RD Robustness Project

Exercise: stressout before dropping outside OBW

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Introduction

The goal of this project is to test the robustness of the Regression-Discontinuity analysis to different extreme cases, via simulations, using the 'rdrobust' package.

This Document: Excercise #2

Stressing out results, by adding noise inside Optimal Bandwitdh (OBW), before repeating exercise #1.

Select exercise type:

```
exercise="bwo"      # Type of exercise - "zero" or "bwo" ('bandwidth only')
```

Set Parameters

Here we set the main parameters for the excercise:

```
jump=10           # Size of jump at cutoff
loop=1000
figs.iter.save=5
quadratic=T       # T - quadratic DGP, F - linear
symm_obw="mserd"  # mserd - symmetric OBW, msetwo - asymmetric OBW
normal.x=T        # T - normal draws of x around cutoff, F - uniform draws
dgp.sd=10         # sd of normal noise added to DGP
noisy.sd=30       # sd of noise added inside OBW
so.int=2          # interval inside OBW for adding noise
bc=F              # bias-corrected estimates or conventional
```

Simulate DGP

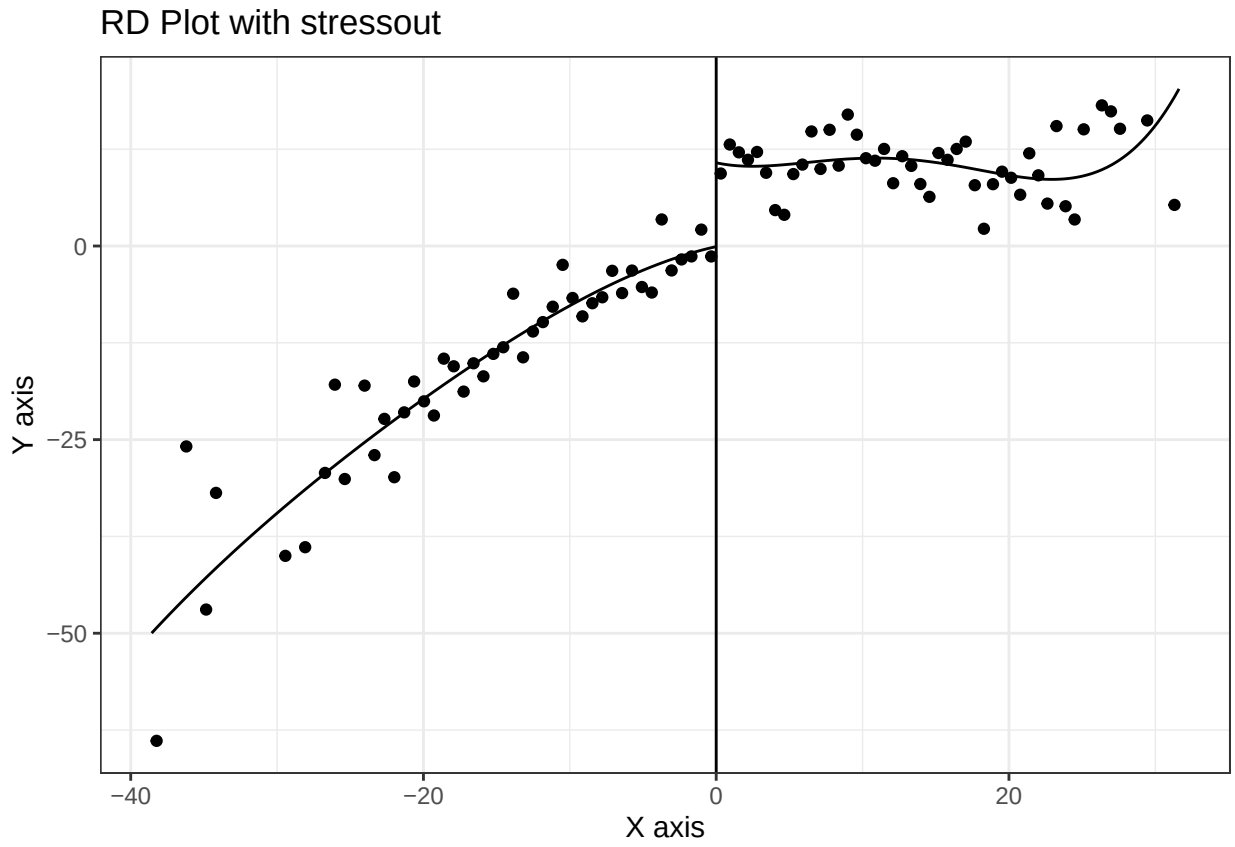
```
df <- as.data.frame(matrix(0, ncol = 0, nrow = length(seq(-100,100,0.01))))
df$x=round(seq(-100,100,0.01), digits=2)
df=subset(df,df$x!=0)
df$treated <- ifelse(df$x>0, 1, 0)

df$y.model<- 0.5*df$x  - 0.025*df$x^2*quadratic + jump*df$treated
df$y=df$y.model+rnorm(length(df$x),0,dgp.sd)
df$y.noisy=df$y+rnorm(length(df$x),0,noisy.sd)

## dataframe for draws (samples)
sample.x <- as.data.frame(matrix(0, ncol = 0, nrow = nrow(df)/10))
```

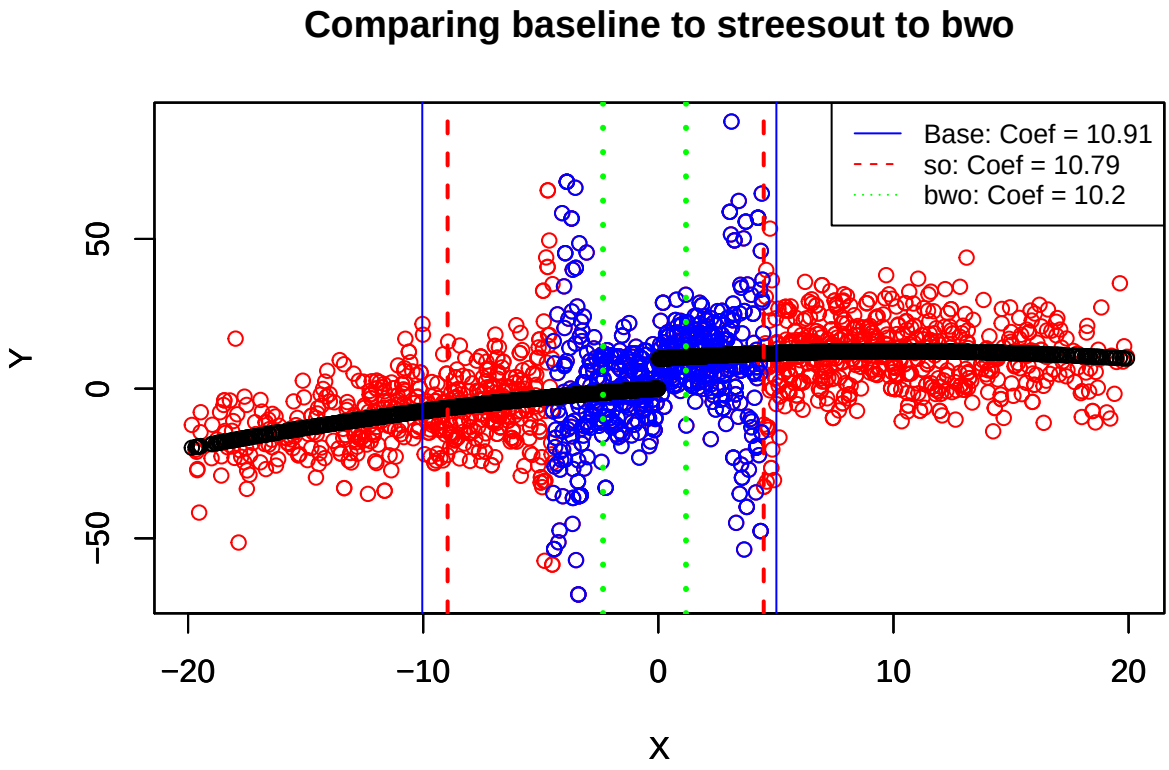
Iterations

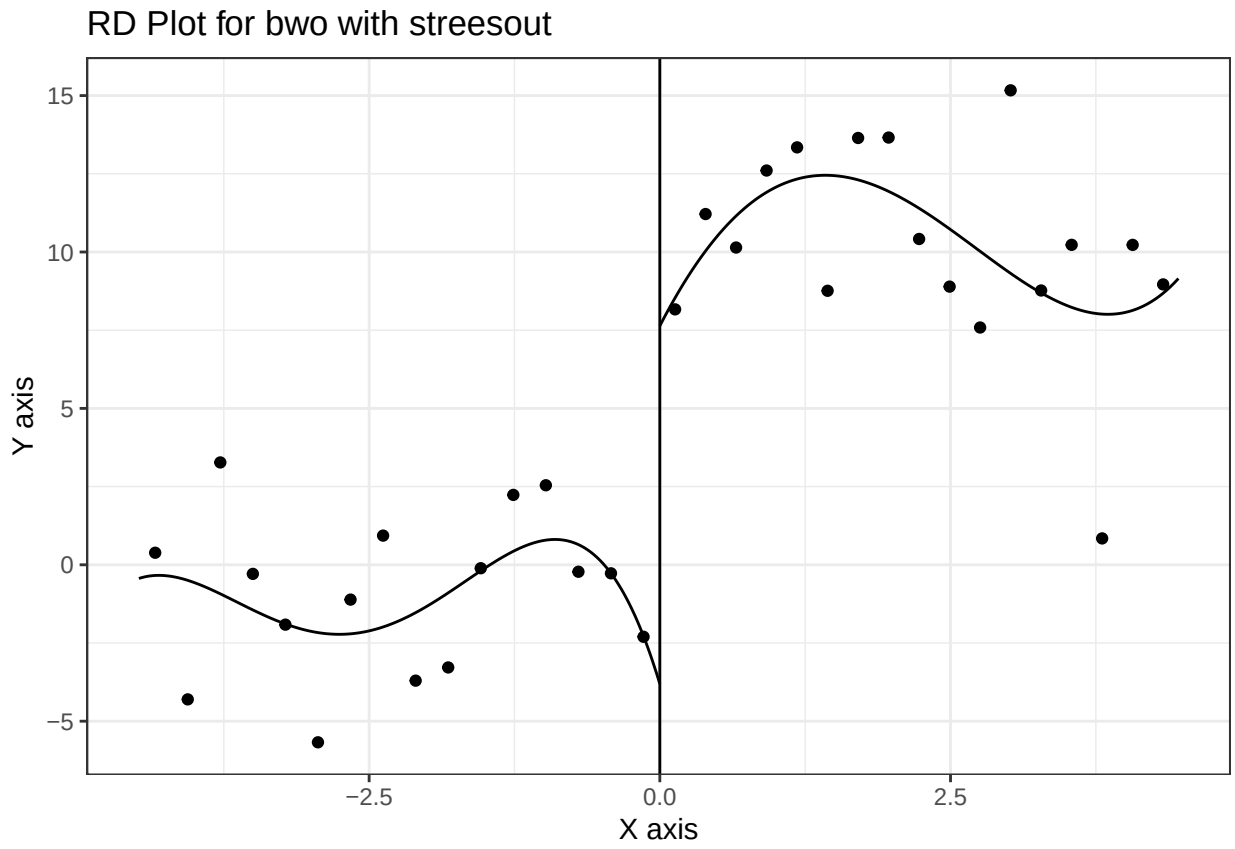
Running 1000 iterations, and saving figures from 5 last iterations to file. In each iteration, we:

1. draw randomly 2000 observations around the cutoff.
2. compute the OBW and RD coefficient
3. Add noise just inside OBW (within 2 units)
4. compute again the OBW and RD coefficient
5. drop observations outside the new OBW/replace them with zero
6. compute again the OBW and RD coefficient.

Presenting figures from last iteration for illustration

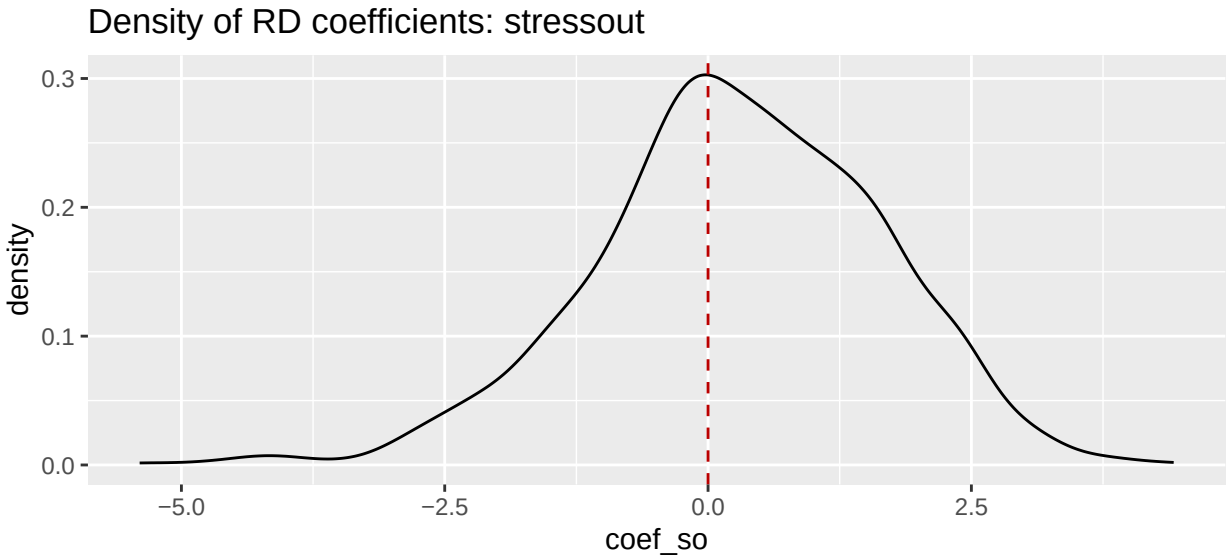


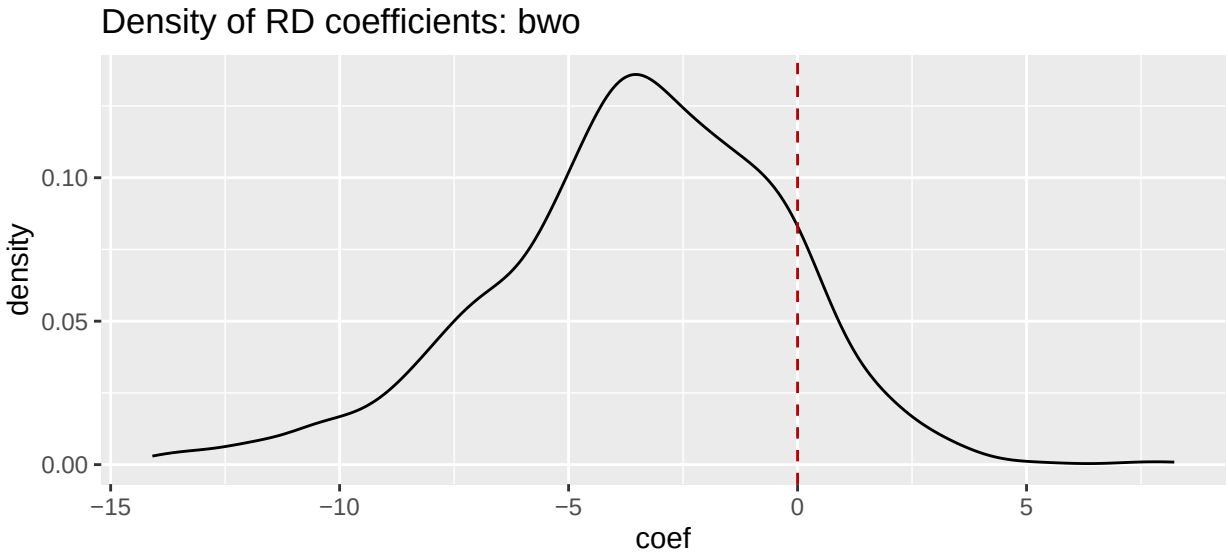


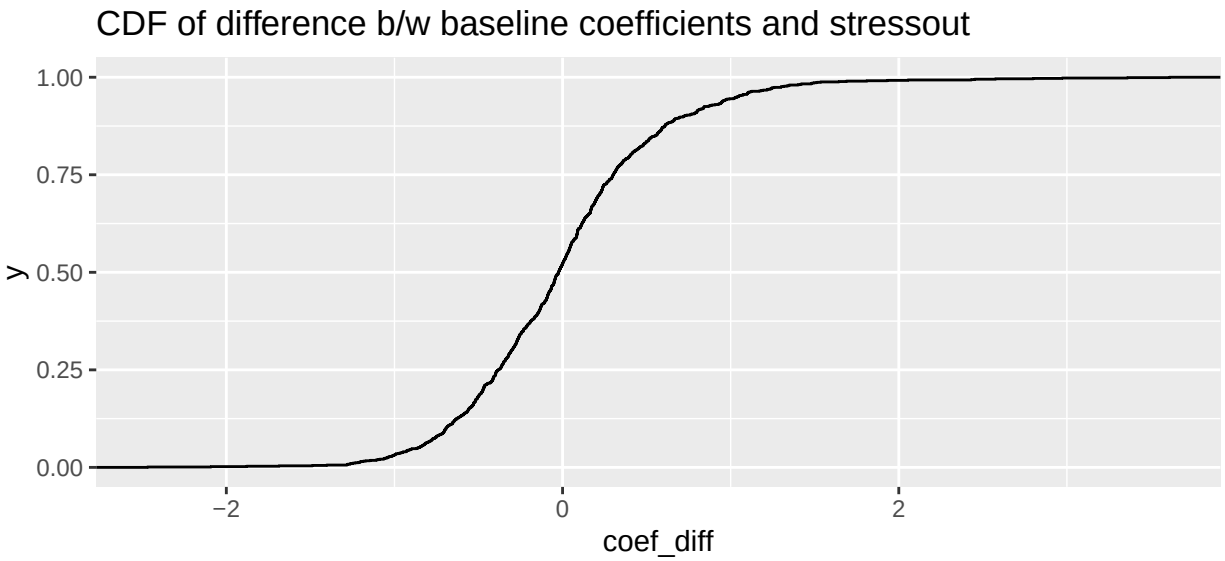

RD Plot for bwo with streesout
15
10
5
0
−5
Y axis
−2.5
0.0
2.5
X axis

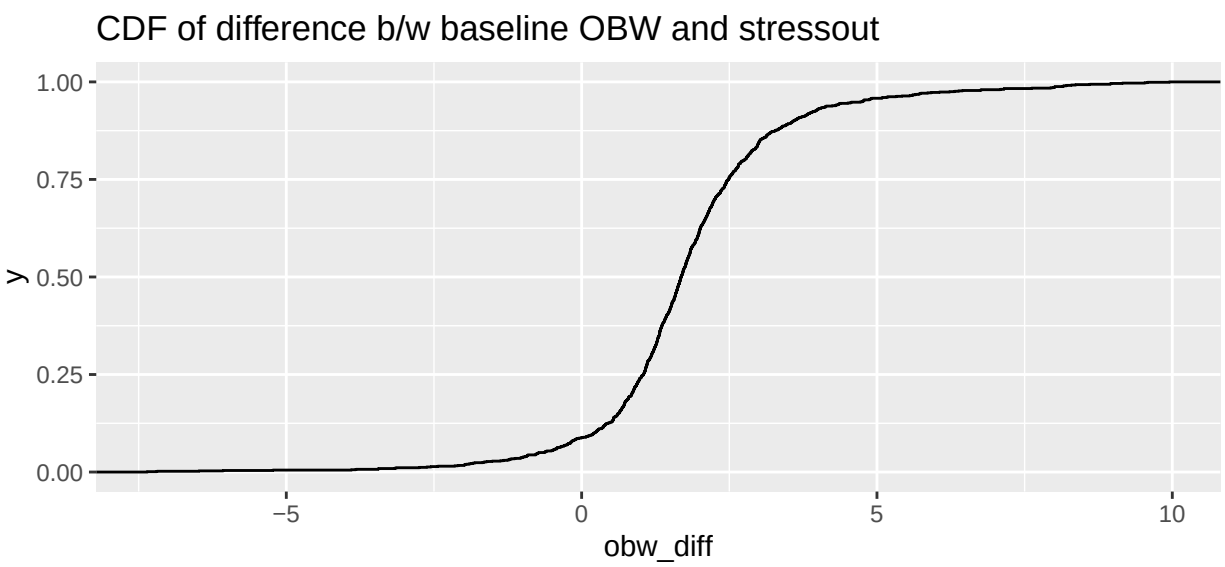
Results

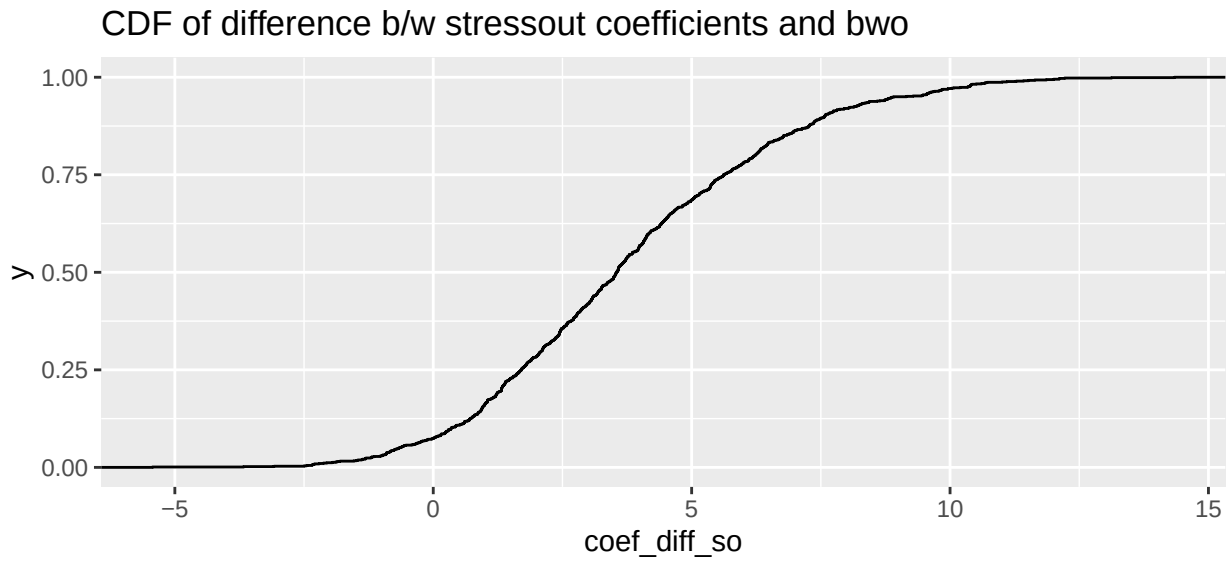
Figures summarizing iterations

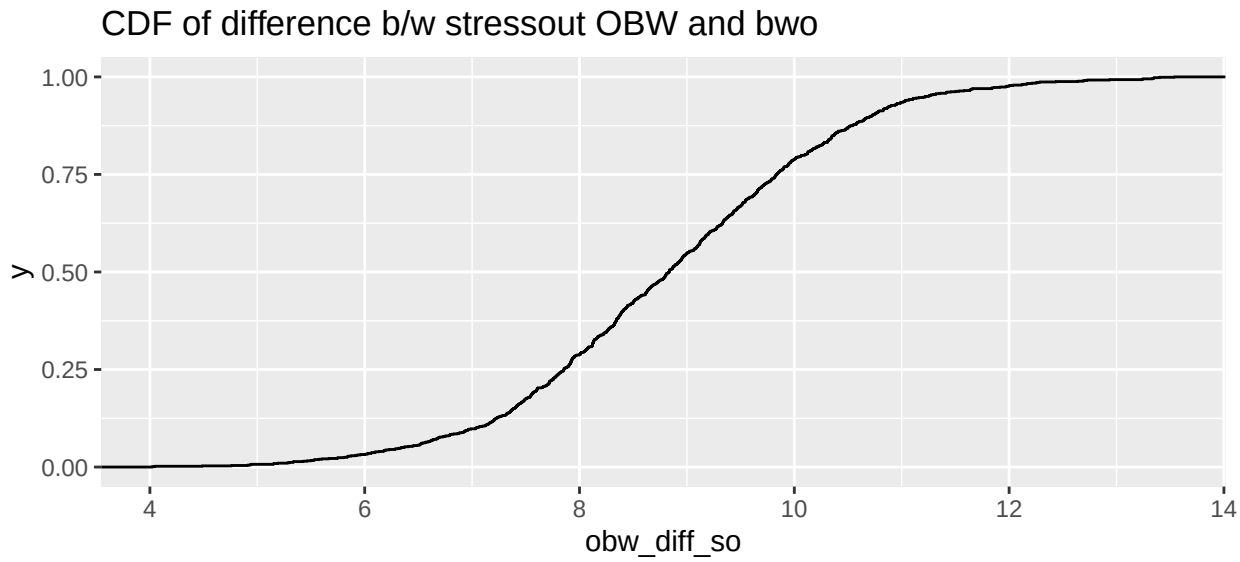





CDF of difference b/w baseline coefficients and stressout
1.00
0.75
0.50
0.25
0.00
y
−2
0
2
coef_diff


CDF of difference b/w baseline OBW and stressout
1.00
0.75
0.50
0.25
0.00
y
−5
0
5
10
obw_diff





Summary results - TABLE

Table 1: Summary Table

	base	stressout	bwo	diff_base	diff_so
coef	0.2874	0.2853	-3.4999	3.7872	3.7851
obw	13.1162	5.6522	2.4609	10.6553	8.8434

Interpreting results

Adding noise within OBW leads to new OBW to be narrower, but coefficients remain unbiased.. Then, when dropping values outside new OBW, the OBW became even smaller, and the estimated coefficients are biased downwards