Title

> **graph twoway lpolyci —** Local polynomial smooth plots with CIs

Description

graph twoway lpolyci plots a local polynomial smooth of *yvar* on *xvar* by using graph twoway line (see [G-2] **graph twoway line**), along with a confidence interval by using graph twoway rarea (see [G-2] **graph twoway rarea**).

Quick start

Local polynomial smooth plot of y versus x with 95% confidence interval and local mean smoothing
    twoway lpolyci y x

Same as above, but with a polynomial of degree 3
    twoway lpolyci y x, degree(3)

Overlay scatterplot of the observed data on polynomial smooth plot
    twoway lpolyci y x || scatter y x

Same as above, but with a 99% confidence interval
    twoway lpolyci y x, level(99) || scatter y x

Specify the Gaussian kernel function
    twoway lpolyci y x, kernel(gaussian) || scatter y x

Specify the half-width of the kernel as 85
    twoway lpolyci y x, bwidth(85) || scatter y x

With a separate graph area for each level of catvar
    twoway lpolyci y x || scatter y x, by(catvar)

Add "My Title" as the title of the graph
    twoway lpolyci y x || scatter y x, title("My Title")

Draw the confidence limits as a pair of lines rather than as an area
    twoway lpolyci y x, ciplot(rline) || scatter y x

Menu

Graphics > Twoway graph (scatter, line, etc.)

Syntax

> <u>tw</u>oway lpolyci *yvar* *xvar* $\big[$*if*$\big]$ $\big[$*in*$\big]$ $\big[$*weight*$\big]$ $\big[$, *options*$\big]$

options	Description
<u>k</u>ernel(*kernel*)	kernel function; default is kernel(epanechnikov)
<u>b</u>width(*#*)	kernel bandwidth
<u>d</u>egree(*#*)	degree of the polynomial smooth; default is degree(0)
n(*#*)	obtain the smooth at *#* points; default is min($N, 50$)
<u>l</u>evel(*#*)	set confidence level; default is level(95)
<u>pw</u>idth(*#*)	pilot bandwidth for standard error calculation
<u>v</u>ar(*#*)	estimate of the constant conditional variance
nofit	do not plot the smooth
<u>fitp</u>lot(*plottype*)	how to plot the smooth; default is fitplot(line)
<u>cip</u>lot(*plottype*)	how to plot CIs; default is ciplot(rarea)
fcline_options	change look of the smoothed line
fitarea_options	change look of CI
axis_choice_options	associate plot with alternative axis
twoway_options	titles, legends, axes, added lines and text, by, regions, name, aspect ratio, etc.

kernel	Description
<u>epan</u>echnikov	Epanechnikov kernel function; the default
epan2	alternative Epanechnikov kernel function
<u>bi</u>weight	biweight kernel function
<u>cos</u>ine	cosine trace kernel function
<u>g</u>aussian	Gaussian kernel function
<u>par</u>zen	Parzen kernel function
<u>rec</u>tangle	rectangle kernel function
<u>tri</u>angle	triangle kernel function

fweights and aweights are allowed; see [U] **11.1.6 weight**.

Options

<u>k</u>ernel(*kernel*) specifies the kernel function for use in calculating the weighted local polynomial estimate. The default is kernel(epanechnikov). See [R] **kdensity** for more information on this option.

<u>b</u>width(*#*) specifies the half-width of the kernel, the width of the smoothing window around each point. If bwidth() is not specified, a rule-of-thumb bandwidth estimator is calculated and used; see [R] **lpoly**.

<u>d</u>egree(*#*) specifies the degree of the polynomial to be used in the smoothing. The default is degree(0), meaning local mean smoothing.

`n(#)` specifies the number of points at which the smooth is to be evaluated. The default is $\min(N, 50)$, where N is the number of observations.

`level(#)` specifies the confidence level, as a percentage, for confidence intervals. The default is `level(95)` or as set by `set level`; see [U] **20.8 Specifying the width of confidence intervals**.

`pwidth(#)` specifies the pilot bandwidth to be used for standard error computations. The default is chosen to be 1.5 times the value of the rule-of-thumb bandwidth selector.

`var(#)` specifies an estimate of a constant conditional variance required for standard error computation. By default, the conditional variance at each smoothing point is estimated by the normalized weighted residual sum of squares obtained from locally fitting a polynomial of order $p + 2$, where p is the degree specified in `degree()`.

`nofit` prevents the smooth from being plotted.

`fitplot(plottype)` specifies how the prediction is to be plotted. The default is `fitplot(line)`, meaning that the smooth will be plotted by `graph twoway line`. See [G-2] **graph twoway** for a list of *plottype* choices. You may choose any that expects one y and one x variable. `fitplot()` is seldom used.

`ciplot(plottype)` specifies how the confidence interval is to be plotted. The default is `ciplot(rarea)`, meaning that the confidence bounds will be plotted by `graph twoway rarea`.

A reasonable alternative is `ciplot(rline)`, which will substitute lines around the smooth for shading. See [G-2] **graph twoway** for a list of *plottype* choices. You may choose any that expects two y variables and one x variable.

fcline_options specify how the lpoly line is rendered and its appearance; see [G-3] *fcline_options*.

fitarea_options specify how the confidence interval is rendered; see [G-3] *fitarea_options*. If you specify `ciplot()`, you should specify whatever is appropriate instead of using *fitarea_options*.

axis_choice_options associate the plot with a particular y or x axis on the graph; see [G-3] *axis_choice_options*.

twoway_options are a set of common options supported by all `twoway` graphs. These options allow you to title graphs, name graphs, control axes and legends, add lines and text, set aspect ratios, create graphs over `by()` groups, and change some advanced settings. See [G-3] *twoway_options*.

Remarks and examples

graph twoway lpolyci *yvar xvar* uses the lpoly command—see [R] **lpoly**—to obtain a local polynomial smooth of *yvar* on *xvar* and confidence intervals and uses graph twoway line and graph twoway rarea to plot results.

Remarks are presented under the following headings:

Typical use
Use with by( )

Typical use

graph twoway lpolyci can be used to overlay the confidence bands obtained from different local polynomial smooths. For example, for local mean and local cubic polynomial smooths:

```
. use https://www.stata-press.com/data/r18/auto
(1978 automobile data)

. twoway lpolyci weight length, nofit                    ||
         lpolyci weight length, degree(3) nofit
                              ciplot(rline) lcolor(gs6) ||
         scatter weight length, msymbol(o)
```
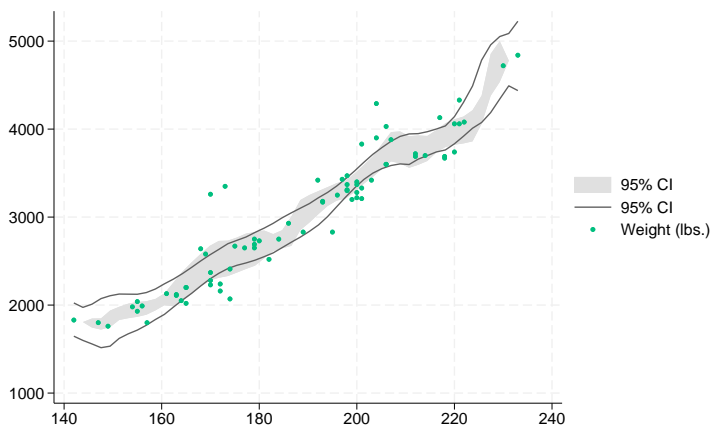

The plotted area corresponds to the confidence bands for the local mean smooth and lines correspond to confidence intervals for the local cubic smooth.

When you overlay graphs, you nearly always need to respecify the axis titles by using the *axis_title_options* ytitle() and xtitle(); see [G-3] *axis_title_options*.

Use with by( )

graph twoway lpolyci may be used with by():

```
. use https://www.stata-press.com/data/r18/auto, clear
(1978 automobile data)
. twoway lpolyci weight length                  ||
            scatter weight length, msymbol(o) ||
    , by(foreign)
```


Graphs by Car origin
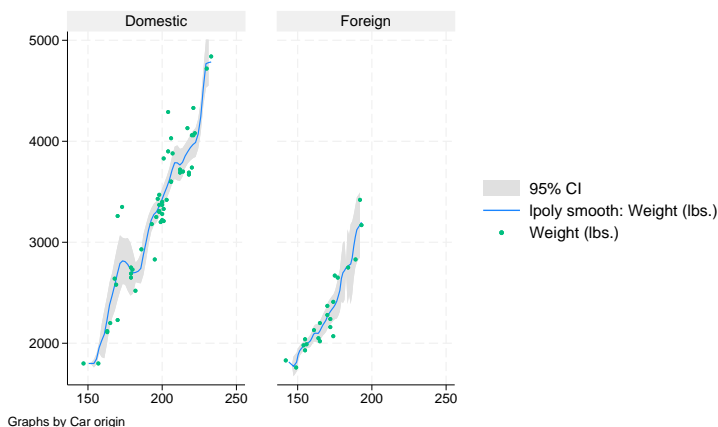
Also see

[R] **lpoly** — Kernel-weighted local polynomial smoothing

[G-2] **graph twoway lpoly** — Local polynomial smooth plots