaining years mortgaged | 82 | 82 | ... | 71 | 71 | 78 | 80 | 74 | 81 | 77 | 81 | 70 |
| 31 | Payment plan of secondary mortgage | 82 | 82 | ... | 71 | 77 | 81 | 69 | 74 | 73 | 80 | 79 | 79 |
| 32 | Household moves and formation in last year | 82 | 83 | 82 | 64 | 77 | 79 | 79 | 71 | 80 | 92 | 80 | 79 |
| 33 | Adult and single children < 18 years old | 84 | 84 | 85 | 67 | 81 | 84 | 84 | 75 | 83 | 94 | 83 | 83 |
| 34 | Amount of savings and investments | 84 | 83 | 85 | 57 | 83 | 87 | 88 | 80 | 90 | 88 | 83 | 83 |
| 35 | Severe physical problems | 84 | 86 | 80 | 68 | 82 | 81 | 83 | 75 | 86 | 87 | 76 | 79 |
| 36 | Owner or manager on property | 84 | ... | 84 | 65 | ... | 85 | 83 | 76 | 88 | 88 | 81 | 83 |
| 37 | Reasons for leaving previous unit | 84 | 81 | 85 | 67 | 76 | 81 | 86 | 75 | 89 | 84 | 85 | 84 |
| 38 | Current interest rate | 85 | 85 | ... | 67 | 70 | 85 | 84 | 77 | 84 | 90 | 79 | 84 |
| 39 | Selected amenities | 85 | 87 | 82 | 68 | 81 | 82 | 81 | 75 | 84 | 91 | 79 | 83 |
| 40 | Nonrelatives' shared housing costs | 85 | 84 | 86 | 65 | 82 | 83 | 86 | 72 | 90 | 89 | 85 | 85 |
| 41 | Term of primary mortgage at origination or assumption | 85 | 85 | ... | 72 | 72 | 82 | 85 | 77 | 84 | 82 | 82 | 75 |
| 42 | Other buildings vandalized or with interior exposed | 85 | 84 | 85 | 68 | ... | 88 | 86 | 77 | 94 | 85 | 86 | 85 |
| 43 | Payment plan of primary mortgage | 85 | 85 | ... | 71 | 72 | 82 | 85 | 77 | 84 | 82 | 82 | 75 |
| 44 | Monthly housing costs | 86 | 86 | 85 | 69 | 82 | 85 | 86 | 77 | 89 | 87 | 82 | 81 |
| 45 | Monthly cost paid for trash | 86 | 85 | 87 | 67 | 84 | 88 | 83 | 76 | 86 | 90 | 81 | 84 |
| 46 | Home search | 86 | 83 | 87 | 69 | 78 | 86 | 89 | 77 | 93 | 88 | 87 | 86 |
| 47 | Repairs, improvements, alterations in last 2 years | 86 | 86 | ... | 71 | 83 | 83 | 86 | 78 | 84 | 92 | 77 | 84 |
| 48 | Common stairways | 86 | 86 | 86 | 71 | ... | 89 | 87 | 78 | 95 | 86 | 86 | 85 |
| 49 | External building conditions | 86 | 86 | 86 | 69 | ... | 89 | 87 | 79 | 95 | 86 | 87 | 86 |
| 50 | Conditions of streets | 86 | 86 | 86 | 70 | ... | 89 | 86 | 79 | 96 | 86 | 87 | 86 |
| 51 | Stories in structure | 86 | 85 | 86 | 69 | ... | 88 | 86 | 79 | 95 | 86 | 87 | 85 |
| 52 | Trash, litter or junk on streets or any properties | 86 | 86 | 86 | 70 | ... | 89 | 88 | 79 | 96 | 86 | 87 | 88 |
| 53 | Stories between main and apartment entrances | 86 | 85 | 86 | 71 | ... | 90 | 87 | 78 | 95 | 86 | 87 | 85 |
| 54 | Condominium and cooperative fee | 86 | 86 | ... | 75 | ... | ... | ... | 75 | 89 | 91 | 80 | 86 |
| 55 | Age of other residential buildings within 300 feet | 86 | 86 | 86 | 69 | ... | 89 | 87 | 79 | 95 | 86 | 87 | 86 |
| 56 | Description of area within 300 feet | 86 | 86 | 86 | 70 | ... | 89 | 87 | 79 | 96 | 86 | 87 | 86 |
| 57 | Homeowners association fee | 86 | 86 | ... | 75 | ... | ... | ... | 77 | 86 | 91 | 80 | 83 |
| 58 | Mobile homes in group | 86 | 85 | 88 | 44 | 86 | 84 | 91 | 80 | 85 | 91 | 77 | 90 |
| 59 | Recent mover comparison to previous neighborhood | 87 | 84 | 88 | 70 | 79 | 85 | 90 | 78 | 94 | 88 | 88 | 87 |
| 60 | Recent mover comparison to previous home | 87 | 84 | 88 | 70 | 79 | 85 | 90 | 78 | 94 | 88 | 88 | 87 |
| 61 | Type of primary mortgage | 87 | 87 | ... | 71 | 75 | 86 | 88 | 79 | 83 | 88 | 82 | 78 |
| 62 | Persons other than spouse or children | 87 | 87 | 87 | 69 | 81 | 87 | 88 | 81 | 92 | 87 | 85 | 87 |
| 63 | Structure type of previous residence | 87 | 85 | 88 | 70 | 79 | 87 | 88 | 78 | 94 | 90 | 87 | 87 |
| 64 | Tenure of previous residence | 87 | 86 | 88 | 70 | 79 | 88 | 89 | 78 | 94 | 90 | 87 | 87 |
| 65 | Choice of present home | 87 | 84 | 88 | 70 | 79 | 87 | 90 | 78 | 94 | 87 | 88 | 87 |
| 66 | Neighborhood search | 87 | 84 | 88 | 70 | 79 | 86 | 90 | 78 | 94 | 88 | 88 | 87 |
| 67 | Monthly cost paid for electricity | 87 | 87 | 86 | 69 | 83 | 89 | 88 | 79 | 90 | 91 | 78 | 84 |
| 68 | Choice of present neighborhood | 87 | 84 | 88 | 69 | 79 | 85 | 91 | 77 | 93 | 88 | 88 | 87 |
| 69 | Items included in primary mortgage payment | 87 | 87 | ... | 72 | 77 | 86 | 89 | 80 | 85 | 89 | 82 | 79 |
| 70 | Year primary mortgage originated | 88 | 88 | ... | 73 | 77 | 88 | 88 | 81 | 87 | 90 | 83 | 81 |
| 71 | Monthly cost paid for other fuels | 88 | 88 | 88 | 69 | 83 | 87 | 89 | 81 | 90 | 93 | 84 | 86 |
| 72 | Lenders of primary and secondary mortgages | 88 | 88 | ... | 72 | 77 | 87 | 88 | 80 | 85 | 89 | 82 | 80 |

[1]Completeness of sampling lists: A small part of the total HU's in the U.S. is not represented in the AHS sample. This undercoverage occurs from imperfections in the sampling frame. We use weighting adjustments to account for these units. There are two main sources of undercoverage: (1) Deficiencies in sampling lists used for AHS (e.g.,1980 census or permit lists), and (2) Errors in the field resulting in completely overlooking certain HU's that belong in sample. The rate represents the proportion of HU's in the U.S. that are covered by the AHS sample frames.

[2]All interviews: A type A noninterview results when the interviewer is unable to obtain the necessary information to complete an interview from an occupied unit. We adjust the weights of interviewed units which most closely resemble type A noninterviews to help reduce the bias from these cases. The interview rate reflects the completeness of the sampling lists as well as the type A noninterviews.

[3]Compared to the 1991 publication, we switched rows 2 and 3. Type A noninterview rate (line 2 in 1991) is titled "All interviews" (line 3 in 1993). Undercoverage rate (line 3 in 1991) is titled "Completeness of sampling lists (percent)" (line 2 in 1993).

| Total occupied units | In (P)MSAs | | Outside (P)MSAs | Urban | | Rural | | | | Regions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Central cities | Suburbs | | Total | Outside (P)MSAs | Total | Suburbs | Outside (P)MSAs | Farm | Northeast | Midwest | South | West | |
| 94 724 | 29 838 | 44 060 | 20 826 | 69 090 | 7 741 | 25 633 | 12 368 | 13 085 | 1 423 | 18 906 | 23 031 | 32 936 | 19 850 | 1 |
| 98 | 98 | 99 | 99 | 98 | 99 | 98 | 98 | 98 | 100 | 100 | 99 | 96 | 97 | 2 |
| 93 | 92 | 93 | 95 | 93 | 95 | 94 | 93 | 95 | 96 | 97 | 94 | 92 | 91 | 3 |
| 39 | 40 | 38 | 38 | 40 | 43 | 36 | 37 | 35 | 32 | 37 | 40 | 41 | 35 | 4 |
| 41 | 42 | 40 | 40 | 42 | 45 | 39 | 39 | 38 | 39 | 39 | 42 | 43 | 37 | 5 |
| | | | | | | | | | | | | | | 6 |
| 52 | 49 | 45 | 69 | 48 | 69 | 62 | 54 | 69 | 68 | 51 | 51 | 57 | 44 | |
| 59 | ... | ... | ... | 68 | ... | 47 | ... | ... | ... | ... | ... | 67 | ... | 7 |
| 66 | ... | 60 | 38 | 78 | ... | 51 | ... | 30 | ... | ... | 43 | 73 | 72 | 8 |
| 68 | 57 | 71 | 74 | 63 | 64 | 78 | 78 | 79 | 87 | 78 | 70 | 68 | 60 | 9 |
| 68 | 66 | 69 | 66 | 69 | 69 | 66 | 67 | 65 | 57 | 69 | 72 | 66 | 67 | 10 |
| 69 | 66 | 70 | 67 | 70 | 71 | 67 | 67 | 66 | 56 | 75 | 74 | 63 | 66 | 11 |
| 70 | 63 | 71 | 70 | 68 | 63 | 71 | 70 | 71 | 76 | 81 | 65 | 73 | 62 | 12 |
| 72 | 71 | 73 | 73 | 72 | 73 | 73 | 72 | 73 | 69 | 73 | 73 | 71 | 72 | 13 |
| 73 | 72 | 74 | 71 | 73 | 70 | 73 | 72 | 73 | ... | 84 | 64 | 68 | 71 | 14 |
| 75 | 71 | 77 | 73 | 74 | 69 | 77 | 80 | 74 | 75 | 84 | 73 | 74 | 73 | 15 |
| 76 | 75 | 76 | 78 | 76 | 79 | 77 | 76 | 78 | 75 | 77 | 77 | 76 | 76 | 16 |
| 76 | 75 | 76 | 78 | 76 | 78 | 77 | 76 | 78 | 75 | 76 | 77 | 75 | 76 | 17 |
| 76 | 72 | 79 | 75 | 75 | 71 | 78 | 80 | 77 | 77 | 76 | 75 | 75 | 80 | 18 |
| 76 | 75 | 76 | 78 | 76 | 79 | 77 | 76 | 78 | 75 | 77 | 77 | 76 | 76 | 19 |
| 76 | 72 | 79 | 75 | 75 | 71 | 78 | 80 | 77 | 77 | 76 | 75 | 75 | 80 | 20 |
| 77 | 73 | 78 | 79 | 75 | 78 | 79 | 79 | 80 | 81 | 80 | 78 | 76 | 73 | 21 |
| 77 | 73 | 78 | 80 | 76 | 80 | 78 | 77 | 79 | 78 | 85 | 83 | 71 | 72 | 22 |
| 79 | 79 | 81 | 77 | 81 | 81 | 76 | 78 | 75 | 64 | 82 | 83 | 76 | 77 | 23 |
| 79 | 80 | 77 | 82 | 79 | 82 | 80 | 78 | 81 | 76 | 84 | 79 | 77 | 77 | 24 |
| 79 | 79 | 79 | 80 | 79 | 83 | 79 | 78 | 79 | 67 | 80 | 83 | 78 | 74 | 25 |
| 80 | 76 | 82 | 78 | 78 | 67 | 85 | 84 | 85 | 90 | 91 | 81 | 73 | 76 | 26 |
| 81 | 78 | 81 | 84 | 79 | 83 | 84 | 84 | 85 | 86 | 85 | 79 | 83 | 74 | 27 |
| 81 | 76 | 81 | 84 | 79 | 83 | 84 | 84 | 85 | 86 | 85 | 79 | 83 | 74 | 28 |
| 82 | 82 | 82 | 82 | 83 | 85 | 81 | 81 | 80 | 79 | 85 | 86 | 80 | 79 | 29 |
| 82 | 82 | 83 | 81 | 83 | 85 | 81 | 82 | 79 | 76 | 85 | 86 | 80 | 78 | 30 |
| 82 | 81 | 83 | 78 | 81 | 73 | 83 | 84 | 80 | ... | 86 | 85 | 78 | 78 | 31 |
| 82 | 82 | 83 | 83 | 83 | 84 | 82 | 81 | 82 | 82 | 87 | 84 | 79 | 82 | 32 |
| 84 | 84 | 84 | 87 | 84 | 86 | 85 | 84 | 87 | 88 | 89 | 86 | 83 | 81 | 33 |
| 84 | 84 | 82 | 87 | 83 | 87 | 86 | 84 | 87 | 83 | 88 | 82 | 84 | 83 | 34 |
| 84 | 82 | 85 | 86 | 83 | 83 | 87 | 86 | 88 | 91 | 88 | 84 | 84 | 81 | 35 |
| 84 | 84 | 85 | 86 | 84 | 85 | 86 | 85 | 88 | ... | 92 | 82 | 79 | 84 | 36 |
| 84 | 84 | 84 | 85 | 84 | 87 | 83 | 83 | 83 | 82 | 89 | 82 | 82 | 86 | 37 |
| 85 | 85 | 85 | 82 | 86 | 84 | 83 | 84 | 81 | 85 | 90 | 89 | 81 | 82 | 38 |
| 85 | 83 | 86 | 86 | 85 | 85 | 86 | 86 | 86 | 87 | 92 | 87 | 82 | 82 | 39 |
| 85 | 85 | 85 | 85 | 85 | 84 | 85 | 85 | 85 | ... | 87 | 83 | 84 | 87 | 40 |
| | | | | | | | | | | | | | | 41 |
| 85 | 85 | 86 | 86 | 86 | 88 | 85 | 86 | 84 | 83 | 89 | 90 | 84 | 81 | |
| | | | | | | | | | | | | | | 42 |
| 85 | 86 | 85 | 77 | 85 | 77 | 79 | 81 | 77 | ... | 93 | 76 | 81 | 86 | |
| 85 | 85 | 86 | 86 | 86 | 88 | 85 | 86 | 85 | 83 | 89 | 89 | 84 | 81 | 43 |
| 86 | 85 | 86 | 86 | 86 | 86 | 86 | 86 | 86 | 85 | 89 | 87 | 84 | 84 | 44 |
| 86 | 83 | 87 | 86 | 84 | 78 | 89 | 89 | 90 | 94 | 94 | 87 | 81 | 83 | 45 |
| 86 | 86 | 86 | 86 | 86 | 88 | 84 | 85 | 84 | 82 | 91 | 84 | 84 | 88 | 46 |
| | | | | | | | | | | | | | | 47 |
| 86 | 85 | 85 | 87 | 86 | 89 | 86 | 86 | 87 | 87 | 89 | 89 | 84 | 82 | |
| 86 | 87 | 86 | 79 | 86 | 79 | 80 | 81 | 78 | ... | 95 | 78 | 82 | 85 | 48 |
| 86 | 87 | 87 | 79 | 86 | 79 | 81 | 83 | 78 | ... | 95 | 78 | 82 | 87 | 49 |
| 86 | 87 | 87 | 79 | 86 | 79 | 81 | 83 | 78 | ... | 95 | 78 | 82 | 87 | 50 |
| 86 | 86 | 87 | 79 | 86 | 79 | 81 | 82 | 79 | ... | 94 | 78 | 82 | 87 | 51 |
| 86 | 87 | 87 | 79 | 86 | 79 | 81 | 83 | 79 | ... | 95 | 78 | 82 | 87 | 52 |
| | | | | | | | | | | | | | | 53 |
| 86 | 86 | 86 | 79 | 86 | 79 | 79 | 81 | 77 | ... | 94 | 78 | 82 | 86 | |
| 86 | 84 | 86 | 82 | 85 | 77 | 88 | 87 | ... | ... | 85 | 88 | 89 | 81 | 54 |
| | | | | | | | | | | | | | | 55 |
| 86 | 87 | 87 | 78 | 86 | 79 | 80 | 82 | 78 | ... | 95 | 78 | 82 | 87 | |
| 86 | 87 | 87 | 79 | 86 | 79 | 80 | 81 | 79 | ... | 95 | 78 | 82 | 87 | 56 |
| 86 | 84 | 86 | 82 | 85 | 76 | 88 | 86 | ... | ... | 86 | 87 | 90 | 80 | 57 |
| 86 | 83 | 87 | 85 | 88 | 90 | 85 | 86 | 84 | 79 | 96 | 84 | 86 | 81 | 58 |
| | | | | | | | | | | | | | | 59 |
| 87 | 87 | 87 | 88 | 87 | 90 | 85 | 85 | 85 | 82 | 91 | 85 | 85 | 89 | |
| 87 | 87 | 87 | 87 | 87 | 90 | 85 | 86 | 85 | 82 | 91 | 85 | 85 | 89 | 60 |
| 87 | 85 | 86 | 89 | 86 | 91 | 87 | 87 | 88 | 88 | 90 | 91 | 85 | 81 | 61 |
| 87 | 87 | 87 | 87 | 87 | 87 | 87 | 86 | 87 | 92 | 91 | 89 | 85 | 85 | 62 |
| 87 | 87 | 87 | 88 | 88 | 90 | 86 | 86 | 86 | 82 | 91 | 86 | 85 | 90 | 63 |
| 87 | 87 | 87 | 88 | 88 | 90 | 86 | 85 | 86 | 82 | 92 | 85 | 85 | 90 | 64 |
| 87 | 87 | 87 | 87 | 87 | 89 | 85 | 85 | 85 | 82 | 91 | 85 | 85 | 89 | 65 |
| 87 | 87 | 87 | 88 | 87 | 90 | 85 | 86 | 85 | 82 | 91 | 85 | 85 | 89 | 66 |
| 87 | 86 | 87 | 89 | 86 | 87 | 89 | 88 | 90 | 91 | 91 | 87 | 86 | 83 | 67 |
| 87 | 86 | 87 | 87 | 87 | 90 | 85 | 85 | 86 | 82 | 91 | 84 | 85 | 89 | 68 |
| 87 | 87 | 87 | 90 | 87 | 91 | 88 | 87 | 89 | 88 | 90 | 92 | 86 | 82 | 69 |
| 88 | 88 | 88 | 90 | 88 | 92 | 88 | 88 | 88 | 88 | 91 | 93 | 87 | 83 | 70 |
| 88 | 88 | 88 | 88 | 88 | 89 | 87 | 86 | 87 | 88 | 92 | 89 | 86 | 85 | 71 |
| 88 | 87 | 87 | 89 | 87 | 91 | 88 | 87 | 88 | 87 | 91 | 92 | 86 | 82 | 72 |

Table 3. **Standard Errors of Bias Resulting From Incomplete Data**

| Publication estimate | Standard error of bias |
|---|---|
| 0 | 126 |
| 10 | 126 |
| 25 | 126 |
| 50 | 127 |
| 100 | 129 |
| 250 | 135 |
| 500 | 144 |
| 1,000 | 162 |
| 2,500 | 216 |
| 5,000 | 307 |
| 10,000 | 489 |
| 15,000 | 670 |
| 25,000 | 1,033 |
| 40,000 | 1,578 |
| 50,000 | 1,941 |
| 75,000 | 1,200 |
| 90,000 | 655 |
| 100,000 | 292 |
| 106,611 | 126 |

## Error Formulas From Sampling to Compute a 90-Percent Confidence Interval

All household items use the formulas in table 4a. Note that neighborhood items[1] for some groups have a different formula. All items for workers use formulas in table 4b.

Table 4a. **Error Formulas From Sampling to Compute a 90-Percent Confidence Interval for Most Items**

| Characteristics | Error formulas |
|---|---|
| U.S.<br>Elderly<br>Mobile Homes (except (neighborhood items))<br>New Construction<br>Black | $1.64 \times \sqrt{3.16 \times A - 0.000030 \times A^2}$ |
| Midwest | $1.64 \times \sqrt{3.16 \times A - 0.000123 \times A^2}$ |
| West | $1.64 \times \sqrt{3.16 \times A - 0.000142 \times A^2}$ |
| Central City<br>Hispanic<br>Urban<br>MSA-Suburb | $1.64 \times \sqrt{2.51 \times A + 0.000171 \times A^2}$ |
| Northeast | $1.64 \times \sqrt{2.51 \times A - 0.000119 \times A^2}$ |
| Rural(except (neighborhood items)) | $1.64 \times \sqrt{3.02 \times A - 0.000028 \times A^2}$ |
| South (except (neighborhood items)) | $1.64 \times \sqrt{3.02 \times A - 0.000084 \times A^2}$ |
| Outside MSA (except (neighborhood items))<br>Vacants | $1.64 \times \sqrt{3.23 \times A - 0.000030 \times A^2}$ |
| Rural (neighborhood items) | $1.64 \times \sqrt{3.85 \times A - 0.000036 \times A^2}$ |
| South (neighborhood items) | $1.64 \times \sqrt{3.85 \times A - 0.000101 \times A^2}$ |
| Outside MSA (neighborhood items) | $1.64 \times \sqrt{3.53 \times A + 0.002859 \times A^2}$ |
| Mobile Homes (neighborhood items) | $1.64 \times \sqrt{3.02 \times A + 0.001148 \times A^2}$ |

Note: The formulas are based on 1.64 times the error from sampling. These formulas give 90-percent confidence interval errors. For 95-percent confidence interval errors, multiply by 1.96 instead of 1.64; for 99-percent confidence interval errors, multiply by 2.58 instead of 1.64.

[1]Neighborhood items include all characteristics in ''neighborhood'' tables except ''mobile home in group.''

Table 4b. **Error Formulas From Sampling to Compute a 90-Percent Confidence Interval for Workers**

| Characteristics | Error formulas |
|---|---|
| U.S.<br>Elderly<br>Mobile Homes<br>New Construction<br>Black<br>Midwest<br>West | $1.64 \times \sqrt{3.16 \times A}$ |
| Central City<br>Hispanic<br>Urban<br>MSA-Suburb<br>Northeast | $1.64 \times \sqrt{2.51 \times A}$ |
| Rural<br>Mobile homes<br>South | $1.64 \times \sqrt{3.02 \times A}$ |
| Outside MSA<br>Vacants | $1.64 \times \sqrt{3.23 \times A}$ |

Note: The formulas are based on 1.64 times the error from sampling. These formulas give 90-percent confidence interval errors. For 95-percent confidence interval errors, multiply by 1.96 instead of 1.64; for 99-percent confidence interval errors, multiply by 2.58 instead of 1.64.

## Table 5. **Calculation of the 90-Percent Confidence Interval for Medians**

The following steps calculate the 90-percent confidence interval for medians. First we give some hypothetical cost data to work with (all numbers are in thousands):

| | | Cumulative number of housing units |
|---|---|---|
| Total housing units | 209 | - |
| Less than $25 | 50 | 50 |
| $25 to $49 | 45 | 95 |
| $50 to $74 | 30 | 125 |
| $75 to $99 | 20 | 145 |
| $100 or more | 55 | 200 |
| Not reported | 9 | - |
| Median | $54 | - |

| Steps for calculations | Formula | Bottom limit | | Top limit | |
|---|---|---|---|---|---|
| | | Example | Your data | Example | Your data |
| How many total units is the median based on (in thousands, exclude 'not reported' and 'don't know')? | A | 200 | | | |
| Half the total, for the median (in thousands) | A/2 | 100 | | | |
| Error from sampling for 50 percent of the base of this median (1st line)[1] | $161/\sqrt{A}$ | 11.4 | | | |
| Multiply this percentage error by .01 to turn it into a fraction and by total units to give the error in housing units | $1.61\sqrt{A}$ | 23 | | | |
| Bottom of error range (2nd line minus 4th line, in thousands) | $B_{bottom}$ | 77* | | | |
| Top of error range (2nd line plus 4th line, in thousands) | $B_{top}$ | | | * 123 | |
| * Start adding up the housing units in the table, category by category, cumulatively from the beginning of the table, until you exceed the starred number above. What interval does the starred number fall in? | | $25-$49 | | $50-$74 | |
| How many housing units are in all the categories before this one (in thousands)? | C | 50 | | 95 | |
| How many housing units are in this category (in thousands)? | D | 45 | | 30 | |
| What is the bottom limit of this category (in dollars, rooms, or whatever the item measures)? | E | $25 | | $50 | |
| What is the bottom limit of the next category (in dollars, rooms, etc)? | F | $50 | | $75 | |
| Formula to calculate the limits of confidence interval. | $\frac{B-C}{D}(F - E) + E$ | $\frac{77-50}{45}(25) + 25$ | | $\frac{123-95}{30}(25) + 50$ | |
| Limits of confidence interval (in dollars, rooms, etc) | | $40 | | $73 | |

* Starting with the starred step, this worksheet is equivalent to interpolation, for those who are familiar with this term.

[1]Statistical note: This formula is based on the error from sampling for 50 percent (using the formula above, $1.64 \times \sqrt{(3.85 \times 50 \times (100-50)/A)} = 161/\sqrt{A}$). This formula is an overestimate for most items. For a more accurate answer, replace the first number under the square foot sign with the first number under the square root sign of the appropriate formula in table 4a or 4b.