Regression-discontinuity designs

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目录

1 Preparation

1.1 Import Data

```
#install.packages("foreign")
library("foreign")
votex<-read.dta("/Users/admin/Desktop/teaching assiatant/Econometrics/teaching assistan
```

1.2 Data

```
str(votex)
```

```
## 'data.frame':    349 obs. of  19 variables:
##  $ fips     : Factor w/ 51 levels "AL","AK","AZ",..: 1 1 1 1 2 3 3 3 3 4 ...
##  $ district : int  2 3 5 7 0 2 3 4 5 1 ...
##  $ d        : num  -0.0129 0.2373 0.1714 0.2053 -0.0192 ...
##  $ win      : int  0 1 1 1 0 1 0 0 0 1 ...
##  $ lne      : num  22.2 21.3 21.3 21.1 21.5 ...
##  $ i        : int  1 1 0 1 1 1 1 1 1 1 ...
##  $ votingpop: int  383051 390281 385257 386174 271051 372763 389417 374765 390294 39
##  $ votpop   : num  0.697 0.703 0.701 0.691 0.675 ...
##  $ populatn : int  549505 555321 549844 559247 401851 543217 544970 543509 542880 57
##  $ black    : num  0.3075 0.282 0.1425 0.3331 0.0342 ...
##  $ bluclr   : num  0.0862 0.1132 0.0951 0.0881 0.0467 ...
##  $ farmer   : num  0.01528 0.00928 0.00994 0.00975 0.01038 ...
##  $ fedwrkr  : num  0.0216 0.0233 0.0451 0.0135 0.0491 ...
##  $ forborn  : num  0.01166 0.00926 0.01448 0.00764 0.04035 ...
##  $ manuf    : num  0.0832 0.1283 0.1145 0.0903 0.0258 ...
##  $ unemplyd : num  0.0271 0.0316 0.0372 0.0315 0.0443 ...
##  $ union    : num  3.31e-05 3.28e-05 3.31e-05 3.25e-05 7.56e-05 ...
##  $ urban    : num  0.65 0.545 0.581 0.522 0.643 ...
##  $ veterans : num  0.107 0.106 0.117 0.104 0.137 ...
##  - attr(*, "datalabel")= chr "102nd Congress"
```

```
##  - attr(*, "time.stamp")= chr " 4 Feb 2013 15:33"
##  - attr(*, "formats")= chr  "%8.0g" "%8.0g" "%10.0g" "%9.0g" ...
##  - attr(*, "types")= int  251 251 255 251 254 251 253 255 253 255 ...
##  - attr(*, "val.labels")= chr  "fips" "" "" "" ...
##  - attr(*, "var.labels")= chr  "State code " "Congr district " "Dem vote share minus
##  - attr(*, "version")= int 12
##  - attr(*, "label.table")=List of 1
##   ..$ fips: Named int  1 2 4 5 6 8 9 10 11 12 ...
##   .. ..- attr(*, "names")= chr  "AL" "AK" "AZ" "AR" ...
```

1.3 Load rddtools package

```
#install.packages("devtools")
#devtools::install_github("bquast/rddtools")
library("rddtools")
```

```
## Loading required package: AER

## Loading required package: car

## Loading required package: carData

## Loading required package: lmtest

## Loading required package: zoo

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

## Loading required package: sandwich

## Loading required package: survival

## Loading required package: np
```

```
## Nonparametric Kernel Methods for Mixed Datatypes (version 0.60-9)
## [vignette("np_faq",package="np") provides answers to frequently asked questions]
## [vignette("np",package="np") an overview]
## [vignette("entropy_np",package="np") an overview of entropy-based methods]
```

1.4 Set outcome, forcing and cutoff variable

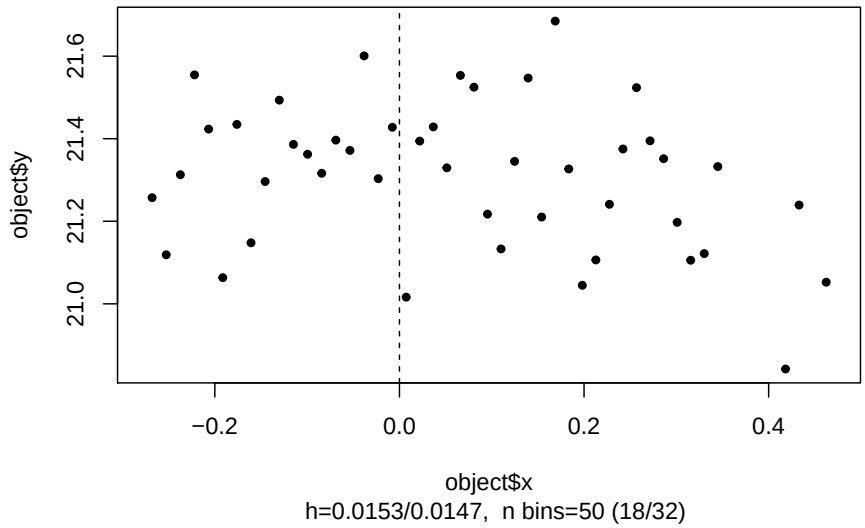
```
votex_rdd <- rdd_data(x=d, y=lne,cutpoint=0, data=votex)
```

1.5 Summary and Plot

```
summary(votex_rdd)
```

```
## ### rdd_data object ###
##
## Cutpoint: 0
## Type: Sharp
## Sample size:
##  -Full : 349
##  -Left : 131
##  -Right: 218
## Covariates: no
```

```
plot(votex_rdd,nbins=50)
```



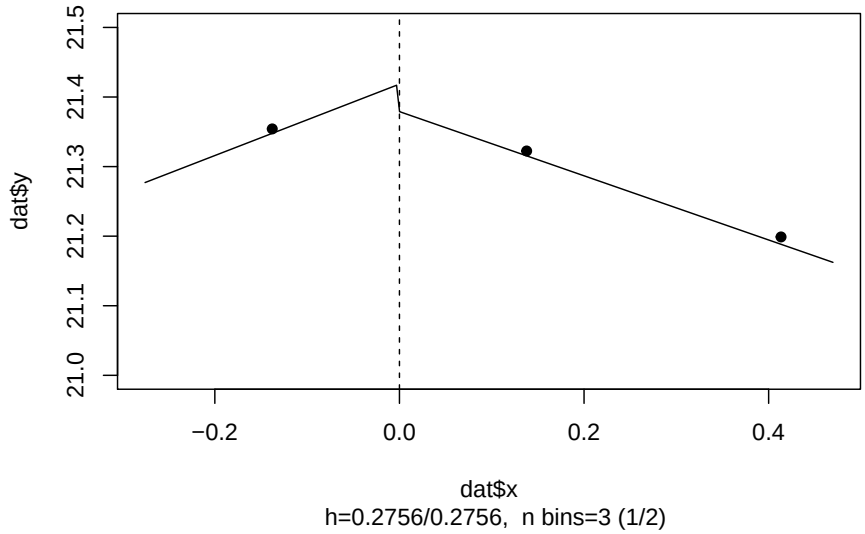
2 Estimate RDD

2.1 Parametric estimation

```
library("rddtools")
reg_para<-rdd_reg_lm(votex_rdd,slope="separate",order = 1)
print(reg_para)
```

```
## ### RDD regression: parametric ###
##  Polynomial order:  1
##  Slopes:  separate
##  Number of obs: 349 (left: 131, right: 218)
##
##  Coefficient:
##    Estimate Std. Error t value Pr(>|t|)
## D -0.039487   0.095882 -0.4118   0.6807
```

```
plot(reg_para,ylim=c(21,21.5))
```

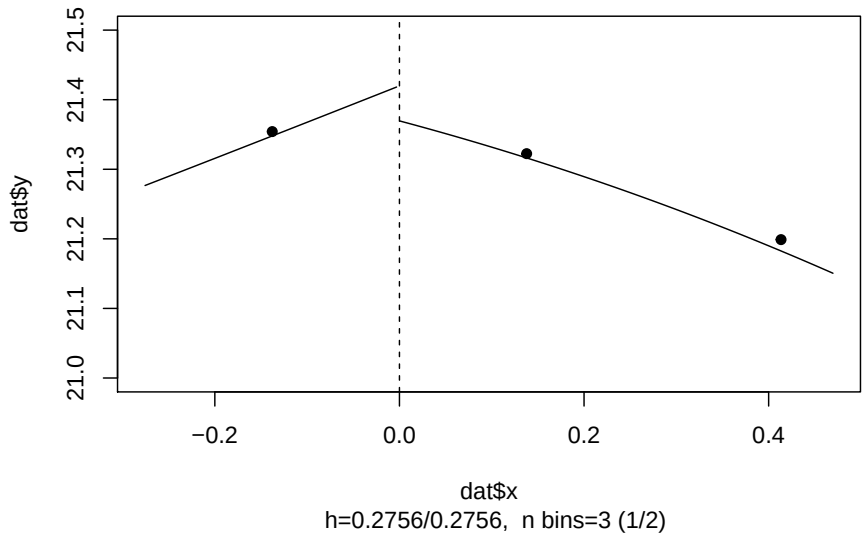


2.2 Nonparametric estimation

```
reg_np <- rdd_reg_np(rdd_object=votex_rdd, slope = "separate")
print(reg_np)
```

```
## ### RDD regression: nonparametric local linear###
##  Bandwidth:  0.3592744
##  Number of obs: 345 (left: 131, right: 214)
##
##  Coefficient:
##    Estimate Std. Error z value Pr(>|z|)
## D -0.069645   0.099797 -0.6979   0.4853
```

```
plot(reg_np,ylim=c(21,21.5))
```



- **Reference**
- Guido Imbens & Karthik Kalyanaraman,2012,**"Optimal Bandwidth Choice for the Regression Discontinuity Estimator"**, *Review of Economic Studies*,Vol.79(3),933-959

2.3 Covariates

```
votex_rdd_cov <- rdd_data(x=d, y=lne,cutpoint=0, data=votex,covar=c(votex$i,votex$votpo
summary(votex_rdd_cov)
```

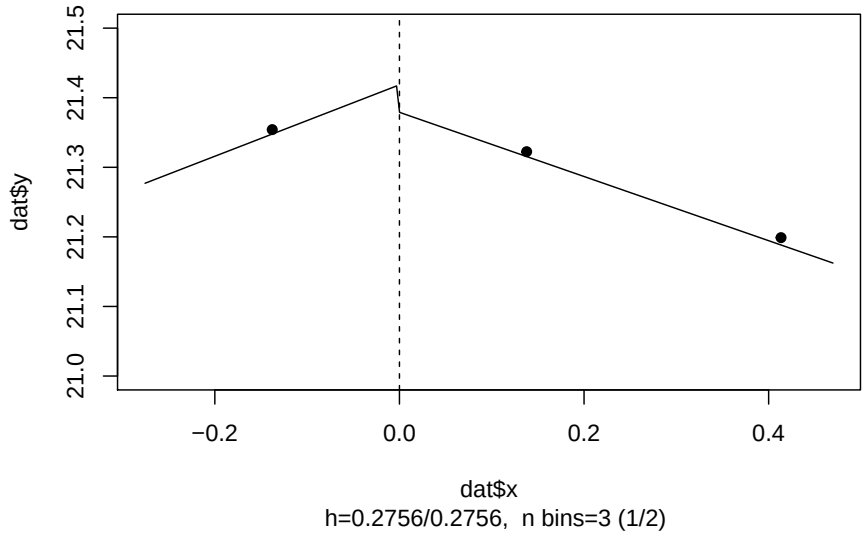
```
## ### rdd_data object ###
##
## Cutpoint: 0
## Type: Sharp
## Sample size:
##  -Full : 1047
##  -Left : 393
##  -Right: 654
```

```
## Covariates: yes
```

```
library("rddtools")
reg_para_cov<- rdd_reg_lm(rdd_object=votex_rdd_cov,slope="separate",covariates=c(votex$
print(reg_para_cov)
```

```
## ### RDD regression: parametric ###
##  Polynomial order:  1
##  Slopes:  separate
##  Number of obs: 1047 (left: 393, right: 654)
##
##  Coefficient:
##    Estimate Std. Error t value Pr(>|t|)
## D -0.039487   0.055145 -0.7161   0.4741
```

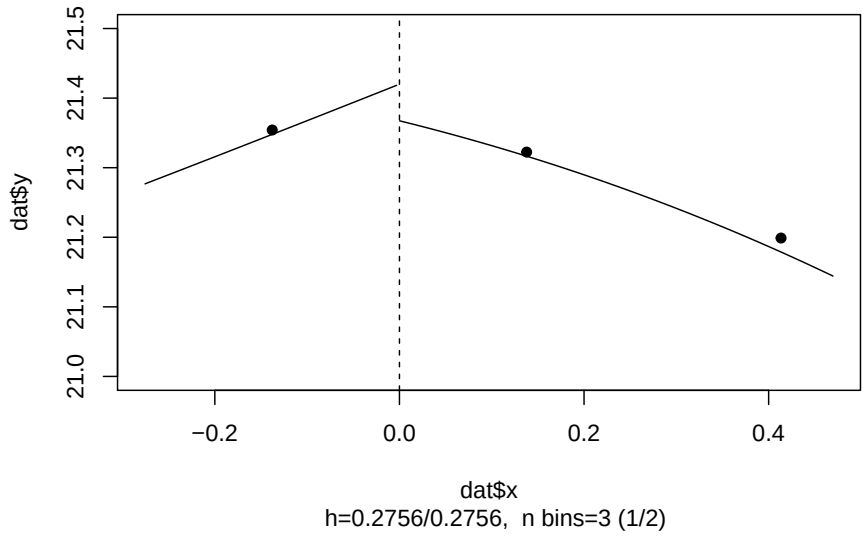
```
plot(reg_para_cov,ylim=c(21,21.5))
```



```
reg_np_cov <- rdd_reg_np(rdd_object=votex_rdd_cov, slope = "separate",covariates=c(vote
print(reg_np_cov)
```

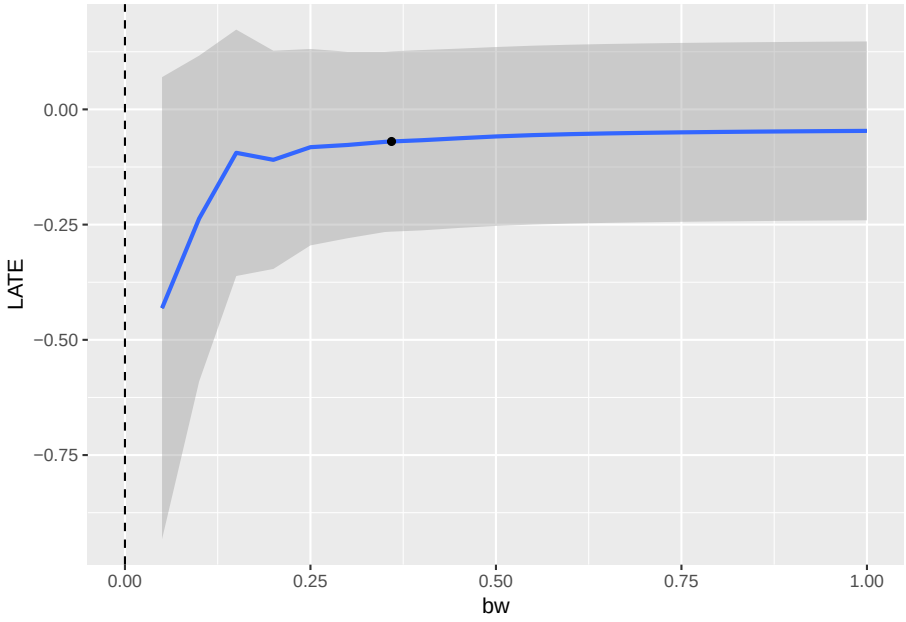
```
## ### RDD regression: nonparametric local linear###
##  Bandwidth:  0.3068581
##  Number of obs: 1008 (left: 393, right: 615)
##
##  Coefficient:
##    Estimate Std. Error z value Pr(>|z|)
## D -0.076478   0.058771 -1.3013   0.1932
```

```
plot(reg_np_cov,ylim=c(21,21.5))
```



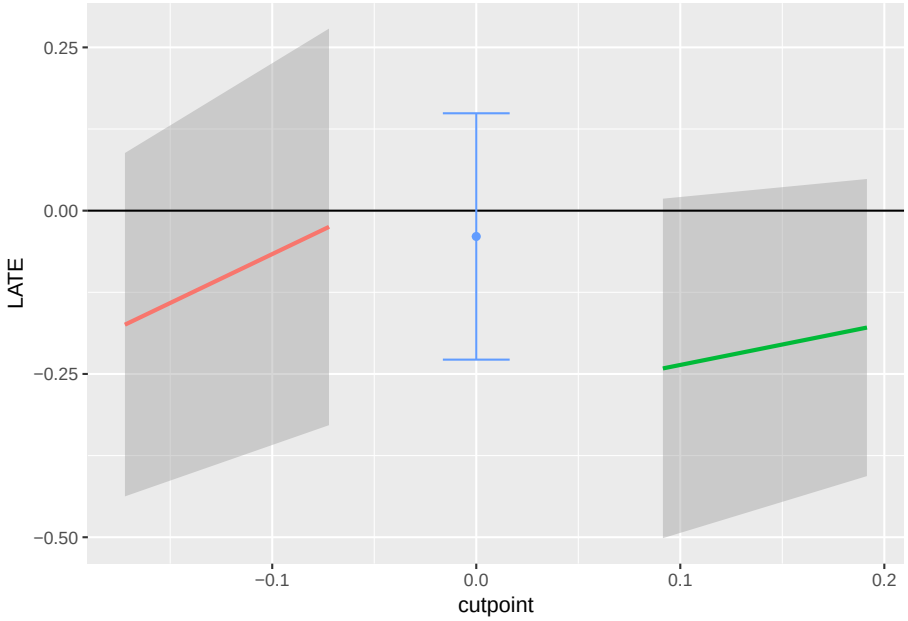
3 Regression sensitivity analysis

```
plotSensi(reg_np,0,1,level = 0.95, output = c("data", "ggplot"), plot = TRUE)
```

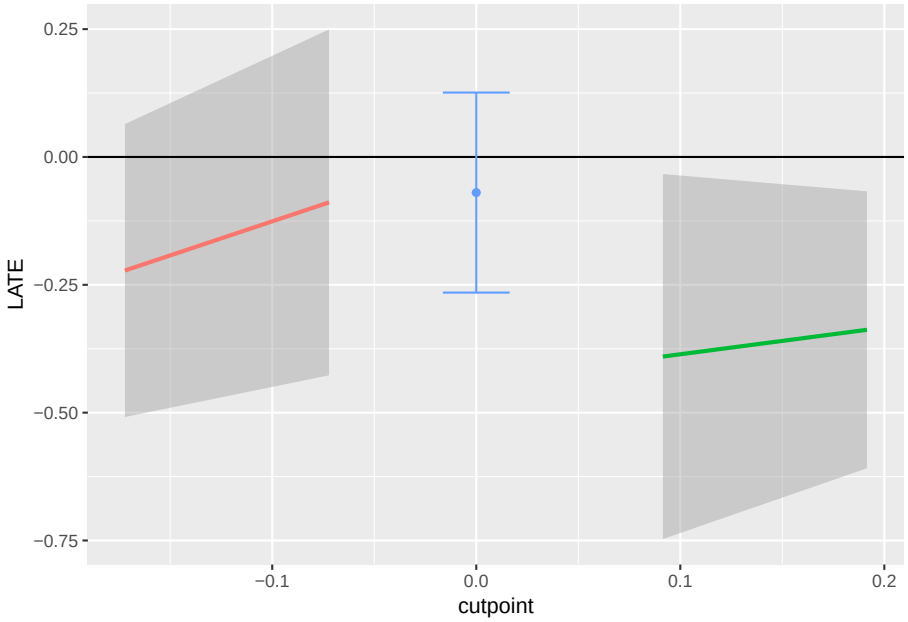


4 Placebo Tests

```
plotPlacebo(reg_para, device = "ggplot",level = 0.95)
```

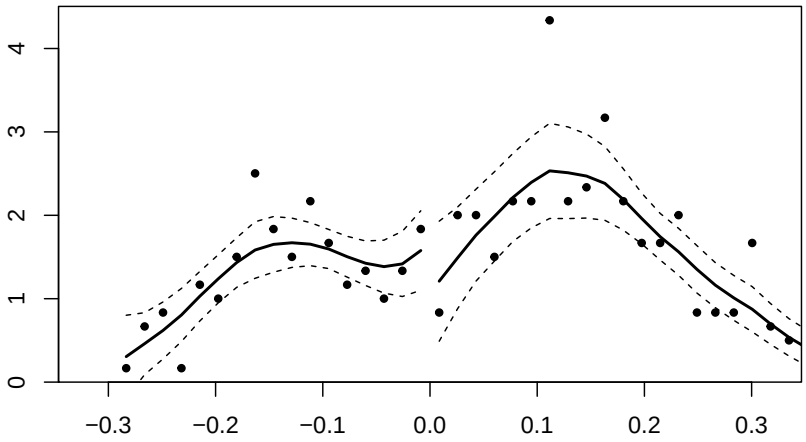



```
plotPlacebo(reg_np, device = "ggplot",level = 0.95)
```



5 Design sensitivity analysis

```
dens_test(reg_para)
```




```
##
##  McCrary Test for no discontinuity of density around cutpoint
##
## data:  reg_para
## z-val = -0.96632, p-value = 0.3339
## alternative hypothesis: Density is discontinuous around cutpoint
## sample estimates:
## Discontinuity
##    -0.4293967
```

- **Reference**
- Justin McCrary,2008,**"Manipulation of the running variable in the regression discontinuity design:A density test"**,*Journal of Econometrics*, Vol.142(2) ,698-714