



Title

rdbwdensity — Bandwidth Selection for Manipulation Testing Using Local Polynomial Density Estimation.

Syntax

```
rdbwdensity Var [if] [in] [,
    c(#) p(#) kernel(KernelFn) fitselect(FitMethod) vce(VceMethod)
    nomasspoints
    nlocalmin(#) nuniquemin(#) noregularize
    ]
```

Description

rdbwdensity implements several data-driven bandwidth selection methods useful to construct manipulation testing procedures using the local polynomial density estimators proposed in Cattaneo, Jansson and Ma (2020).

A detailed introduction to this Stata command is given in Cattaneo, Jansson and Ma (2018). Companion R functions are also available [here](#).

Companion function is **rddensity**. See also the **lpdensity** package for other related bandwidth selection methods.

Related Stata and R packages useful for inference in regression discontinuity (RD) designs are described in the following website:

<https://rdpackages.github.io/>

Options

Bandwidth Selection

c(#) specifies the threshold or cutoff value in the support of *Var*, which determines the two samples (e.g., control and treatment units in RD settings). Default is **c**(0).

p(#) specifies the local polynomial order used to construct the density estimators. Default is **p**(2) (local quadratic approximation).

fitselect(*FitMethod*) specifies the density estimation method.
unrestricted for density estimation without any restrictions (two-sample, unrestricted inference). This is the default option.
restricted for density estimation assuming equal distribution function and higher-order derivatives.

kernel(*KernelFn*) specifies the kernel function used to construct the local polynomial estimators.

triangular $K(u) = (1 - |u|) * (|u| \leq 1)$. This is the default option.
epanechnikov $K(u) = 0.75 * (1 - u^2) * (|u| \leq 1)$.
uniform $K(u) = 0.5 * (|u| \leq 1)$.

vce(*VceMethod*) specifies the procedure used to compute the variance-covariance matrix estimator.

plugin for asymptotic plug-in standard errors.
jackknife for jackknife standard errors. This is the default option.

nomasspoints will not adjust for mass points in the data.

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 the local sample size checking feature.

Example: Cattaneo, Frandsen and Titiunik (2015) Incumbency Data.

Load dataset (cutoff is 0 in this dataset):
`. use rddensity_senate.dta`

Bandwidth selection for manipulation test using default options:
`. rdbwdensity margin`

Bandwidth selection for manipulation test using plug-in standard errors:
`. rdbwdensity margin, vce(plugin)`

Saved results

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

Macros

| | |
|----------------------|--|
| e(c) | cutoff value |
| e(p) | order of the polynomial used for density estimation |
| e(N_l) | sample size to the left of the cutoff |
| e(N_r) | sample size to the right of the cutoff |
| e(h) | matrix of estimated bandwidth (including underlying estimated constants) |
| e(runningvar) | running variable used |
| e(kernel) | kernel used |
| e(fitmethod) | model used |
| e(vce) | standard errors estimator used |

References

- Cattaneo, M. D., B. Frandsen, and R. Titiunik. 2015. Randomization Inference in the Regression Discontinuity Design: An Application to the Study of Party Advantages in the U.S. Senate. *Journal of Causal Inference* 3(1): 1-24.
- Cattaneo, M. D., M. Jansson, and X. Ma. 2018. Manipulation Testing based on Density Discontinuity. *Stata Journal* 18(1): 234-261.
- Cattaneo, M. D., M. Jansson, and X. Ma. 2020. Simple Local Polynomial Density Estimators. *Journal of the American Statistical Association* 115(531): 1449-1455.

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