# Three Year Averages

The purpose of this documentation is to provide data users with a basic understanding of the estimation methodology and the accuracy of the ACS data for three year averages.

Three year average tables and profiles will be tabulated using the most up-to-date geography for the most recent year in the three year average. For a 1996-1998 average, this means that both the 1996 and 1997 data is updated to 1998 geography.

THREE YEAR AVERAGES

For this documentation, year one refers to the first (or oldest) year of the average, year two refers to second (or middle) year of the average, and year three refers to the third (or most recent) year of the average.

Computing the Average

The combined year one through year three (weighted) averages are computed from the individual year estimates using the following formulas:

(A) Year One through Year Three Count =

(Count for Year One + Count for Year Two + Count for Year Three) / 3

(B) Year One through Year Three Aggregate =

(Aggregate for Year One + Aggregate for Year Two + Aggregate for Year Three) / 3

(C) Year One through Year Three Ratio =

(Year One through Year Three numerator) / (Year One through Year Three denominator)

(This holds for proportions, means and per capita amounts)
The numerator and denominator could either be a count or an aggregate. For example, in Summary Table P81A the numerator is aggregate income and the denominator is count of persons.

(D) Year One through Year Three Median = Median of all observations for the three years

Note on Rounding

When you sum the cell estimates in a table, it may not give you the same estimate as the universe table because the cells of the table are rounded separately and not controlled to the marginal total. An example follows for Brevard County for 1996 and 1997 data. This example is for two year averages, but the same principal holds for three year averages.

Table P1

| 1996 estimate | 1997 estimate | 1996-1997 estimate not rounded | 1996-1997 estimate rounded |
|---|---|---|---|
| 447,416 | 454,603 | 451,009.5 | 451,010 |

Table P6

| Table Stub | 1996 estimate | 1997 estimate | 1996-1997 estimate not rounded | 1996-1997 estimate rounded |
|---|---|---|---|---|
| White | 390,683 | 397,366 | 394,024.5 | 394,025 |
| Black | 40,472 | 42,538 | 41,505 | 41,505 |
| American Indian, Eskimo, and Aleut | 2,529 | 2,920 | 2,724.5 | 2,725 |
| Asian and Pacific Islander | 8,310 | 8,360 | 8,335 | 8,335 |
| Other Race | 5,422 | 3,419 | 4,420.5 | 4,421 |
| Total | 447,416 | 454,603 | 451,009.5 | 451,011 |

From Table P6 we can see that the total number of people is 451,011, but from Table P1 it is 451,010. The difference here is due to rounding in the stubs of Table P6.

Computing the Year One through Year Three Average Standard Error

When using formulas (A) or (B) you first need to calculate the standard errors for the year one, year two, and year three estimates. The procedures for calculating the standard errors for individual years can be found in the Accuracy of the Data documents for the appropriate years. Once you have the standard errors for the year one, year two, and year three estimates separately, use the following formula to obtain the standard error for the year one through year three average for counts and aggregates.

$$\text{se for counts and aggregates} = \sqrt{\frac{1}{9} * (SE^2_{\text{year 1}} + SE^2_{\text{year 2}} + SE^2_{\text{year 3}})}$$

If the average estimate is a ratio (C), then you need the standard errors for each of the individual year estimates that make up the numerator and denominator, which are of the form (A) or (B). Once you have the standard errors for the year one, year two, and year three estimates for the numerator and denominator separately, use the following formula to obtain the standard error for the year one through year three average for ratios.

se for proportions, ratios, means and per capita amounts =

$$\frac{EST_{nyear\ 1} + EST_{nyear\ 2} + EST_{nyear\ 3}}{EST_{dyear\ 1} + EST_{dyear\ 2} + EST_{dyear\ 3}} *$$

$$\sqrt{\frac{SE^2_{nyear\ 1} + SE^2_{nyear\ 2} + SE^2_{nyear\ 3}}{(EST_{nyear\ 1} + EST_{nyear\ 2} + EST_{nyear\ 3})^2} + \frac{SE^2_{dyear\ 1} + SE^2_{dyear\ 2} + SE^2_{dyear\ 3}}{(EST_{dyear\ 1} + EST_{dyear\ 2} + EST_{dyear\ 3})^2}}$$

Where n stands for numerator and d for denominator. So $EST_{nyear\ 1}$ is the estimate of the numerator for year one and $SE_{dyear\ 2}$ is the standard error of the denominator for year two.

The direct standard error for medians (D) was obtained by using, with the combined data, the method that was used for each of the year one, year two, and year three single year data products.

There are three exceptions to the above formulas:

1. Only a small number of identical values are reported and used to calculate an aggregate for an individual year or the median for the three years. In this case, there are two few sample observations to compute a stable estimate of the standard error. The lower and upper bounds are assigned a value of "*". This is also true for means and per capita amounts because the numerators for these estimates are aggregates.

2. There are no sample observations available to compute a ratio estimate or an estimate of its standard error. This happens when $EST_{dyear\ 1}$, $EST_{dyear\ 2}$, and $EST_{dyear\ 3}$ are all equal to zero. The estimate of the average is represented by a "-" and the lower and uppers bounds are assigned a value of "**".

3. The estimate of the denominator for a proportion is non-zero, but $EST_{nyear\ 1}$, $EST_{nyear\ 2}$, and $EST_{nyear\ 3}$ are all equal to zero. Use the following formula to obtain the standard error:

se for proportions = $$\sqrt{\frac{SE^2_{nyear\ 1} + SE^2_{nyear\ 2} + SE^2_{nyear\ 3}}{(EST_{dyear\ 1} + EST_{dyear\ 2} + EST_{dyear\ 3})^2}}$$

Computing the Three Year Average Upper and Lower Bounds

If the year one, year two, and year three standard errors are all zero due to the estimates being controlled, then the lower and upper bounds were given a value of “*****”. This also holds for proportions when both the numerators and denominators are controlled for all three years.

For all other estimates the lower and upper bounds for the average estimate were calculated as follows:

lower bound (lb) = average - 1.65 * se(average)

upper bound (ub) = average + 1.65 * se(average)

Generalized variances are used wherever applicable for the year one, year two, and year three components of the averages. In calculating standard errors for 1996 estimates, the exact value of 85/15 was used, not the rounded value of 5.7 given in the formulas for generalized variances following Tables A and B in the Accuracy of the Data 1996.

For examples please see “Estimates for 1996-1997 Data Products.” This document has examples for two year averages, but the same principles apply.