Description  The regression discontinuity (RD) design is a popular quasi-experimental design for causal inference and policy evaluation. The 'rdmulti' package provides tools to analyze RD designs with multiple cutoffs or scores: rdmc() estimates pooled and cutoff specific effects for multi-cutoff designs, rdmcplot() draws RD plots for multi-cutoff designs and rdms() estimates effects in cumulative cutoffs or multi-score designs. See Cattaneo, Titiunik and Vazquez-Bare (2020) <https://rdpackages.github.io/references/Cattaneo-Titiunik-VazquezBare_2020_Stata.pdf> for further methodological details.
Description

The regression discontinuity (RD) design is a popular quasi-experimental design for causal inference and policy evaluation. The ‘rdmulti’ package provides tools to analyze RD designs with multiple cutoffs or scores: \texttt{rdmc()} estimates pooled and cutoff-specific effects in multi-cutoff designs, \texttt{rdmplot()} draws RD plots for multi-cutoff RD designs and \texttt{rdms()} estimates effects in cumulative cutoffs or multi-score designs. For more details, and related Stata and R packages useful for analysis of RD designs, visit \url{https://rdpackages.github.io/}.

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References


Description

`rdmc()` analyzes RD designs with multiple cutoffs.

Usage

```r
drdmc(
  Y,  
  X,  
  C, 
  fuzzy = NULL, 
  derivvec = NULL, 
  pooled_opt = NULL, 
  verbose = FALSE, 
  pvec = NULL, 
  qvec = NULL, 
  hmat = NULL, 
  bmat = NULL, 
  rhovec = NULL, 
  covs_mat = NULL, 
  covs_list = NULL, 
  covs_dropvec = NULL, 
  kernelvec = NULL, 
  weightsvec = NULL, 
  bwselectvec = NULL, 
  scaleparvec = NULL, 
  scaleregulvec = NULL, 
  masspointsvec = NULL, 
  bwcheckvec = NULL, 
  bwrestrictvec = NULL, 
  stdvarvec = NULL, 
  vcevec = NULL, 
  nnmatchvec = NULL, 
  cluster = NULL, 
  level = 95, 
  plot = FALSE, 
  conventional = FALSE
)
```

Arguments

- **Y**  outcome variable.
- **X**  running variable.
C
cutoff variable.
fuzzy
specifies a fuzzy design. See rdrobust() for details.
derivvec
vector of cutoff-specific order of derivatives. See rdrobust() for details.
pooled_opt
options to be passed to rdrobust() to calculate pooled estimand.
verbose
displays the output from rdrobust for estimating the pooled estimand.
pvec
vector of cutoff-specific polynomial orders. See rdrobust() for details.
qvec
vector of cutoff-specific polynomial orders for bias estimation. See rdrobust() for details.
hmat
matrix of cutoff-specific bandwidths. See rdrobust() for details.
bmat
matrix of cutoff-specific bandwidths for bias estimation. See rdrobust() for details.
rhovec
vector of cutoff-specific values of rho. See rdrobust() for details.
covs_mat
matrix of covariates. See rdrobust() for details.
covs_list
list of covariates to be used in each cutoff.
covs_dropvec
vector indicating whether collinear covariates should be dropped at each cutoff. See rdrobust() for details.
kernelvec
vector of cutoff-specific kernels. See rdrobust() for details.
weightsvec
vector of cutoff-specific weights. See rdrobust() for details.
bwselectvec
vector of cutoff-specific bandwidth selection methods. See rdrobust() for details.
scaleparvec
vector of cutoff-specific scale parameters. See rdrobust() for details.
scaleregulvec
vector of cutoff-specific scale regularization parameters. See rdrobust() for details.
masspointsvec
vector indicating how to handle repeated values at each cutoff. See rdrobust() for details.
bwcheckvec
vector indicating the value of bwcheck at each cutoff. See rdrobust() for details.
bwrestrictvec
vector indicating whether computed bandwidths are restricted to the range or runvar at each cutoff. See rdrobust() for details.
stdvarsvec
vector indicating whether variables are standardized at each cutoff. See rdrobust() for details.
vcevec
vector of cutoff-specific variance-covariance estimation methods. See rdrobust() for details.
nnmatchvec
vector of cutoff-specific nearest neighbors for variance estimation. See rdrobust() for details.
cluster
cluster ID variable. See rdrobust() for details.
level
confidence level for confidence intervals. See rdrobust() for details.
plot
plots cutoff-specific estimates and weights.
conventional
reports conventional, instead of robust-bias corrected, p-values and confidence intervals.
Value

- **tau**: pooled estimate
- **se.rb**: robust bias corrected standard error for pooled estimate
- **pv.rb**: robust bias corrected p-value for pooled estimate
- **ci.rb.l**: left limit of robust bias corrected CI for pooled estimate
- **ci.rb.r**: right limit of robust bias corrected CI for pooled estimate
- **hl**: bandwidth to the left of the cutoff for pooled estimate
- **hr**: bandwidth to the right of the cutoff for pooled estimate
- **Nh**: sample size within bandwidth to the left of the cutoff for pooled estimate
- **Nh**: sample size within bandwidth to the right of the cutoff for pooled estimate
- **B**: vector of bias-corrected estimates
- **V**: vector of robust variances of the estimates
- **Coefs**: vector of conventional estimates
- **W**: vector of weights for each cutoff-specific estimate
- **Nh**: vector of sample sizes within bandwidth
- **CI**: robust bias-corrected confidence intervals
- **H**: matrix of bandwidths
- **Pv**: vector of robust p-values
- **rdrobust.results**: results from rdrobust for pooled estimate
- **cfail**: Cutoffs where rdrobust() encountered problems

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References


Examples

```r
# Toy dataset
X <- runif(1000,0,100)
C <- c(rep(33,500),rep(66,500))
Y <- (1 + X + (X>=C))*(C==33)+(.5 + .5*X + .8*(X>=C))*(C==66) + rnorm(1000)
# rdmc with standard syntax
tmp <- rdmc(Y,X,C)
```
rdmcplot

RD plots with multiple cutoffs.

Description

rdmcplot() RD plots with multiple cutoffs.

Usage

rdmcplot(
  Y,
  X,
  C,
  nbinsmat = NULL,
  binselectvec = NULL,
  scalevec = NULL,
  supportmat = NULL,
  pvec = NULL,
  hmat = NULL,
  kernelvec = NULL,
  weightsvec = NULL,
  covs_mat = NULL,
  covs_list = NULL,
  covs_evalvec = NULL,
  covs_dropvec = NULL,
  ci = NULL,
  col_bins = NULL,
  pch_bins = NULL,
  col_poly = NULL,
  lty_poly = NULL,
  col_xline = NULL,
  lty_xline = NULL,
  nobins = FALSE,
  nopoly = FALSE,
  noxline = FALSE,
  nodraw = FALSE
)

Arguments

Y      outcome variable.
X      running variable.
C      cutoff variable.
nbinsmat    matrix of cutoff-specific number of bins. See rdplot() for details.
binselectvec vector of cutoff-specific bins selection method. See rdplot() for details.
scalevec vector of cutoff-specific scale factors. See rdplot() for details.
supportmat matrix of cutoff-specific support conditions. See rdplot() for details.
pvec vector of cutoff-specific polynomial orders. See rdplot() for details.
hmat matrix of cutoff-specific bandwidths. See rdplot() for details.
kernelvec vector of cutoff-specific kernels. See rdplot() for details.
weightsvec vector of cutoff-specific weights. See rdplot() for details.
covs_mat matrix of covariates. See rdplot() for details.
covs_list list of covariates to be used in each cutoff.
covs_evalvec vector indicating the evaluation point for additional covariates. See rdrobust() for details.
covs_dropvec vector indicating whether collinear covariates should be dropped at each cutoff. See rdrobust() for details.
ci adds confidence intervals of the specified level to the plot. See rdrobust() for details.
col_bins vector of colors for bins.
pch_bins vector of characters (pch) type for bins.
col_poly vector of colors for polynomial curves.
lty_poly vector of lty for polynomial curves.
col_xline vector of colors for vertical lines.
lty_xline vector of lty for vertical lines.
nobins omits bins plot.
nopoly omits polynomial curve plot.
noxline omits vertical lines indicating the cutoffs.
nodraw omits plot.

Value

clist list of cutoffs
cnum number of cutoffs
X0 matrix of X values for control units
X1 matrix of X values for treated units
Yhat0 estimated polynomial for control units
Yhat1 estimated polynomial for treated units
Xmean bin average of X values
Ymean bin average for Y values
CI_l lower end of confidence intervals
CI_r upper end of confidence intervals
cfail Cutoffs where rdrobust() encountered problems
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References

Examples
# Toy dataset
X <- runif(1000,0,100)
C <- c(rep(33,500),rep(66,500))
Y <- (1 + X + (X>=C))*(C==33)+(.5 + .5*X + .8*(X>=C))*(C==66) + rnorm(1000)
# rdmcplot with standard syntax
tmp <- rdmcplot(Y,X,C)

rdms

Analysis of RD designs with cumulative cutoffs or two running variables

Description
rdms() analyzes RD designs with cumulative cutoffs or two running variables.

Usage
rdms(
Y,  
X,  
C,  
X2 = NULL,  
zvar = NULL,  
C2 = NULL,  
rangemat = NULL,  
xnorm = NULL,  
fuzzy = NULL,  
derivvec = NULL,  
pooled_opt = NULL,  
pvec = NULL,  
qvec = NULL,  
hmat = NULL,  
bmat = NULL,
Arguments

Y  outcome variable.
X  running variable.
C  vector of cutoffs.
X2 if specified, second running variable.
zvar if X2 is specified, treatment indicator.
C2 if specified, second vector of cutoffs.
rangematt matrix of cutoff-specific ranges for the running variable.
xnorm normalized running variable to estimate pooled effect.
fuzzy specifies a fuzzy design. See \texttt{rdrobust()} for details.
derivvec vector of cutoff-specific order of derivatives. See \texttt{rdrobust()} for details.
pooled_opt options to be passed to \texttt{rdrobust()} to calculate pooled estimand.
pvec vector of cutoff-specific polynomial orders. See \texttt{rdrobust()} for details.
qvec vector of cutoff-specific polynomial orders for bias estimation. See \texttt{rdrobust()} for details.
hmat matrix of cutoff-specific bandwidths. See \texttt{rdrobust()} for details.
bmat matrix of cutoff-specific bandwidths for bias estimation. See \texttt{rdrobust()} for details.
rhovec vector of cutoff-specific values of rho. See \texttt{rdrobust()} for details.
covs_mat matrix of covariates. See \texttt{rdplot()} for details.
covs_list list of covariates to be used in each cutoff.
covs_dropvec  vector indicating whether collinear covariates should be dropped at each cutoff. See rdrobust() for details.
kernvec     vector of cutoff-specific kernels. See rdrobust() for details.
weightsvec  vector of cutoff-specific weights. See rdrobust() for details.
bwselectvec vector of cutoff-specific bandwidth selection methods. See rdrobust() for details.
scaleparvec  vector of cutoff-specific scale parameters. See rdrobust() for details.
scaleregulvec vector of cutoff-specific scale regularization parameters. See rdrobust() for details.
masspointsvec vector indicating how to handle repeated values at each cutoff. See rdrobust() for details.
bwcheckvec  vector indicating the value of bwcheck at each cutoff. See rdrobust() for details.
bwrestrictvec vector indicating whether computed bandwidths are restricted to the range or runvar at each cutoff. See rdrobust() for details.
stdvarsvec  vector indicating whether variables are standardized at each cutoff. See rdrobust() for details.
vcevec      vector of cutoff-specific variance-covariance estimation methods. See rdrobust() for details.
nnmatchvec  vector of cutoff-specific nearest neighbors for variance estimation. See rdrobust() for details.
cluster     cluster ID variable. See rdrobust() for details.
level       confidence level for confidence intervals. See rdrobust() for details.
plot        plots cutoff-specific and pooled estimates.
conventional reports conventional, instead of robust-bias corrected, p-values and confidence intervals.

Value

B          vector of bias-corrected coefficients
V          variance-covariance matrix of the estimators
Coefs      vector of conventional coefficients
Nh         vector of sample sizes within bandwidth at each cutoff
CI         bias corrected confidence intervals
H          bandwidth used at each cutoff
Pv         vector of robust p-values

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rdms

References

Examples

# Toy dataset: cumulative cutoffs
X <- runif(1000,0,100)
C <- c(33,66)
Y <- (1+X)*(X<C[1])+(0.8+0.8*X)*(X>=C[1]&X<C[2])+(1.2+1.2*X)*(X>=C[2]) + rnorm(1000)
# rdms: basic syntax
tmp <- rdms(Y,X,C)
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