Statistics/Data analysis

Title

lpbwdensity —— Bandwidth Selection for Local Polynomial Density Estimation and Inference.

Syntax

lpbwdensity *Var* [*if*] [*in*] [,
grid(*Var***) p(***#***) v(***#***) kernel(***KernelFn* **)bwselect(***BwMethod***) nomasspoints nostdvar**
nlocalmin(*#***) nuniquemin(***#***) noregularize**
cweights(*Var***) pweights(***Var***)**
genvars(*NewVarName***)**
rgrid(*Var***) rindex(***Var***) separator(***#***)**
]

Description

lpbwdensity implements the bandwidth selection methods for local polynomial based density (and derivatives) estimation proposed and studied in Cattaneo, Jansson and Ma (2020a) and Cattaneo, Jansson and Ma (2020b). See Cattaneo, Jansson and Ma (2020c) for more implementation details and illustrations.

Companion command: lpdensity for estimation and robust bias-corrected inference.

Companion R functions are also available here.

Related Stata and R packages are available in the following website:

https://sites.google.com/site/nppackages/

Options

Bandwidth Selection

grid(*Var*) specifies the grid on which density is estimated. When set to default, grid points will be chosen as 0.05-0.95 percentiles of the data, with 0.05 step size.

p(*#*) specifies the the order of the local-polynomial used to construct point estimates. Default is **p(2)** (local quadratic regression).

v(*#*) specifies the derivative of distribution function to be estimated. **v(0)** for the distribution function, **v(1)** (default) for the density funtion, etc.

kernel(*KernelFn*) specifies the kernel function used to construct the local-polynomial estimator(s).
triangular *K(u) = (1 - |u|) * (|u|<=1)*. This is the default option.
epanechnikov *K(u) = 0.75 * (1 - u^2) * (|u|<=1)*.
uniform *K(u) = 0.5 * (|u|<=1)*.

bwselect(*BwMethod*) specifies method for data-driven bandwidth selection. This option will be ignored if **bw(***Var***)** is provided.
mse-dpi mean squared error optimal bandwidth for each grid point. This is the default option.
imse-dpi integrated mean squared error optimal bandwidth which is common for all grid points.
mse-rot rule-of-thumb bandwidth based on a Gaussian reference model.
imse-rot integrated rule-of-thumb bandwidth based on a Gaussian reference model which is common for all grid points.

nomasspoints will not adjust for mass points in the data.

nostdvar will not standardize the data for bandwidth selection. Note that this may lead to unstable performance of the numerical optimization procedure.

Local Sample Size Checking

nlocalmin(*#*) specifies the minimum number of observations in each local neighborhood. This option will be ignored if set to 0, or if **noregularize** is used. The default value is **20+p(*#*)+1**.

nuniquemin(*#*) specifies the minimum number of unique observations in each local neighborhood. This option will be ignored if set to 0, or if **noregularize** is used. The default value is **20+p(*#*)+1**.

noregularize suppresses local sample size checking.

Weights

cweights(*Var*) specifies weights used for counterfactual distribution construction.

pweights(*Var*) specifies weights used in sampling. Should be nonnegative.

Storing and displaying results

genvars(*NewVarName*) specifies if new varaibles should be generated to store estimation results. If *newVarName* is provided, the following new varaibles will be generated:
NewVarName_grid grid points,
NewVarName_bw bandwidths,
newVarName_nh local/effective sample sizes.

rgrid(*var*) specifies a set of grid points to display the results. When omitted, this will be the same as **grid(*Var*)**.

rindex(*var*) specifies a set of indices to display the results. This option will be ignored if **rgrid(*Var*)** is provided.

separator(*#*) draw a seperation line after every # variables; default is **separator(5)**.

Examples

Generate artifitial data:

```
. set obs 1000
. set seed 42
. gen lpd_data = rnormal()
```

MSE-optimal bandwidths for empirical quantiles:

```
. lpbwdensity lpd_data
```

Save estimation results to variables:

```
. capture drop temp_*
. lpbwdensity lpd_data, genvars(temp)
```

Saved results

lpbwdensity saves the following in **e()**:

Scalars

e(N)	sample size
e(p)	option **p(*#*)**
e(v)	option **v(*#*)**

Macros

e(bwselect)	option **bwselect(*BwMethod*)**
e(kernel)	option **kernel(*KernelFn*)**

Matrices

e(result)	estimation result

References

Cattaneo, M. D., Michael Jansson, and Xinwei Ma. 2020a. Simple Local Polynomial Density Estimators.
Journal of the American Statistical Association, forthcoming.

Cattaneo, M. D., Michael Jansson, and Xinwei Ma. 2020b. Local Regression Distribution Estimators.
Working paper.

Cattaneo, M. D., Michael Jansson, and Xinwei Ma. 2020c. lpdensity: Local Polynomial Density Estimation and Inference.
Working paper.

Authors

Matias D. Cattaneo, Princeton University, Princeton, NJ. cattaneo@princeton.edu.

Michael Jansson, University of California Berkeley, Berkeley, CA. mjansson@econ.berkeley.edu.

Xinwei Ma, University of California San Diego, La Jolla, CA. x1ma@ucsd.edu.