STaTa

Statistics/Data analysis

Title

> **rdmc** —— Analysis of Regression Discontinuity Designs with Multiple Cutoffs.

Syntax

> **rdmc** *depvar runvar* [*if*] [*in*], **cvar(***string***)** [**fuzzy(***string***) derivvar(***string***)**
>   **pooled_opt(***string***) verbose pvar(***string***) qvar(***string***) hvar(***string***)**
>   **hrightvar(***string***) bvar(***string***) brightvar(***string***) rhovar(***string***)**
>   **covsvar(***string***) covsdropvar(***string***) kernelvar(***string***) weightsvar(***string***)**
>   **bwselectvar(***string***) scaleparvar(***string***) scaleregulvar(***string***)**
>   **masspointsvar(***string***) bwcheckvar(***string***) bwrestrictvar(***string***)**
>   **stdvarsvar(***string***) vcevar(***string***) level(#) plot graph_opt(***string***)]**

Description

> **rdmc** provides tools to analyze regression discontinuity (RD) designs with multiple
>   cutoffs. For methodological background see Keele and Titiunik (2015),
>   Cattaneo, Keele, Titiunik and Vazquez-Bare (2016), and Cattaneo, Keele,
>   Titiunik and Vazquez-Bare (2021). It also computes alternative estimation and
>   inference procedures available in the literature.

> Companion commands are: rdmcplot for multi-cutoff RD plots, and rdms for
>   multi-score RD estimation and inference.

> A detailed introduction to this command is given in Cattaneo, Titiunik and
>   Vazquez-Bare (2020).

> Companion R functions are also available here.

> This command employs the Stata (and R) package rdrobust for underlying
>   calculations. See Calonico, Cattaneo and Titiunik (2014), Calonico, Cattaneo
>   and Titiunik (2015), and Calonico, Cattaneo, Farrell and Titiunik (2017) for
>   more details.

> Related Stata and R packages useful for inference in RD designs are described in
>   the following website:

> https://rdpackages.github.io/

Options

    ┌─ Estimand ┐

> **cvar(***string***)** specifies the numeric variable containing the RD cutoff for *indepvar*
>   for each unit in the sample.

> **fuzzy(***string***)** indicates a fuzzy design. See rdrobust for details.

> **derivvar(***string***)** a variable of length equal to the number of different cutoffs
>   that specifies the order of the derivative for **rdrobust** to calculate
>   cutoff-specific estimates. See rdrobust for details.

    ┌─ rdrobust Options ┐

> **pooled_opt(***string***)** specifies the options to be passed to **rdrobust** to calculate
>   pooled estimates. See rdrobust for details.

> **verbose** displays the output from **rdrobust** for estimating the pooled estimand.

    ┌─ Local Polynomial Regression ┐

> **pvar(***string***)** a variable of length equal to the number of different cutoffs that
>   specifies the order of the polynomials for **rdrobust** to calculate
>   cutoff-specific estimates. See rdrobust for details.

qvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the order of the polynomials for bias estimation for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

hvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the bandwidths for **rdrobust** to calculate cutoff-specific estimates. When **hrightvar** is specified, **hvar** indicates the bandwidth to the left of the cutoff. When **hrightvar** is not specified, the same bandwidths are used at each side. See <u>rdrobust</u> for details.

hrightvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the bandwidths to the right of the cutoff for **rdrobust** to calculate cutoff-specific estimates. When **hrightvar** is not specified, the bandwidths in **hvar** are used at each side. See <u>rdrobust</u> for details.

bvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the bandwidths for bias estimation for **rdrobust** to calculate cutoff-specific estimates. When **brightvar** is specified, **hvar** indicates the bandwidth to the left of the cutoff. When **brightvar** is not specified, the same bandwidths are used at each side. See <u>rdrobust</u> for details.

brightvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the bandwidths for bias estimation to the right of the cutoff for **rdrobust** to calculate cutoff-specific estimates. When **brightvar** is not specified, the bandwidths in **bvar** are used at each side. See <u>rdrobust</u> for details.

rhovar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the value of rho for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

covsvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the covariates for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

covsdropvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies whether collinear covariates should be dropped. See <u>rdrobust</u> for details.

kernelvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the kernels for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

weightsvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the weights for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

Bandwidth Selection

bwselectvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the bandwidth selection method for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

scaleparvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the value of scalepar for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

scaleregulvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the value of scaleregul for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

masspointsvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies how to handle repeated values in the running variable. See <u>rdrobust</u> for details.

bwcheckvar(_string_**)** a variable of length equal to the number of different cutoffs that specifies the value of **bwcheck**. See <u>rdrobust</u> for details.

bwrestrictvar(*string***)** a variable of length equal to the number of different cutoffs that specifies whether computed bandwidths are restricted to the range of *runvar*. See <u>rdrobust</u> for details.

stdvarsvar(*string***)** a variable of length equal to the number of different cutoffs that specifies whether *depvar* and *runvar* are standardized. See <u>rdrobust</u> for details.

Variance-Covariance Estimation

vcevar(*string***)** a variable of length equal to the number of different cutoffs that specifies the variance-covariance matrix estimation method for **rdrobust** to calculate cutoff-specific estimates. See <u>rdrobust</u> for details.

level(*#***)** specifies the confidence level for confidence intervals. See <u>rdrobust</u> for details.

Plot

plot plots the pooled and cutoff-specific estimates and the weights given by the pooled estimate to each cutoff-specific estimate.

graph_opt(*string***)** options to be passed to the graph when **plot** is specified.

Examples

Standard use of rdmc
     . **rdmc yvar xvar, c(cvar)**

rdmc with plots of estimates and weights
     . **rdmc yvar xvar, c(cvar) plot**

rdmc showing output from **rdrobust** and specifying uniform kernel
     . **rdmc yvar xvar, c(cvar) verbose** pooled_opt(kernel(uniform))

Saved results

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

Scalars

e(tau_weight)	weighted estimate
e(se_weight_rb)	robust bias corrected s.e. for weighted estimate
e(pv_weight_rb)	robust bias corrected p-value for weighted estimate
e(ci_weight_l)	left limit of robust bias corrected confidence interval for weighted estimate
e(ci_weight_r)	right limit of robust bias corrected confidence interval for weighted estimate
e(N_h_l)	effective sample size to the left of the cutoff used to estimate weighted estimand
e(N_h_r)	effective sample size to the right of the cutoff used to estimate weighted estimand
e(tau_pool)	pooled estimate
e(se_rb)	robust bias corrected s.e. for pooled estimate
e(pv_rb)	robust bias corrected p-value
e(ci_rb_l)	left limit of robust bias corrected confidence interval
e(ci_rb_r)	right limit of robust bias corrected confidence interval
e(h_l)	bandwidth to the left of the cutoff used to estimate pooled estimand
e(h_r)	bandwidth to the right of the cutoff used to estimate pooled estimand
e(N_h_l)	sample size within bandwidth to the left of the cutoff used to estimate pooled estimand
e(N_h_r)	sample size within bandwidth to the right of the cutoff used to estimate pooled estimand

Matrices
  e(b)   bias-corrected coefficient vector
  e(V)   robust variance-covariance matrix of the estimators
  e(coefs)   conventional coefficient vector
  e(pv_rb)   robust p-value vector
  e(CI_rb)   bias-corrected confidence intervals
  e(H)   vector of bandwidths at each side of each cutoff
  e(weights)   vector of weights for each cutoff-specific estimate
  e(sampsis)   vector of sample sizes at each side of each cutoff
  e(c_failed)   vector of cutoffs at which rdrobust encountered problems

References

Calonico, S., M. D. Cattaneo, M. H. Farrell, and R. Titiunik. 2017. rdrobust:
    Software for Regression Discontinuity Designs.
    Stata Journal 17(2): 372–404.

Calonico, S., M. D. Cattaneo, and R. Titiunik. 2014. Robust Data-Driven Inference
    in the Regression-Discontinuity Design.
    Stata Journal 14(4): 909–946.

Calonico, S., M. D. Cattaneo, and R. Titiunik. 2015. rdrobust: An R Package for
    Robust Nonparametric Inference in Regression-Discontinuity Designs.
    R Journal 7(1): 38–51.

Cattaneo, M. D., L. Keele, R. Titiunik, and G. Vazquez-Bare. 2016. Interpreting
    Regression Discontinuity Designs with Multiple Cutoffs.
    Journal of Politics 78(4): 1229–1248.

Cattaneo, M. D., L. Keele, R. Titiunik, and G. Vazquez-Bare. 2021. Extrapolating
    Treatment Effects in Multi-Cutoff Regression Discontinuity Designs.
    Journal of American Statistical Association, forthcoming.

Cattaneo, M. D., R. Titiunik, and G. Vazquez-Bare. 2020. Analysis of Regression
    Discontinuity Designs with Multiple Cutoffs or Multiple Scores.
    Stata Journal, forthcoming.

Keele, L., and R. Titiunik. 2015. Geographic Boundaries as Regression
    Discontinuities.
    Political Analysis 23(1): 127–155.

Authors

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

Rocio Titiunik, Princeton University, Princeton, NJ. titiunik@princeton.edu.

Gonzalo Vazquez-Bare, UC Santa Barbara, Santa Barbara, CA.
    gvazquez@econ.ucsb.edu.