Module 3: Medicare Advantage Quality and Regression Discontinuity

Part 3: RD in Practice

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Econ 470 & HLTH 470

MA Data

```
ma.data ← read_rds(here("data/final_ma_data.rds"))
```

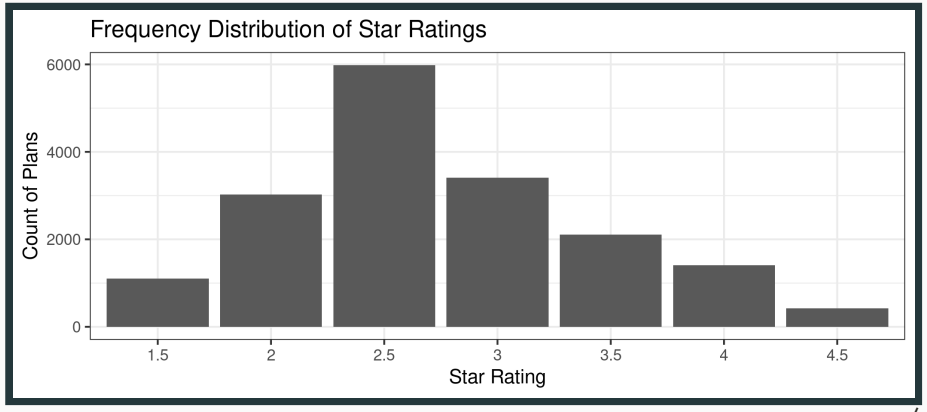
```
ma.data.clean ← ma.data %>%
  filter(!is.na(avg_enrollment) & year==2009 & !is.na(partc_score))
```

Calculate raw average rating

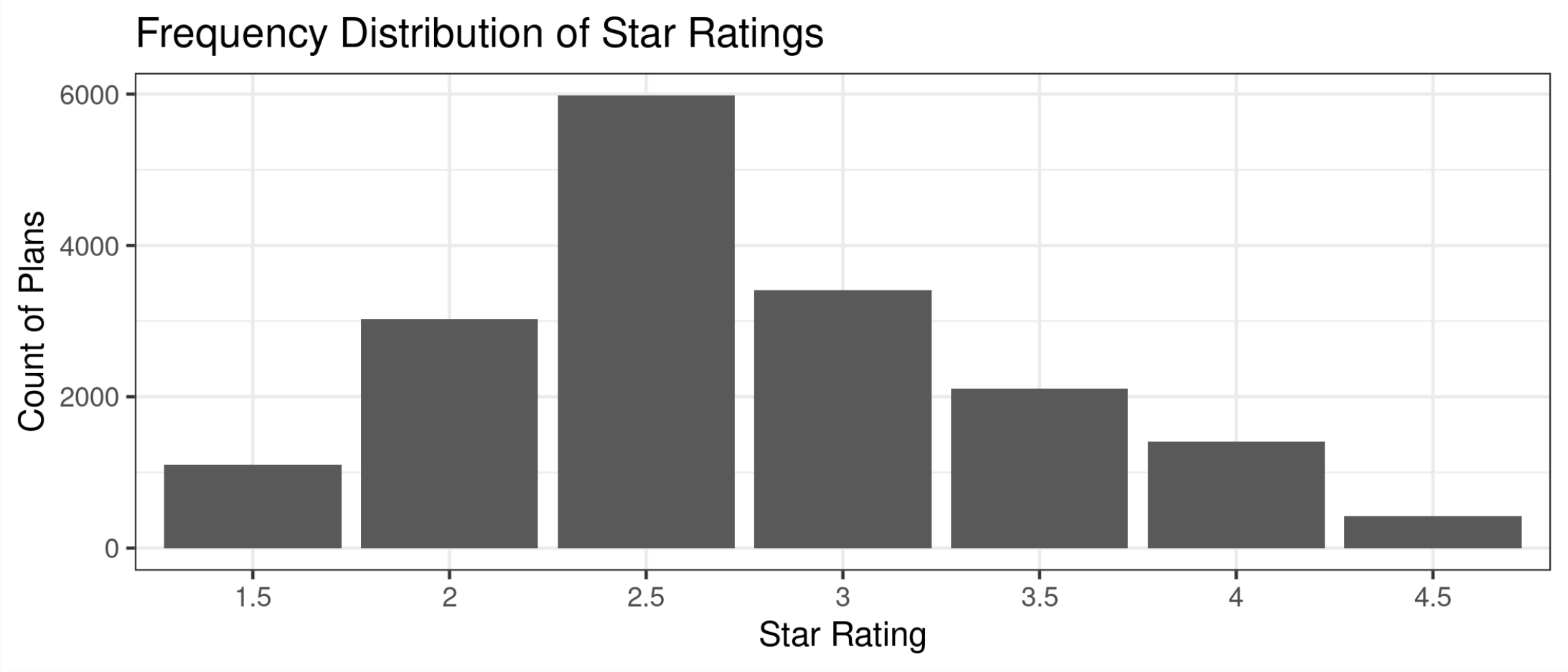
```
ma.data.clean ← ma.data.clean %>%
  mutate(raw_rating=rowMeans(
    cbind(breastcancer_screen,rectalcancer_screen,cv_cholscreen,diabetes_cholscreen,
          glaucoma_test,monitoring,flu_vaccine,pn_vaccine,physical_health,
          mental_health,osteo_test,physical_monitor,primaryaccess,
          hospital_followup,depression_followup,nodelays,carequickly,
          overallrating_care,overallrating_plan,calltime,
          doctor_communicate,customer_service,osteo_manage,
          diabetes_eye,diabetes_kidney,diabetes_bloodsugar,
          diabetes_chol,antidepressant,bloodpressure,ra_manage,
          copd_test,betablocker,bladder,falling,appeals_timely,
          appeals_review),
    na.rm=T)) %>%
  select(contractid, planid, fips, avg_enrollment, first_enrollment,
         last_enrollment, state, county, raw_rating, partc_score,
         avg_eligibles, avg_enrolled, premium_partc, risk_ab, Star_Rating,
         bid, avg_ffscost, ma_rate)
```

Distribution of star ratings

```
ma.data.clean %>%
  ggplot(aes(x=as.factor(Star_Rating))) +
  geom_bar() +
  labs(
    x="Star Rating",
    y="Count of Plans",
    title="Frequency Distribution of Star Ratings"
  ) + theme_bw()
```



Distribution of star ratings



Enrollments and star ratings

```
##
## Call:
## lm(formula = avg_enrollment ~ factor(Star_Rating), data = ma.data.clean)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##   -627   -388   -214    -51  41908
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)                87.31      43.32   2.016  0.04387 *
## factor(Star_Rating)2       32.75      50.62   0.647  0.51758
## factor(Star_Rating)2.5    194.65      47.15   4.128 3.67e-05 ***
## factor(Star_Rating)3      433.95      49.84   8.707  < 2e-16 ***
## factor(Star_Rating)3.5    470.91      53.47   8.808  < 2e-16 ***
## factor(Star_Rating)4      552.30      57.91   9.538  < 2e-16 ***
## factor(Star_Rating)4.5    272.36      82.68   3.294  0.00099 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1440 on 17451 degrees of freedom
## Multiple R-squared:  0.01559,    Adjusted R-squared:  0.01526
## F-statistic: 46.07 on 6 and 17451 DF,  p-value: < 2.2e-16
```

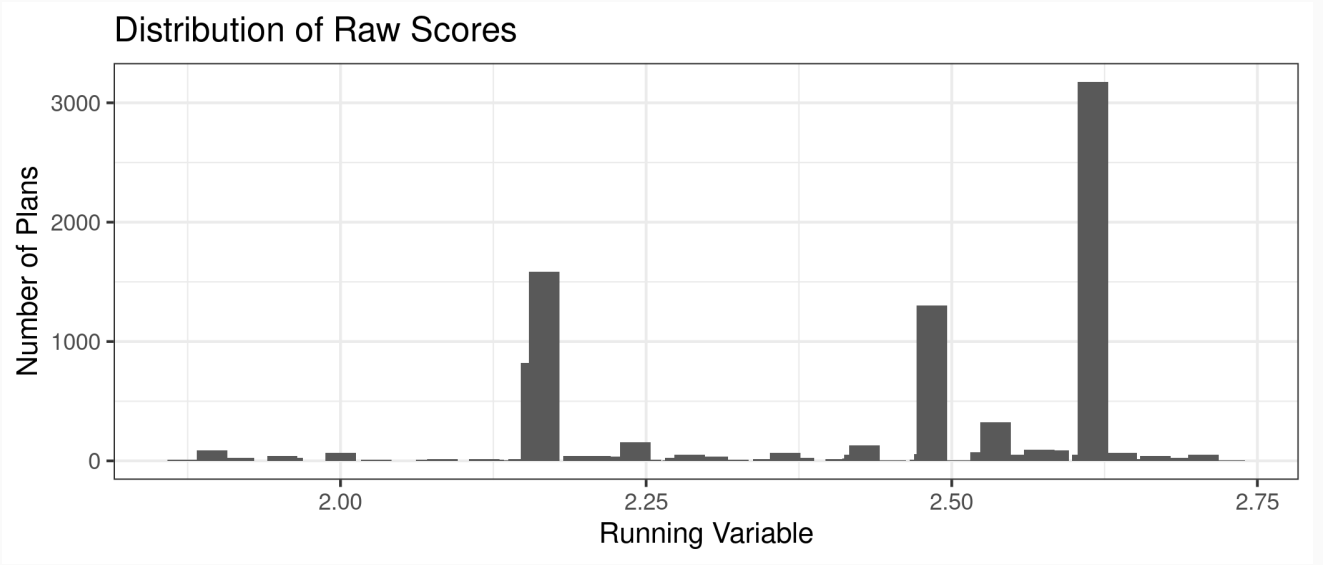
Problems

- Certainly not the effect of a higher rating...
- Lots of things unobserved, like
  - actual quality
  - perceived quality
  - prices

Effect of 3-star rating

```
ma.rd1 ← ma.data.clean %>%
  filter(Star_Rating==2 | Star_Rating==2.5)
```

```
ma.rd1 %>% ggplot(aes(x=raw_rating)) +
  geom_bar(width=.025) + theme_bw() +
  labs(
    x="Running Variable",
    y="Number of Plans",
    title="Distribution of Raw Scores"
  )
```



Note about scores

CMS does more than just an average...

- variance across individual metrics
- high variance is punished, low variance rewarded

RD estimates

```
ma.rd1 <- ma.rd1 %>%
  mutate(score = raw_rating - 2.25,
         treat = (Star_Rating==2.5),
         window1 = (score>-.175 & score<.175),
         window2 = (score>-.125 & score<.125),
         mkt_share = avg_enrollment/avg_eligibles,
         ln_share = log(mkt_share),
         score_treat=score*treat)
star25.1 <- lm(mkt_share ~ score + treat, data=ma.rd1)
star25.2 <- lm(mkt_share ~ score + treat, data= (ma.rd1 %>% filter(window1==TRUE)))
star25.3 <- lm(mkt_share ~ score + treat + score_treat, data= (ma.rd1 %>% filter(window1==TRUE)))
star25.4 <- lm(mkt_share ~ score + treat + score_treat, data= (ma.rd1 %>% filter(window2==TRUE)))
est1 <- as.numeric(star25.1$coef[3])
est2 <- as.numeric(star25.2$coef[3])
est3 <- as.numeric(star25.3$coef[3])
est4 <- as.numeric(star25.4$coef[3])
```

RD estimates

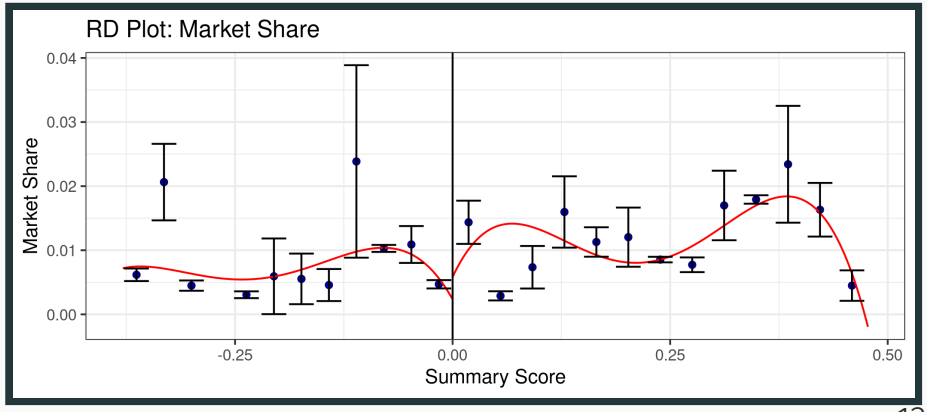
	mkt_share			
	(1)	(2)	(3)	(4)
Raw Score	0.030***	-0.044***	-0.066***	-0.085***
	(0.002)	(0.009)	(0.012)	(0.013)
Treatment	-0.008***	0.009***	0.008***	0.012***
	(0.001)	(0.002)	(0.002)	(0.002)
Score x Treat			0.049***	-0.023
			(0.019)	(0.027)
Bandwith	0.5	0.175	0.175.	0.125

Interpretation

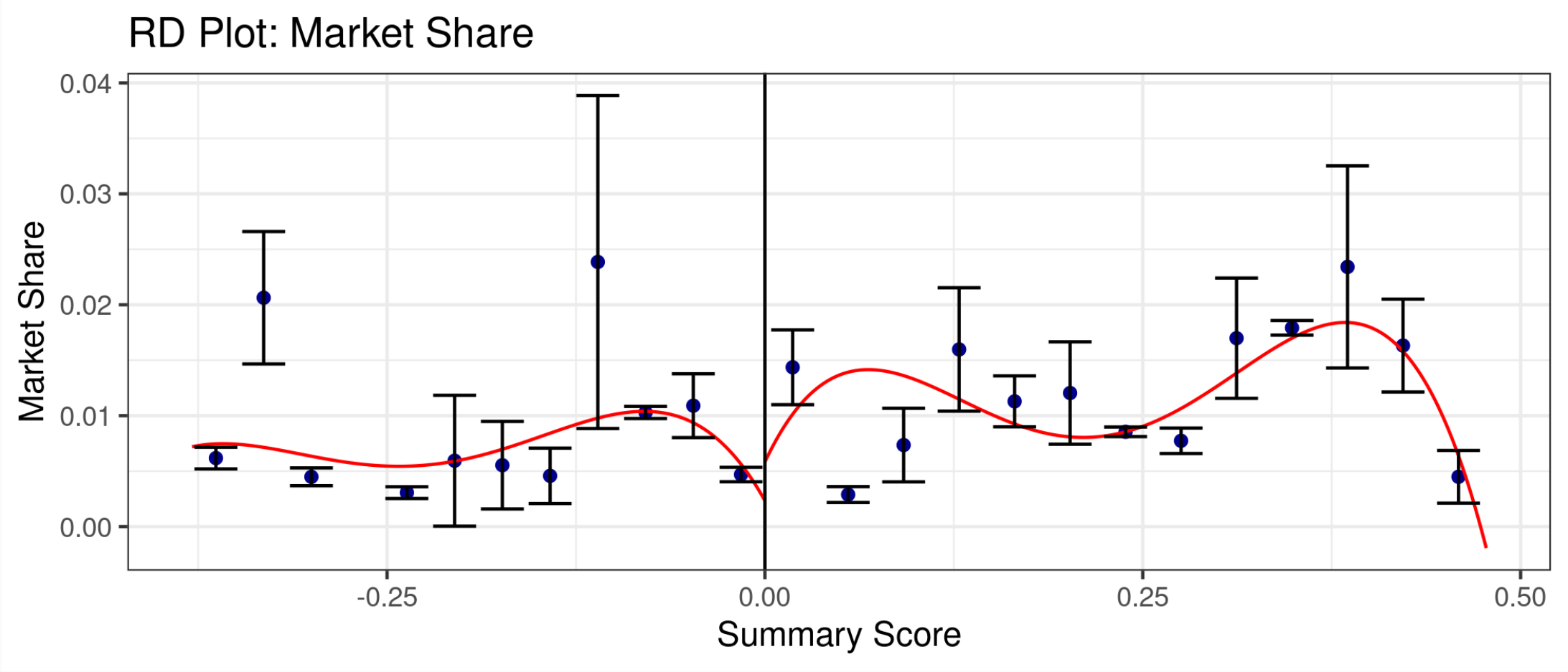
- OLS on full sample: -0.8% increase in market shares among 2.5-star plans versus 2-star plan
- RD on 0.175 bandwidth: 0.9% increase when imposing constant slopes, 0.8% increase when allowing for differential slopes
- RD on 0.125 bandwidth: 1.2% increase (again allowing for differential slopes)

Built-in RD packages

```
library(rdrobust)
rdplot(y=ma.rd1$mkt_share, x=ma.rd1$score, binselect="es", ci=95,
       title="RD Plot: Market Share", x.label="Summary Score",
       y.label="Market Share", masspoints="off")
```



RD Plot


RD Plot: Market Share
Market Share
0.04
0.03
0.02
0.01
0.00
-0.25
0.00
0.25
0.50
Summary Score

Estimates from RD package

```
est1 ← rdrobust(y=ma.rd1$mkt_share, x=ma.rd1$score,
                h=0.124, p=1, kernel="uniform")
```

```
## [1] "Mass points detected in the running variable."
```

Estimates from RD package

```
## Call: rdrobust
##
## Number of Obs.                 9006
## BW type                      Manual
## Kernel                      Uniform
## VCE method                       NN
##
## Number of Obs.                 3024         5982
## Eff. Number of Obs.            2702          260
## Order est. (p)                    1            1
## Order bias  (q)                   2            2
## BW est. (h)                   0.125        0.125
## BW bias (b)                   0.125        0.125
## rho (h/b)                     1.000        1.000
## Unique Obs.                      20           46
##
## ============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ============================================================================
##   Conventional     0.006     0.002     2.501     0.012     [0.001 , 0.010]
##         Robust         -         -     5.929     0.000     [0.025 , 0.049]
## ============================================================================
```