Addendum to

SOURCE AND ACCURACY STATEMENT

Property Owners and Managers Survey, 1995-1996

WEIGHTS

Single-Family Microdata

- The SWEIGHT variable is designed to allow aggregation and analysis at the level of the housing unit.
- There is no property weight variable for single-family because they are themselves an individual property.

Multifamily Microdata

- The MWEIGHT variable is designed to allow aggregation and analysis at the level of the housing unit. The total of MWEIGHT values is the total number of units in multifamily properties.
- The PROPWGT variable is should be used to analyze the data at the level of the property. The total of PROPWGT is the total number of multifamily properties.

SOURCE AND ACCURACY STATEMENT

Property Owners and Managers Survey, 1995-1996

SAMPLE DESIGN

POMS Sample

The purpose of the Property Owners and Managers Survey (POMS) was to collect information from the owners and managers of rental properties on a wide range of topics about how they manage their units.

The POMS sample was selected from the 1993 AHS-National sample units. All units that fell into the following five categories from the 1993 AHS-National sample were selected for the POMS sample. There were 17,706 units falling into these classifications.

1. renter occupied in 1993
2. vacant for rent in 1993
3. vacant for sale or rent in 1993
4. rented, but not yet occupied in 1993
5. noninterviews in 1993 (units eligible for interview but for which we couldn't obtain an interview after repeated visits) that were either renter occupied, vacant for rent, vacant for sale or rent, or rented but not yet occupied in the 1989 or 1991 AHS-National surveys.

An additional selection criteria for the POMS sample was that it contain one 1993 AHS-National sample unit per property. In order to meet this selection criteria, we used AHS-National addresses and owner information to classify units into properties. Mobile home units were counted as a single property (the park was not considered a property). We then selected one AHS-National unit per property and dropped all remaining units from the POMS sample. We dropped 1,438 units in this sample reduction.

There were 16,268 units remaining in the POMS sample after the sample reduction.
Table 1 summarizes the 16,268 POMS sample units by POMS interview status and interview mode:

Table 1. Number of POMS Sample Units by POMS Interview Status and Interview Mode					
Dates	Interview Mode	Interview Status			Total by Interview Mode
		Interviews	Out-of-Scope Units [1]	Noninterviews	
Nov, 1995-Feb, 1996	Mail Returns	1,980	394	11	2,385
March, 1995-June, 1996	Telephone or Personal Visit Follow-up	6,278	2,596	5,009 [2]	13,883
Nov, 1995-June, 1996	Total by Interview Status	8,258	2,990	5,020	16,268

[1] Out-of-scope units are given by the following:
- part of a property owned by a public housing authority
- owned by the United States military or by any other Federal Agency
- vacant, available for sale only
- vacant, but not available for sale or rent
- occupied by the owner of the property
- used primarily as a second or vacation home by the owner or people who rent on a daily, weekly, or short-term basis
- rental at the time of the 1993 AHS-National survey but no longer rental at the time of the POMS
- units that became rental after the 1993 AHS-National survey (i.e., owner units that became rental)

[2] We weren't able to complete follow-up procedures for 2,601 of the 5,009 units that we classified as noninterviewed units due to time constraints.

AHS-National Sample

We selected the AHS-National sample according to the following: First, we divided the United States into areas made up of counties or groups of counties and independent cities, which we refer to as primary sampling units (PSU's). We selected a sample of these PSU's. Then we selected a sample of housing units within these PSU's.

Selection of sample areas. The AHS sample is spread over 394 PSU's. These PSU's cover 878 counties and independent cities with coverage in all 50 States and the District of Columbia. If there were a sufficient number of housing units in a PSU; the PSU was known as a *self-representing* PSU and was in sample with certainty. The sample from the PSU represents only that PSU. There are 170 self-representing PSU's.

We grouped the remaining PSU's into strata and selected one PSU per stratum to represent all PSU's in the stratum. We refer to these PSU's as *nonself-representing PSU's.* The sample of nonself-representing PSU's for AHS are a subsample of the Current Population Survey's (CPS) sample areas.

Selection of sample housing units. The AHS sample consists of the following housing units:

Housing units selected from the 1980 census

New construction in permit issuing areas

Housing units missed in the 1980 census

Other housing units added since the 1980 census

Housing units selected from the 1980 census. We selected a sample of housing units from the 1980 decennial census files using an overall sampling rate of about 1 in 2,148. We determined the within-PSU sampling rate so the overall probability of selection for each sample housing unit was the same (e.g., if the probability of selecting a NSR PSU was 1 in 10, then the within-PSU sampling rate would be 214.8).

We classified the areas within a PSU into two types based on (a) the completeness of the addresses in the areas that make up the PSU and (b) the presence of a system to monitor new construction through building permits. The two types of areas were known as address enumeration districts (ED's) or area ED's. We selected the sample of 1980 census units differently in the two types of areas.

In *address ED's,* most of the housing-unit addresses were complete, and the construction of new housing units was monitored by building permits. We selected a sample of housing units from the list of units that received long-form questionnaires in the 1980 census.

We also used the census files to select a sample of living quarters in address ED's that did not meet the definition of a housing unit (e.g., military barracks, college dorm). We used this sample to identify units that converted to housing units after the 1980 census.

In *area ED's,* 4 percent or more of the 1980 census addresses were either incomplete or inadequate or new construction was not governed by building permits (mostly rural areas).

We selected a sample of housing units from the list of units that received 1980 census long-form questionnaires in several steps. First, we grouped area ED's based on certain characteristics of interest. Then we selected a systematic sample of ED's. We selected a sample of land areas in these ED's. Finally, we selected a sample of housing units that received 1980 census long forms within the land areas.

New construction in permit issuing areas. The building permit frame covers only non-mobile home new construction. We selected the sample of permit new construction housing units from permits that were expected to be completed after April 1, 1980. In certain permit areas and for structures of certain sizes, we included permits issued as early as March 1979. But, for the most part, we included permits issued since July 1979. Within each PSU, we selected building permits monthly, based on certain geography characteristics.

We created clusters of approximately four housing units and subsampled units within these clusters at the rate of 1 in 4, yielding clusters of size 1. The overall probability of selection of these units is about 1 in 2,148.

Housing units missed in the 1980 census. The Census Bureau conducted a special study, called the Housing Unit Coverage Study (HUCS), as part of the 1980 census. This study identified units at addresses missed or inadequately defined in the 1980 census. We included a sample of the units identified in the HUCS in the AHS sample.

Housing units added since the 1980 census. We picked up two other types of units added since the 1980 census: (a) units added within structures containing sample units and (b) whole structure additions that did not contain living quarters at the time of the 1980 census.

Within structure additions. These additions have a chance of being in sample because there is at least one unit that existed at the time of the 1980 census that was eligible for selection. We identified these adds in structures with at least one unit selected from the 1980 census sample and the HUCS sample. We also picked up adds in permit new construction, e.g., units added since the structure was completed.

Whole structure additions. These types of additions are units in structures that contained no living quarters at the time of the 1980 census. We used area sampling methods to identify these in all types of areas. Under area sampling, we list all housing units within a land area and then select a systematic sample.

Refer to the Current Housing Report H/150/93, 'American Housing Survey for the United States in 1993', for further details on the AHS-National sample design.

POMS WEIGHTING

The POMS weighting procedures produced unit-level weights that can be used to produce unit-level estimates of POMS characteristics. These estimates represent the universe of units in rental properties in 1993 that were still rental properties for the POMS.

We assigned each POMS unit a weight to reflect the probability of selection. We determined this weight by using the AHS probability of selection weight adjusted for the POMS one unit per property reduction. The remaining steps in the POMS weighting procedure are described below.

We made adjustments to the POMS interviewed units to account for units that could not be interviewed. Out-of-scope units were excluded from this procedure. We used 1993 AHS-National sample information to classify each POMS interviewed and noninterviewed unit into noninterview adjustment cells. If the 1993 AHS-National characteristic was not available , we used the AHS-National characteristic from 1991 or 1989. The cells included the following characteristics:

Geography (region, MSA status, urban/rural)

Units in structure

Number of rooms

We computed a factor for each cell and applied it to the corresponding interviewed units in the cell. The factors for each cell equaled the following ratio:

$$\frac{\text{Interviewed housing units + Noninterviewed housing units}}{\text{Interviewed housing units}}$$

The remaining steps involved a four stage ratio estimation procedure that adjusted for the following: (a) sampling of nonself representing PSU's, (b) known sampling deficiencies in new construction, (c) differences between sample estimates and independent estimates of assisted rental units and (d) differences between the sample estimates and independent estimates of key renter characteristics for total housing units.

The *first stage* of this procedure reduced the portion of the variance due to the sampling of nonself-representing PSU's. The procedure accounted for differences that existed at the time of the 1980 census between the survey housing units estimated from the nonself-representing sample PSU's and the 1980 census count of housing units from all nonself-representing strata.

We computed factors accounting for these differences separately for the following characteristics: (a) region, (b) tenure, (c) metropolitan area status, and (d) urban or rural status. In addition, we use ethnicity (Hispanic, non-Hispanic) in the South and West regions and race (Black, non-Black) in the South region.

The first stage factor equaled the following ratio:

$$\frac{\text{1980 census housing units for all nonself-representing strata in a cell}}{\text{Number of 1980 housing units in the same cell estimated from the sampling of nonself-representing PSU's}}$$

We calculated the numerators of the ratios by summing the 1980 census housing unit counts for each cell across all nonself-representing strata. We computed the denominators by weighting the 1980 census housing unit counts from each nonself-representing sample PSU by the inverse of the probability of selection for that PSU. Then we summed the weighted counts across all nonself-representing sample PSU's.

We applied the first stage ratio estimate factor to all POMS sample units in nonself-representing PSUs excluding noninterviews.

The *second stage* of the ratio estimation procedure adjusted the POMS sample estimates of new construction (i.e., units built since the 1980 census) to account for known deficiencies. Noninterviews were excluded from this procedure.

We classified the POMS interviewed and out-of-scope units into cells using the 1993 AHS-National sample characteristics. For nonmobile homes, we classified units into cells using characteristics for year built, units-in-structure, and region. For mobile homes, we classified units into cells using characteristics for model year and region.

We then computed factors separately for each cell. The second stage factor equaled the following ratio:

$$\frac{\text{AHS-National sample estimate for a cell}}{\text{POMS sample estimate in that cell}}$$

We computed the denominators of the above ratio by summing the existing POMS weight on each POMS interview and out-of-scope record after the first stage of ratio estimation over all records in a cell. We computed the numerators of the above ratio by summing the 1993 AHS-National final weight over all 1993 AHS-National interviewed records in a cell. The AHS-National new construction sample estimates reflect the ratio estimation to independent new construction controls that were based on the Survey of Construction and Survey of Mobile Home Placements. Refer to the Current Housing Report H/150/93, 'American Housing Survey for the United States in 1993', for further details on the AHS-National new construction ratio estimation procedure.

We applied the factor from this step to all POMS units in the cell excluding noninterviews.

The *third stage* of the ratio estimation procedure adjusted the POMS sample estimates to independent estimates of assisted rental units[1]. Noninterviews were excluded from this procedure.

We classified POMS interviewed and out-of-scope units into the following four cells:

1. 1993 rental housing units under the management of a public housing authority[2]
2. 1993 rental housing units in assistance projects under the management of a private sponsor[2]
3. 1993 rental housing units with certificate and voucher holders[3]
4. 1993 rental housing units that aren't assisted (all POMS units not in cells 1-3)

We then computed the third stage ratio estimate factor for each cell using the following ratio:

$$\frac{\text{independent estimate of housing units for a cell}}{\text{POMS sample estimate of housing units in that cell}}$$

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[1]"assisted rental units" refers to the following units: rental units in assisted projects under the management of private sponsors; rental units under a public housing authority; and rental units containing voucher and certificate holders. Examples of assistance programs include rental units that received cash receipts from old age assistance, aid to families with dependent children, and aid to the blind or totally disabled.

[2]HUD determined the rental housing units in assistance projects under the management of a public housing authority or under the management of a private sponsor

[3]The Census Bureau took lists of 1993 AHS-National renter households to all identifiable local agencies who manage the certificate and voucher programs in the areas in which the AHS-National is conducted. The Census interviewers matched their AHS-National renters against the local agency files of certificate and voucher holders. The AHS-National units matching to the local agency files were defined as voucher and certificate renter assisted units.

We computed the denominators of the above ratio by summing the existing POMS weight on each record after the second stage of ratio estimation over all records in a cell. For the numerator of assisted rental units (cells 1-3), we based our independent estimates on HUD's estimate of the total number of 1993 rental units in the cell. For cell 3, we obtained the independent estimate by multiplying the undercoverage factor from the 1993 AHS-National certificate and voucher weighting by the POMS sample estimate of cell 3 after the second stage ratio estimation.

For the numerator of the cell with housing units that weren't assisted (cell 4), we used the final weighted estimate of renter units using the 1993 AHS-National survey and subtracted out the independent estimates of assisted housing units (cells 1-3). The AHS-National sample estimates reflects the ratio estimation to independent controls of total housing units that were based on the 1990 census, the Current Population Survey, and the Housing and Vacancy Survey. Refer to the Current Housing Report H/150/93, 'American Housing Survey for the United States in 1993', for further details on the AHS-National ratio estimation procedures.

Then we applied the factor from this step to all POMS units in the cell excluding noninterviews.

The *fourth stage* of the ratio estimation procedure adjusts the POMS sample estimates of 1993 total renter housing units to the 1993 AHS-National sample estimate of total renter housing units. This procedure was done separately for 1993 renter occupied and 1993 vacant rental units. Noninterviews were excluded from this procedure.

We classified the POMS interviewed and out-of-scope units into cells using the AHS-National sample characteristics from 1993 or 1991 or 1989.

For POMS interviewed and out-of-scope units which were occupied for the 1993 AHS-National sample, we classified units into cells using the following AHS-National characteristics:

Region

Race of head of household (Black and non-Black)

Marital Status/Sex of head of household (married, other male, other female)

Age of head of household

For POMS interviewed and out-of-scope units which were vacant for the 1993 AHS-National sample, we classified units into cells using the following AHS-National characteristics:

Region

Metropolitan Statistical Area status

We then computed the fourth stage factor for each cell using the following ratio:

$$\frac{\text{AHS-National sample estimate of total housing units for a cell}}{\text{POMS sample estimate of total housing units in that cell}}$$

We computed the denominators of the above ratio by summing the existing POMS weight on each POMS interview and out-of-scope record after the third stage of ratio estimation over all records in a cell. We computed the numerators of the above ratio by summing the 1993 AHS-National final weight over all the 1993 AHS-National interviewed records in a cell. The AHS-National sample estimates reflect the ratio estimation to independent controls of total housing units. Refer to the Current Housing Report H/150/93, 'American Housing Survey for the United States in 1993', for further details on the AHS-National ratio estimation procedures.

We applied the factor from this step to all POMS units in the cell excluding noninterviews.

We repeated the second stage, third stage and fourth stage ratio estimation procedures to bring the POMS sample estimates into closer agreement with the independent estimates. We used the final weight resulting from all iterations as the final weight for the POMS sample.

As a result of these ratio estimation procedures, the sampling error for most statistics is less than if the sample were simply weighted by the inverse of the probability of selection.

NONSAMPLING ERRORS

We classify nonsampling errors into three groups: wrong answers, coverage errors, and nonresponse errors. These errors occur for many reasons and are usually the largest source of errors, larger than sampling errors.

Wrong answers. There are many reasons for wrong answers. The interviewers may affect the accuracy of the response by the way they ask the questions or by recording the data incorrectly. People may misunderstand questions, cannot recall the correct answer or do not want to give the right answer.

Since this is the first time the POMS questionnaires were used, questions may exist that are unclear to respondents. Unclear questions are usually revised based on studies of response for a survey which is done multiple times. As with any first time survey such as POMS, users should be wary of the potentially high level of wrong answers when drawing conclusions from the data.

Answers given may depend on the interview mode. There may be differences in interpreting questions between the three POMS interview modes (mail return, telephone follow-up, personal visit follow-up). POMS did not attempt to analyze differences between the interview modes.

Respondents may give different answers when they're asked the same questions at different times (response inconsistency). POMS could not catch and reconcile these inconsistencies so wrong answers still remain. The rate of response inconsistency and wrong answers vary by question. In general, questions measuring attitudes, opinions, or more subjective aspects tend to have higher response inconsistency rates than other items for surveys. The following are two examples of these types of questions: 1) How often did vandalism, theft, violence or drug usage happen in the last two years? and 2) How would you describe the legal requirements

for eviction in this jurisdiction? Users should be wary of the potentially high level of response inconsistency for these types of questions when drawing conclusions from the data.

Coverage Errors. Each home in the POMS sample represents a large number of other homes. However, because of incomplete sampling lists (i.e., undercoverage), the homes in the survey do not fully represent all homes in the country. Therefore, the raw numbers from the survey are raised proportionally so that the POMS estimates of the total number of housing units match independent estimates of the total number of homes. These independent estimates are based on the 1990 Census of Housing, plus changes since then. The types of units that have known coverage deficiencies are given in Table 2.

Table 2. 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 (e.g., hotels, rooming houses, staff quarters, etc)	Not covered
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.

Nonresponse Errors. There are two types of nonresponse. The first is item nonresponse and refers to partial interviews where information is not given for all items. The second is noninterviews where no information is collected about the sample unit. These two types of nonresponse were handled differently, as described below, and have the potential to introduce nonsampling error into the data.

Item Nonresponse

We assigned (imputed) values for units-in-property item nonresponse using AHS or POMS information. If AHS data from a prior year was available we used it. Otherwise, we used data from another POMS interview that was located geographically near the unit without data. We did this imputation separately by single and multi unit structures. This will cause nonsampling errors if our imputed values are different than the actual values. This was done for about 5 percent of the units in multi-unit structures.

Item nonresponse error also exists for items for which there are no imputations (not reported). The totals by

item are distorted since they are based on reported cases only. The percentages by item may be distorted depending on how the nonresponse cases are distributed by the categories of that item.

The percent of not reported responses varied by item. In general, the percent of items not reported was less than 6% for characteristics pertaining to rental units, ranged 20-50% (multi unit properties) and 10-30% (single unit properties) for owner-oriented questions (acquisition and financing of the property and characteristics of the owner), and was less than 15% for the other items. Exceptions to these percentages include items pertaining to operating costs (15-50%), rental receipts, and items pertaining to characteristics of problem tenants and the manner in dealing with undesirable behavior and the restrictions/regulations (15-35%). Users should be wary of drawing conclusions for items with high "not reported" rates.

Noninterviews

Noninterviews were attributed to unit refusal, units which couldn't be located, and units that we couldn't complete the follow-up procedures for due to time constraints. Overall, POMS had a 38% nonresponse (noninterview) rate. The nonresponse rate varied somewhat by characteristic as shown below:

Nonresponse Rate by Type of Property (Percent)

Characteristic	Multi Unit Properties	Single Unit Properties
U.S. Total	40	36
Region		
Northeast	38	41
Midwest	35	32
South	39	30
West	48	42
MSA		
Central City	42	38
Balance	45	36
nonMSA	29	25

These noninterviews are represented in the POMS estimates by the noninterview adjustment step in the POMS weighting procedures (see POMS Weighting). The noninterview adjustment assumes that interviewed units of similar size and geographic location (i.e., region, MSA, urban/rural) can adequately represent the POMS characteristics of these noninterviews. This assumption is never exactly true so some nonresponse nonsampling error still exists for the POMS estimates. Since POMS had very high nonresponse rates, the potential for a relatively high level of nonresponse nonsampling error does exist for POMS and it could be the most severe type of nonsampling error for this survey.

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 the actual estimate with a specified probability.

Counts. Sample estimates from POMS are counts of housing units (e.g., number of units with a year built of 1985-1989). These counts have error from sampling. Table 3 gives a convenient list of errors for a range of numbers. These errors are an overestimate for most items. As with the other types of errors, readers should be wary of numbers with large errors from sampling.

Table 3. Errors from Sampling to Compute a 90 Percent Confidence Interval

When the number of units is one the following numbers-	The chances are 90 percent that the actual value is inside the range of plus or minus-
0	4,230
10,000	10,665
20,000	15,080
100,000	33,678
200,000	47,554
500,000	74,840
1,000,000	105,011
2,000,000	146,135
5,000,000	219,417
10,000,000	280,723
15,000,000	303,289
18,000,000	302,490
21,000,000	291,071

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

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

$$1.64 \times \sqrt{4{,}230 \times A \quad 0.000130 \times A^2}$$

where A is a number (a count of units).

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

For example, the error from sampling for an estimate of 300,000 units (i.e., A = 300,000) is:

$$1.64 \times \sqrt{4{,}230 \times 300{,}000 \quad 0.000130 \times 300{,}000^2} \quad 58{,}152.$$

The 90 percent confidence interval can then be formed by adding and subtracting this error to the survey estimate of 300,000 (i.e., 300,000 ± 58,152). Statements such as "the actual value is in the range 300,000 ± 58,152 (241,848 to 358,152)" are right 90 percent of the time and wrong 10 percent of the time.[4]

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:

$$1.64 \times \sqrt{4{,}230 \times P \times (100 \quad P) / A}$$

where P is the percent; A is the denominator, or base of the percent.[5]

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 4.a or 4.b.

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

$$1.64 \times \sqrt{4{,}230 \times 40 \times 60/200{,}000} \quad 11.7$$

Statements such as "the actual percent is in the range 28.3 percent to 51.7 percent" are right 90 percent of the time.

Note that when a ratio C/D is computed where C is *not* a subgroup of D (for example the number of units having owners with limited partnership as a ratio of the number of units with owners of general partnership) the error from sampling is different. The error from sampling for a 90 percent confidence interval for a ratio C/D[6] is:

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

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[4]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.

[5]This formula is actually $1.64 \times \sqrt{(p(100\ p)/n,)}$ since 4,230/A adjusts the data to the effective sample size.

[6]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.

Medians. The following steps calculate the error from sampling for a 90 percent confidence interval for medians.[7]

Steps for Calculations	the formula	an example	your data
How many total units is the median based on (in thousands, exclude 'not reported')?	A	200,000	_____
What are the endpoints 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	30,000	_____
Then the error from sampling for the median is approximately:[8]	$\frac{53.33 \times W \times \sqrt{A}}{B}$	$\frac{53.33 \times 25 \times \sqrt{200,000}}{30,000}$ = $20	_____
The 90 percent confidence interval for the median is:	median $\pm \frac{53.33 \times W \times \sqrt{A}}{B}$	median $\pm$ $20	_____

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

[8]The factor 53.33 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 4,230. Take the square root of this answer and multiply by 53.33 to get your factor.

Differences. Two numbers (representing the number of units for two POMS characteristics), like 34,000 and 40,000 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:

Formula[9]

$$\sqrt{(\textit{error for first number})^2 \quad (\textit{error for second number})^2}$$

For example, if the first number is 34,000 with an error of 19,657 and the second number is 40,000 with an error of 21,319, then the 90 percent confidence interval error for this difference of 6,000 is:

$$\sqrt{19{,}657^2 \quad 21{,}319^2} \quad 28{,}999$$

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

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[9]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.

Error Formulas from Sampling to Compute a 90-percent Confidence Interval

Use the formulas in table 4a for single unit properties. Use the formulas for all items in each region/MSA and for the U.S. except as noted for mobile homes and for single family attached house.

Use the formulas in table 4b for multi unit properties. Use the formulas for all items in each region/MSA and for the U.S. except as noted for units-in-property 20+.

Table 4a. Error Formulas From Sampling to Compute a 90-Percent Confidence Interval for Single Unit Properties

Item	Error formulas
All Items Excluding Mobile Home and Single family attached house	
U.S.	
Northeast	$1.64x\sqrt{3{,}852xA \quad 0.000195xA^2}$
Midwest	
West	
Central City	
South	
Balance	$1.64x\sqrt{4{,}103xA \quad 0.000051xA^2}$
Outside MSA	$1.64x\sqrt{3{,}760xA \quad 0.001315xA^2}$
Single family attached house	$1.64x\sqrt{3{,}760xA \quad 0.001315xA^2}$
Mobile Home	$1.64x\sqrt{4{,}696xA \quad 0.004653xA^2}$

Note: The formulas are based on 1.64 times 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 4b. Error Formulas From Sampling to Compute a 90-Percent Confidence Interval for Multi Unit Properties

Characteristics	Error formulas
All Items Excluding Units-in property 20+	
U.S.	
Northeast	
Midwest	$1.64x\sqrt{4,230xA \quad 0.000130xA^2}$
South	
West	
Central City	
Balance	$1.64x\sqrt{4,057xA \quad 0.000042xA^2}$
Outside MSA	$1.64x\sqrt{5,192xA \quad 0.002763xA^2}$
Units-in property 20+	$1.64x\sqrt{3,972xA \quad 0.000333xA^2}$

Note: The formulas are based on 1.64 times 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	209,000	
Less than $25	50,000	50,000
$25 to $49	45,000	95,000
$50 to $74	30,000	125,000
$75 to $99	20,000	145,000
$100 or more	55,000	200,000
Not reported	9,000	-
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	200,000			
Half the total, for the Median (in thousands)	A/2	100,000			
Error from sampling for 50 percent of the base of this median (1st line)[10]	$5.33\sqrt{A}$	12			
Multiply this percentage error by .01 to turn into a fraction and by total units to give the error in housing units	$53.33\sqrt{A}$	23,850			
Bottom of error range (2nd line minus 4th line, in thousands)	B_{bottom}	* 76,150			
Top of error range (2nd line plus 4th line, in thousands	B_{top}			* 123,850	
* 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	50,000		95,000	
How many housing units are in this category (in thousands)?	D	45,000		30,000	
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	$\frac{B \quad C}{D}(F \quad E) \quad E$	$\frac{76,150 \quad 50,000}{45,000}(25) \quad 25$		$\frac{123,850 \quad 95,000}{30,000}(25) \quad 50$	
Limits of confidence interval (in dollars, rooms etc)		$40		$74	

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

[10]Statistical note: This formula is based on the error from sampling for 50 percent (using the formula above.

$1.64\times\sqrt{4,230\times.50\times(100-.50)/A}) \quad 5.333\sqrt{A}$. 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.