

Homework 7

Environmental Economics II
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Problem 1 Python

1. It might not be a sharp RD as vehicle sold in 2017 might be from previous inventory that is produced when the policy is not in place.
2. Scatter plot of the data is shown in Figure 1. The plot shows that there is a discontinuity at the cutoff point.

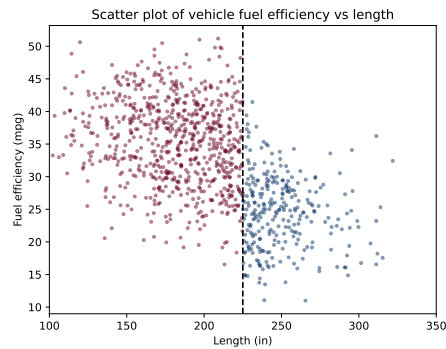


Figure 1: Scatter plot of fuel efficiency vs length of vehicle

3. Table 1 shows the RD estimates for using different polynomial.

Table 1: RD estimates

	<i>Dependent variable: Fuel efficiency (mpg)</i>		
	(1)	(2)	(3)
LATE	-10.920** (4.495)	-8.255 (46.302)	0.376 (0.342)
Polynomial specification	1 st order	2 nd order	5 th order
Observations	1000	1000	1000
R^2	0.399	0.399	0.401
Adjusted R^2	0.397	0.396	0.395
Residual Std. Error	6.158	6.160	6.165
F Statistic	259.649***	162.427***	248.217***

Note:

*p<0.1; **p<0.05; ***p<0.01

The following figure show the resulting first order polynomial.

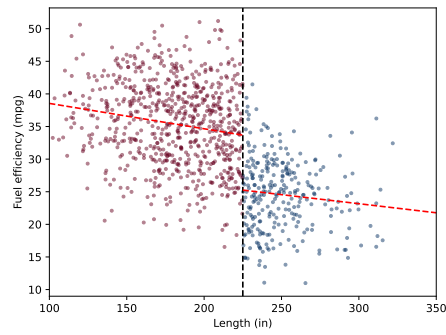


Figure 2: RD using first order polynomial

4. The following figure show the resulting second order polynomial.

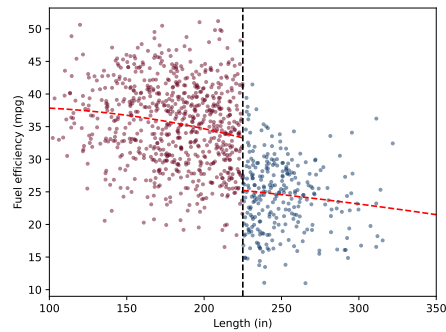


Figure 3: RD using second order polynomial

5. The following figure show the resulting fifth order polynomial.

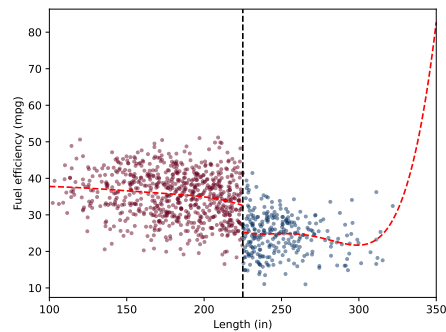


Figure 4: RD using fifth order polynomial

6. Using the discontinuity as instrument for fuel efficiency, average treatment effect estimate is 158.77 \$/mpg.

Problem 2 - Stata

1. The LATE from the RD design is -7.9915 with a standard error of 1.2434.
 - (a) The following table shows the second-stage estimates. Note that I did not correct the standard error and directly use the second stage result from Stata. The ATE is 157.43 \$/mpg.

Table 2: ATE estimates	
	Second-stage estimates
Miles per gallon	157.43*** (26.68)
=1 if the vehicle is sedan	-3674.49*** (224.25)
Adjusted R^2	0.219
Observations	1000

Standard errors in parentheses
 * $p < .1$, ** $p < .05$, *** $p < .01$

- (b) The plot of the RD is shown in Figure 5.

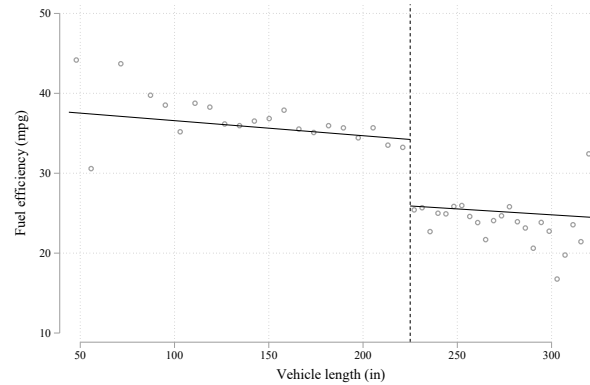


Figure 5: RD using first order polynomial in Stata

2. I think the instrument is valid as the RD result is convincing and the exclusion restriction is satisfied. I plot the first stage residual vs car type in Figure 6 to show this visually, I don't think there's meaningful difference in the distribution.

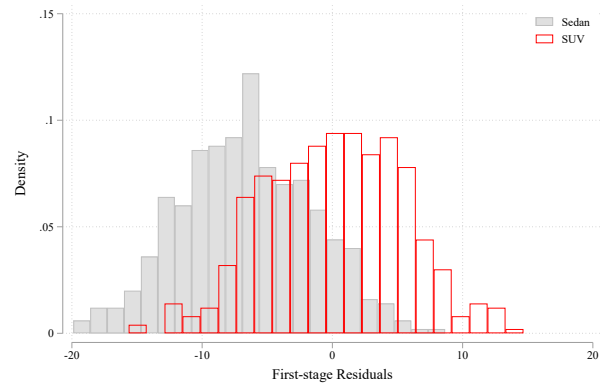


Figure 6: First stage residual for different car type