Title

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Syntax		Menu	Description	Options
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ntax				
<u>su</u> mmarize [varlist] [if]	[in] [weight]	[, options]	
<u>su</u> mmarize [<i>options</i>	varlist] [if] Description	[in] [weight]	[, options]	
L		[in] [weight]	[, options]	
options	Description	[in] [weight]	[, options]	
options 	Description display addit	tional statistics	[, options]	ner's option
options Main detail	Description display addit suppress the	tional statistics		ner's option
options Main detail <u>mean</u> only	Description display addit suppress the use variable	tional statistics display; calculate s display format		-

aweights, fweights, and iweights are allowed. However, iweights may not be used with the detail option; see [U] 11.1.6 weight.

Menu

Statistics > Summaries, tables, and tests > Summary and descriptive statistics > Summary statistics

Description

summarize calculates and displays a variety of univariate summary statistics. If no *varlist* is specified, summary statistics are calculated for all the variables in the dataset.

Also see [R] ci for calculating the standard error and confidence intervals of the mean.

Options

Main

detail produces additional statistics, including skewness, kurtosis, the four smallest and largest values, and various percentiles.

meanonly, which is allowed only when detail is not specified, suppresses the display of results and calculation of the variance. Ado-file writers will find this useful for fast calls.

format requests that the summary statistics be displayed using the display formats associated with the variables rather than the default g display format; see [U] 12.5 Formats: Controlling how data are displayed.

separator(#) specifies how often to insert separation lines into the output. The default is separator(5), meaning that a line is drawn after every five variables. separator(10) would draw a line after every 10 variables. separator(0) suppresses the separation line.

display_options: vsquish, noemptycells, baselevels, allbaselevels, nofvlabel, fvwrap(#), and fvwrapon(style); see [R] estimation options.

Remarks and examples

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summarize can produce two different sets of summary statistics. Without the detail option, the number of nonmissing observations, the mean and standard deviation, and the minimum and maximum values are presented. With detail, the same information is presented along with the variance, skewness, and kurtosis; the four smallest and four largest values; and the 1st, 5th, 10th, 25th, 50th (median), 75th, 90th, 95th, and 99th percentiles.

Example 1: summarize with the separator() option

We have data containing information on various automobiles, among which is the variable mpg, the mileage rating. We can obtain a quick summary of the mpg variable by typing

```
. use http://www.stata-press.com/data/r13/auto2
(1978 Automobile Data)
. summarize mpg
Variable Obs Mean Std. Dev. Min Max
mpg 74 21.2973 5.785503 12 41
```

We see that we have 74 observations. The mean of mpg is 21.3 miles per gallon, and the standard deviation is 5.79. The minimum is 12, and the maximum is 41.

If we had not specified the variable (or variables) we wanted to summarize, we would have obtained summary statistics on all the variables in the dataset:

. summarize, s	separator(4)				
Variable	Obs	Mean	Std. Dev.	Min	Max
make	0				
price	74	6165.257	2949.496	3291	15906
mpg	74	21.2973	5.785503	12	41
rep78	69	3.405797	.9899323	1	5
headroom	74	2.993243	.8459948	1.5	5
trunk	74	13.75676	4.277404	5	23
weight	74	3019.459	777.1936	1760	4840
length	74	187.9324	22.26634	142	233
turn	74	39.64865	4.399354	31	51
displacement	74	197.2973	91.83722	79	425
gear_ratio	74	3.014865	.4562871	2.19	3.89
foreign	74	.2972973	.4601885	0	1

There are only 69 observations on rep78, so some of the observations are missing. There are no observations on make because it is a string variable.

The idea of the mean is quite old (Plackett 1958), but its extension to a scheme of moment-based measures was not done until the end of the 19th century. Between 1893 and 1905, Pearson discussed and named the standard deviation, skewness, and kurtosis, but he was not the first to use any of these. Thiele (1889), in contrast, had earlier firmly grasped the notion that the m_r provide a systematic basis for discussing distributions. However, even earlier anticipations can also be found. For example, Euler in 1778 used m_2 and m_3 in passing in a treatment of estimation (Hald 1998, 87), but seemingly did not build on that.

Similarly, the idea of the median is quite old. The history of the interquartile range is tangled up with that of the probable error, a long-popular measure. Extending this in various ways to a more general approach based on quantiles (to use a later term) occurred to several people in the nineteenth century. Galton (1875) is a nice example, particularly because he seems so close to the key idea of the quantiles as a function, which took another century to reemerge strongly.

Thorvald Nicolai Thiele (1838–1910) was a Danish scientist who worked in astronomy, mathematics, actuarial science, and statistics. He made many pioneering contributions to statistics, several of which were overlooked until recently. Thiele advocated graphical analysis of residuals checking for trends, symmetry of distributions, and changes of sign, and he even warned against overinterpreting such graphs.

Example 2: summarize with the detail option

The detail option provides all the information of a normal summarize and more. The format of the output also differs, as shown here:

. summarize mpg, detail							
		Mileage	(mpg)				
	Percentiles	Smallest					
1%	12	12					
5%	14	12					
10%	14	14	Obs	74			
25%	18	14	Sum of Wgt.	74			
50%	20		Mean	21.2973			
		Largest	Std. Dev.	5.785503			
75%	25	34					
90%	29	35	Variance	33.47205			
95%	34	35	Skewness	.9487176			
99%	41	41	Kurtosis	3.975005			

As in the previous example, we see that the mean of mpg is 21.3 miles per gallon and that the standard deviation is 5.79. We also see the various percentiles. The median of mpg (the 50th percentile) is 20 miles per gallon. The 25th percentile is 18, and the 75th percentile is 25.

When we performed summarize, we learned that the minimum and maximum were 12 and 41, respectively. We now see that the four smallest values in our dataset are 12, 12, 14, and 14. The four largest values are 34, 35, 35, and 41. The skewness of the distribution is 0.95, and the kurtosis is 3.98. (A normal distribution would have a skewness of 0 and a kurtosis of 3.)

Skewness is a measure of the lack of symmetry of a distribution. If the distribution is symmetric, the coefficient of skewness is 0. If the coefficient is negative, the median is usually greater than the mean and the distribution is said to be skewed left. If the coefficient is positive, the median is usually less than the mean and the distribution is said to be skewed right. *Kurtosis* (from the Greek *kyrtosis*, meaning curvature) is a measure of peakedness of a distribution. The smaller the coefficient of kurtosis, the flatter the distribution. The normal distribution has a coefficient of kurtosis of 3 and provides a convenient benchmark.

Technical note

The convention of calculating the median of an even number of values by averaging the central two order statistics is of long standing. (That is, given 8 values, average the 4th and 5th smallest values, or given 42, average the 21st and 22nd smallest.) Stigler (1977) filled a much-needed gap in the literature by naming such paired central order statistics as "comedians", although it remains unclear how far he was joking.

Example 3: summarize with the by prefix

summarize can usefully be combined with the by *varlist*: prefix. In our dataset, we have a variable, foreign, that distinguishes foreign and domestic cars. We can obtain summaries of mpg and weight within each subgroup by typing

> foreign = Dor	mestic				
Variable	Obs	Mean	Std. Dev.	Min	Max
mpg weight	52 52	19.82692 3317.115	4.743297 695.3637	12 1800	34 4840
> foreign = For	reign				
Variable	Obs	Mean	Std. Dev.	Min	Max
mpg	22	24.77273	6.611187	14	41
weight	22	2315.909	433.0035	1760	3420

. by foreign: summarize mpg weight

Domestic cars in our dataset average 19.8 miles per gallon, whereas foreign cars average 24.8.

Because by *varlist*: can be combined with summarize, it can also be combined with summarize, detail:

. by foreign: summarize mpg, detail

-> fo	oreign = Domestic				
		Mileage	(mpg)		
	Percentiles	Smallest			
1%	12	12			
5%	14	12			
10%	14	14		Obs	52
25%	16.5	14		Sum of Wgt.	52
50%	19			Mean	19.82692
		Largest		Std. Dev.	4.743297
75%	22	28			
90%	26	29		Variance	22.49887
95%	29	30		Skewness	.7712432
99%	34	34		Kurtosis	3.441459

```
-> foreign = Foreign
```

		Mileage	(mpg)	
	Percentiles	Smallest		
1%	14	14		
5%	17	17		
10%	17	17	Obs	22
25%	21	18	Sum of Wgt.	22
50%	24.5		Mean	24.77273
		Largest	Std. Dev.	6.611187
75%	28	31		
90%	35	35	Variance	43.70779
95%	35	35	Skewness	.657329
99%	41	41	Kurtosis	3.10734

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Technical note

summarize respects display formats if we specify the format option. When we type summarize price weight, we obtain

. summarize p	rice weight				
Variable	Obs	Mean	Std. Dev.	Min	Max
price weight	74 74	6165.257 3019.459	2949.496 777.1936	3291 1760	15906 4840

The display is accurate but is not as aesthetically pleasing as we may wish, particularly if we plan to use the output directly in published work. By placing formats on the variables, we can control how the table appears:

```
. format price weight %9.2fc
```

```
. summarize price weight, format
```

Variable	Obs	Mean	Std. Dev.	Min	Max
price	74	6,165.26	2,949.50	3,291.00	15,906.00
weight	74	3,019.46	777.19	1,760.00	4,840.00

If you specify a weight (see [U] **11.1.6 weight**), each observation is multiplied by the value of the weighting expression before the summary statistics are calculated so that the weighting expression is interpreted as the discrete density of each observation.

Example 4: summarize with factor variables

You can also use summarize to obtain summary statistics for factor variables. For example, if you type

. summarize i	.rep78				
Variable	Obs	Mean	Std. Dev.	Min	Max
rep78					
Fair	69	.115942	.3225009	0	1
Average	69	.4347826	.4993602	0	1
Good	69	.2608696	.4423259	0	1
Excellent	69	.1594203	.3687494	0	1

you obtain the sample proportions for four of the five levels of the rep78 variable. For example, 11.6% of the 69 cars with nonmissing values of rep78 have a fair repair record. When you use factor-variable notation, the base category is suppressed by default. If you type

. summarize bn.rep78							
Variable	Obs	Mean	Std. Dev.	Min	Max		
rep78							
Poor	69	.0289855	.1689948	0	1		
Fair	69	.115942	.3225009	0	1		
Average	69	.4347826	.4993602	0	1		
Good	69	.2608696	.4423259	0	1		
Excellent	69	.1594203	.3687494	0	1		

the notation bn.rep78 indicates that Stata should not suppress the base category so that we see the proportions for all five levels.

We could have used tabulate oneway rep78 to obtain the sample proportions along with the cumulative proportions. Alternatively, we could have used proportions rep78 to obtain the sample proportions along with the standard errors of the proportions instead of the standard deviations of the proportions.

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Example 5: summarize with weights

We have 1980 census data on each of the 50 states. Included in our variables is medage, the median age of the population of each state. If we type summarize medage, we obtain unweighted statistics:

. use http://w (1980 Census d	ww.stata-press. ata by state)	com/data/	r13/census					
. summarize me	. summarize medage							
Variable	Obs	Mean	Std. Dev.	Min	Max			
medage	50	29.54	1.693445	24.2	34.7			

Also among our variables is pop, the population in each state. Typing summarize medage [w=pop] produces population-weighted statistics:

. summarize medage [w=pop] (analytic weights assumed)							
Variable	Obs	Weight	Mean	Std. Dev.	Min	Max	
medage	50	225907472	30.11047	1.66933	24.2	34.7	

The number listed under Weight is the sum of the weighting variable, pop, indicating that there are roughly 226 million people in the United States. The pop-weighted mean of medage is 30.11 (compared with 29.54 for the unweighted statistic), and the weighted standard deviation is 1.67 (compared with 1.69).

Example 6: summarize with weights and the detail option

We can obtain detailed summaries of weighted data as well. When we do this, *all* the statistics are weighted, including the percentiles.

. summarize medage [w=pop], detail (analytic weights assumed)						
Median age						
	Percentiles	Smallest				
1%	27.1	24.2				
5%	27.7	26.1				
10%	28.2	27.1	Obs	50		
25%	29.2	27.4	Sum of Wgt.	225907472		
50%	29.9		Mean	30.11047		
		Largest	Std. Dev.	1.66933		
75%	30.9	32				
90%	32.1	32.1	Variance	2.786661		
95%	32.2	32.2	Skewness	.5281972		
99%	34.7	34.7	Kurtosis	4.494223		

□ Technical note

If you are writing a program and need to access the mean of a variable, the meanonly option provides for fast calls. For example, suppose that your program reads as follows:

```
program mean
    summarize '1', meanonly
    display " mean = " r(mean)
end
```

The result of executing this is

```
. use http://www.stata-press.com/data/r13/auto2
(1978 Automobile Data)
. mean price
  mean = 6165.2568
```

4

4

Video example

Descriptive statistics in Stata

Stored results

summarize stores the following in r():

Scalars			
r(N)	number of observations	r(p50)	50th percentile (detail only)
r(mean)	mean	r(p75)	75th percentile (detail only)
r(skewness)	skewness (detail only)	r(p90)	90th percentile (detail only)
r(min)	minimum	r(p95)	95th percentile (detail only)
r(max)	maximum	r(p99)	99th percentile (detail only)
r(sum_w)	sum of the weights	r(Var)	variance
r(p1)	1st percentile (detail only)	r(kurtosis)	kurtosis (detail only)
r(p5)	5th percentile (detail only)	r(sum)	sum of variable
r(p10)	10th percentile (detail only)	r(sd)	standard deviation
r(p25)	25th percentile (detail only)		

Methods and formulas

Let x denote the variable on which we want to calculate summary statistics, and let x_i , i = 1, ..., n, denote an individual observation on x. Let v_i be the weight, and if no weight is specified, define $v_i = 1$ for all i.

Define V as the sum of the weight:

$$V = \sum_{i=1}^{n} v_i$$

Define w_i to be v_i normalized to sum to n, $w_i = v_i(n/V)$.

The mean, \overline{x} , is defined as

$$\overline{x} = \frac{1}{n} \sum_{i=1}^{n} w_i x_i$$

The variance, s^2 , is defined as

$$s^{2} = \frac{1}{n-1} \sum_{i=1}^{n} w_{i} (x_{i} - \overline{x})^{2}$$

The standard deviation, s, is defined as $\sqrt{s^2}$.

Define m_r as the rth moment about the mean \overline{x} :

$$m_r = \frac{1}{n} \sum_{i=1}^n w_i (x_i - \overline{x})^r$$

The coefficient of skewness is then defined as $m_3 m_2^{-3/2}$. The coefficient of kurtosis is defined as $m_4 m_2^{-2}$.

Let $x_{(i)}$ refer to the x in ascending order, and let $w_{(i)}$ refer to the corresponding weights of $x_{(i)}$. The four smallest values are $x_{(1)}$, $x_{(2)}$, $x_{(3)}$, and $x_{(4)}$. The four largest values are $x_{(n)}$, $x_{(n-1)}$, $x_{(n-2)}$, and $x_{(n-3)}$. To obtain the *p*th *percentile*, which we will denote as $x_{[p]}$, let P = np/100. Let

$$W_{(i)} = \sum_{j=1}^{i} w_{(j)}$$

Find the first index i such that $W_{(i)} > P$. The pth percentile is then

$$x_{[p]} = \begin{cases} \frac{x_{(i-1)} + x_{(i)}}{2} & \text{if } W_{(i-1)} = P\\ x_{(i)} & \text{otherwise} \end{cases}$$

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Also see

- [R] ameans Arithmetic, geometric, and harmonic means
- [R] centile Report centile and confidence interval
- [R] mean Estimate means
- [R] **proportion** Estimate proportions
- [R] ratio Estimate ratios
- [R] table Flexible table of summary statistics
- [R] tabstat Compact table of summary statistics
- [R] tabulate, summarize() One- and two-way tables of summary statistics
- [R] **total** Estimate totals
- [D] codebook Describe data contents
- [D] describe Describe data in memory or in file
- [D] **inspect** Display simple summary of data's attributes
- [ST] stsum Summarize survival-time data
- [SVY] svy estimation Estimation commands for survey data
- [XT] xtsum Summarize xt data