graph matrix — Matrix graphs

Description

graph matrix draws scatterplot matrices.

Quick start

Scatterplot matrix for variables v1, v2, v3, v4, and v5
    graph matrix v1 v2 v3 v4 v5

As above, but draw only the lower triangle
    graph matrix v1 v2 v3 v4 v5, half

Separate scatterplot matrices for each level of catvar
    graph matrix v1 v2 v3 v4 v5, by(catvar)

With hollow circles as markers
    graph matrix v1 v2 v3 v4 v5, half msymbol(Oh)

As above, but with periods as markers
    graph matrix v1 v2 v3 v4 v5, half msymbol(p)

Override the default text on the diagonal for v1 and v3
    graph matrix v1 v2 v3 v4 v5, diagonal("Variable 1" . "Variable 3")

Menu

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Syntax

```
graph matrix varlist [if] [in] [weight] [, options]
```

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All options allowed by `graph twoway scatter` are also allowed, but they are ignored.

- `half`, `diagonal()`, `scale()`, and `iscale()` are unique; `jitter()` and `jitterseed()` are rightmost and `maxes()` is merged-implicit; see [G-4] `Concept: repeated options`.
- `stringlist`, ..., the argument allowed by `diagonal()`, is defined
  ```
  [ { . | "string" } [ { . | "string" } ... ] [ , textbox_options ]
  ```
- `aweights`, `fweights`, and `pweights` are allowed; see [U] `11.1.6 weight`. Weights affect the size of the markers. See `Weighted markers` in [G-2] `graph twoway scatter`.

Options

half specifies that only the lower triangle of the scatterplot matrix be drawn.

*marker_options* specify the look of the markers used to designate the location of the points. The important *marker_options* are `msymbol()`, `mcolor()`, and `msize()`.

The default symbol used is `msymbol(0)`—solid circles. You specify `msymbol(Oh)` if you want hollow circles (a recommended alternative). If you have many observations, we recommend specifying `msymbol(p)`; see `Marker symbols and the number of observations` under Remarks and examples below. See [G-4] `symbolstyle` for a list of marker symbol choices.

The default `mcolor()` is dictated by the scheme; see [G-4] `Schemes intro`. See [G-4] `colorstyle` for a list of color choices.

Be careful specifying the `msize()` option. In `graph matrix`, the size of the markers varies with the number of variables specified; see option `iscale()` below. If you specify `msize()`, that will override the automatic scaling.

See [G-3] `marker_options` for more information on markers.
marker_label_options allow placing identifying labels on the points. To obtain this, you specify the 
marker_label_option mlabel(varname); see [G-3] marker_label_options. These options are of
little use for scatterplot matrices because they make the graph seem too crowded.

jitter(#) adds spherical random noise to the data before plotting. # represents the size of the noise
as a percentage of the graphical area. This is useful when plotting data which otherwise would
result in points plotted on top of each other. See Jittered markers in [G-2] graph twoway scatter
for an explanation of jittering.

jitterseed(#) specifies the seed for the random noise added by the jitter() option. # should
be specified as a positive integer. Use this option to reproduce the same plotted points when the
jitter() option is specified.

diagonal([stringlist][, textbox_options]) specifies text and its style to be displayed along the
diagonal. This text serves to label the graphs (axes). By default, what appears along the diagonals
are the variable labels of the variables of varlist or, if a variable has no variable label, its name.
Typing

    . graph matrix mpg weight displ, diag(. "Weight of car")

would change the text appearing in the cell corresponding to variable weight. We specified period
(.) to leave the text in the first cell unchanged, and we did not bother to type a third string or a
period, so we left the third element unchanged, too.

You may specify textbox_options following stringlist (which may itself be omitted) and a comma.
These options will modify the style in which the text is presented but are of little use here. We
recommend that you do not specify diagonal(size()) to override the default sizing of the text. By default, the size of text varies with the number of variables specified; see option
iscale() below. Specifying diagonal(size()) will override the automatic size scaling. See
[G-3] textbox_options for more information on textboxes.

diagopts(textbox_options) specify the look of text on the diagonal. This option is a shortcut for
diagonal(size()), text appearing along the diagonals, and the labels and ticks appearing on the axes.

scale(#) specifies a multiplier that affects the size of all text and markers in a graph. scale(1) is
the default, and scale(1.2) would make all text and markers 20% larger. See [G-3] scale_option.

iscale(#) and iscale(*#) specify an adjustment (multiplier) to be used to scale the markers, the
text appearing along the diagonals, and the labels and ticks appearing on the axes.

By default, iscale() gets smaller and smaller the larger n is, the number of variables specified in
varlist. The default is parameterized as a multiplier f(n)—0 < f(n) < 1, f'(n) < 0—that is used as
a multiplier for msize(), diagonal(size()), maxes(labsize()), and maxes(tlength()).

If you specify iscale(#), the number you specify is substituted for f(n). We recommend that
you specify a number between 0 and 1, but you are free to specify numbers larger than 1.

If you specify iscale(*#), the number you specify is multiplied by f(n), and that product is used
to scale text. Here you should specify #>0; #>1 merely means you want the text to be bigger
than graph matrix would otherwise choose.

maxes(axis_scale_options axis_label_options) affect the scaling and look of the axes. This is a case
where you specify options within options.

Consider the axis_scale_options \{ y | x \}scale(log), which produces logarithmic scales. Type
maxes(yscale(log) xscale(log)) to draw the scatterplot matrix by using log scales. Remember
to specify both xscale(log) and yscale(log), unless you really want just the y axis or just
the x axis logged.
Or consider the `axis_label_options` `{y|x}label(grid)`, which adds grid lines. Specify `maxes(ylabel(grid))` to add grid lines across, `maxes(xlabel(grid))` to add grid lines vertically, and both options to add grid lines in both directions. When using both, you can specify the `maxes()` option twice—`maxes(ylabel(grid)) maxes(xlabel(grid))`—or once combined—`maxes(ylabel(grid) xlabel(grid))`—it makes no difference because `maxes()` is `merged-implicit`; see [G-4] `Concept: repeated options`.

See [G-3] `axis_scale_options` and [G-3] `axis_label_options` for the suboptions that may appear inside `maxes()`. In reading those entries, ignore the `axis(#)` suboption; `graph matrix` will ignore it if you specify it.

`axis_label_options` allow you to assert axis-by-axis control over the labeling. Do not confuse this with `maxes(axis_label_options)`, which specifies options that affect all the axes. `axis_label_options` specified outside the `maxes()` option specify options that affect just one of the axes. `axis_label_options` can be repeated for each axis.

When you specify `axis_label_options` outside `maxes()`, you must specify the axis-label suboption `axis(#)`. For instance, you might type

```
   . graph matrix mpg weight displ, ylabel(0(5)40, axis(1))
```

The effect of that would be to label the specified values on the first `y` axis (the one appearing on the far right). The axes are numbered as follows:

```
  x  
axis(2) v1/v2 v1/v3 v1/v4 v1/v5 y axis(1)  
  x  
axis(4) v2/v1 v2/v3 v2/v4 v2/v5 y axis(3)  
  y axis(2) v3/v1 v3/v2 v3/v4 v3/v5 y axis(5)  
  y axis(4) v4/v1 v4/v2 v4/v3 y axis(3)  
  y axis(4) v5/v1 v5/v2 v5/v3 v5/v4 y axis(5)  
  y axis(5) x  
axis(1) x axis(2) x axis(3) x axis(4) x axis(5)  
```

and if `half` is specified, the numbering scheme is

```
  y axis(2) v2/v1  
  y axis(3) v3/v1 v3/v2  
  y axis(4) v4/v1 v4/v2 v4/v3  
  y axis(5) v5/v1 v5/v2 v5/v3 v5/v4  
  y axis(2)  
  y axis(3)  
  y axis(4)  
  y axis(5)  
  x axis(1) x axis(2) x axis(3) x axis(4) x axis(5)  
```

See [G-3] `axis_label_options`; remember to specify the `axis(#)` suboption, and do not specify the `graph matrix` option `maxes()`.

`by(varlist, . . .)` allows drawing multiple graphs for each subgroup of the data. See `Use with by()` under `Remarks and examples` below, and see [G-3] `by_option`. 
**Remarks and examples**

Remarks are presented under the following headings:

- Typical use
- Marker symbols and the number of observations
- Controlling the axes labeling
- Adding grid lines
- Adding titles
- Use with by()
- History

**Typical use**

*graph matrix* provides an excellent alternative to correlation matrices (see [R] `correlate`) as a quick way to examine the relationships among variables:

```
. use https://www.stata-press.com/data/r16/lifeexp
  (Life expectancy, 1998)
. graph matrix popgrowth-safewater
```

![Graph matrix example](attachment:image.png)
Seeing the above graph, we are tempted to transform `gnppc` into log units:

```
. generate lgnppc = ln(gnppc)
(5 missing values generated)
. graph matrix popgr lexp lgnp safe
```

Some people prefer showing just half the matrix, moving the “dependent” variable to the end of the list:

```
. gr matrix popgr lgnp safe lexp, half
```
Marker symbols and the number of observations

The `msymbol()` option—abbreviation `ms()`—allows us to control the marker symbol used; see [G-3] `marker_options`. Hollow symbols sometimes work better as the number of observations increases:

```
> use https://www.stata-press.com/data/r16/auto, clear
(1978 Automobile Data)
> gr mat mpg price weight length, ms(Oh)
```

Points work best when there are many data:

```
> use https://www.stata-press.com/data/r16/citytemp, clear
(City Temperature Data)
> gr mat heatdd-tempjuly, ms(p)
```
Controlling the axes labeling

By default, approximately three values are labeled and ticked on the $y$ and $x$ axes. When graphing only a few variables, increasing this often works well:

```
. use https://www.stata-press.com/data/r16/citytemp, clear
   (City Temperature Data)
. gr mat heatdd-tempjuly, ms(p) maxes(ylab(#4) xlab(#4))
```

Specifying #4 does not guarantee four labels; it specifies that approximately four labels be used; see [G-3] `axis_label_options'. Also see `axis_label_options' under `Options' above for instructions on controlling the axes individually.

Adding grid lines

To add horizontal grid lines, specify `maxes(ylab(,grid))', and to add vertical grid lines, specify `maxes(xlab(,grid))'. Below we do both and specify that four values be labeled:

```
. use https://www.stata-press.com/data/r16/lifeexp, clear
   (Life expectancy, 1998)
. generate lgnppc = ln(gnppc)
   (5 missing values generated)
. graph matrix popgr lexp lgnp safe, maxes(ylab(#4, grid) xlab(#4, grid))
```
Adding titles

The standard title options may be used with `graph matrix`:

```stata
. use https://www.stata-press.com/data/r16/lifeexp, clear
   (Life expectancy, 1998)
. generate lgnppc = ln(gnppc)
   (5 missing values generated)
. label var lgnppc "ln GNP per capita"
. graph matrix popgr lexp lgnp safe, maxes(ylab(#4, grid) xlab(#4, grid))
   subtitle("Summary of 1998 life-expectancy data")
   note("Source: The World Bank Group")
```
Use with by()

Graph matrix may be used with by():

```
use https://www.stata-press.com/data/r16/auto, clear
(1978 Automobile Data)
.gr matrix mpg weight displ, by(foreign) xsize(5)
```

See [G-3] by_option.

History

The origin of the scatterplot matrix is unknown, although early written discussions may be found in Hartigan (1975), Tukey and Tukey (1981), and Chambers et al. (1983). The scatterplot matrix has also been called the draftman’s display and pairwise scatterplot. Regardless of the name used, we believe that the first “canned” implementation was by Becker and Chambers in a system called S—see Becker and Chambers (1984)—although S predates 1984. We also believe that Stata provided the second implementation, in 1985.

References


Also see

[G-2] graph — The graph command

[G-2] graph twoway scatter — Twoway scatterplots