# Homework 7

## Economics 7103

## March 4, 2024

# 1 Python

## 1.1

**Do you think that this design should be a sharp or fuzzy RD? Explain.**
I think this is a sharp RD because all cars over the cutoff length MUST have the additional safety features. Generally with a fuzzy RD it's a situation where the cutoff makes the group on one side eligible for treatment rather than requiring a treatment.

## 1.2

**Create a scatter plot with mpg on the y-axis and lengthcutoff on the x-axis with a line at the RD cutoff. Is there visual evidence of bunching? Is there visual evidence of a discontinuity?**
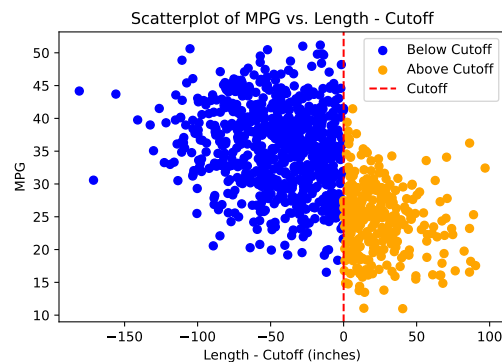


Figure 1: Scatterplot of discontinuity

There does not appear to be evidence of bunching. There is visual evidence of a discontinuity.

## 1.3

**Fit a first-order polynomial to both sides of the cutoff in a regression discontinuity design. Plot the resulting polynomial over a scatterplot and estimate the impact of the policy on fuel efficiency around the cutoff. Report your first-stage treatment effect estimate and plot.**

The first stage treatment effect is 0.0110.

## 1.4

**Fit a second-order polynomial to both sides of the cutoff in a regression discontinuity design. Plot the resulting polynomial over a scatterplot and estimate the impact of the policy on fuel**
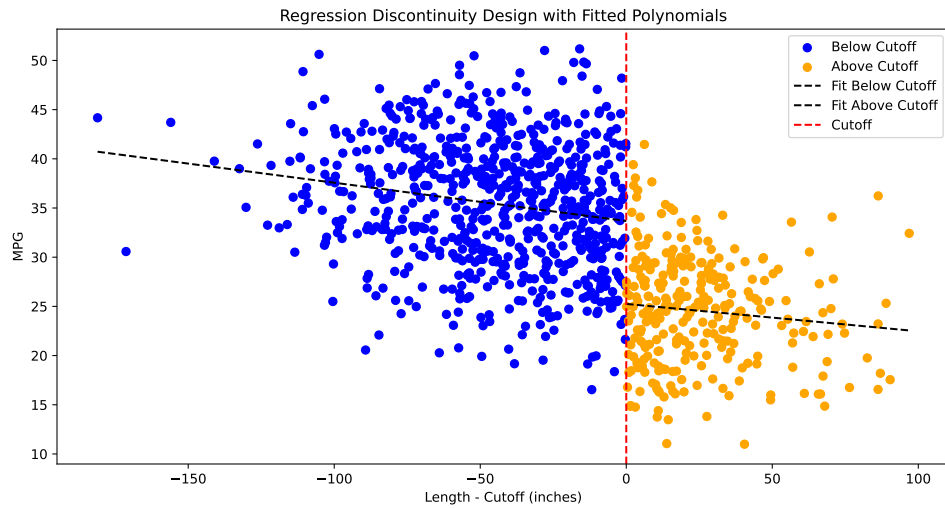
Figure 2: Scatterplot of discontinuity

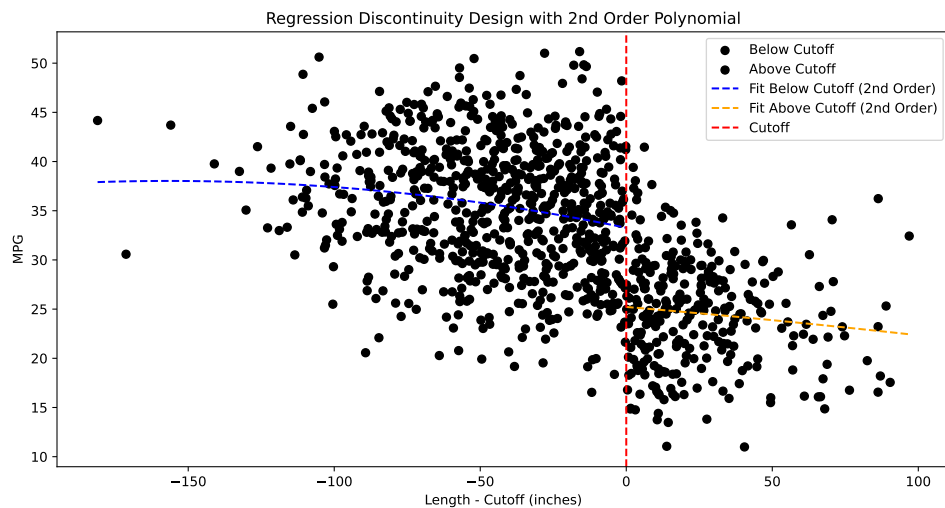efficiency around the cutoff. Report your first-stage treatment effect estimate and plot.



Figure 3: Scatterplot of discontinuity

The first stage treatment effect is -0.00299.

## 1.5

**Fit a fifth-order polynomial to both sides of the cutoff in a regression discontinuity design. Plot the resulting polynomial over a scatterplot and estimate the impact of the policy on fuel efficiency around the cutoff. Report your first-stage treatment effect estimate and plot.**

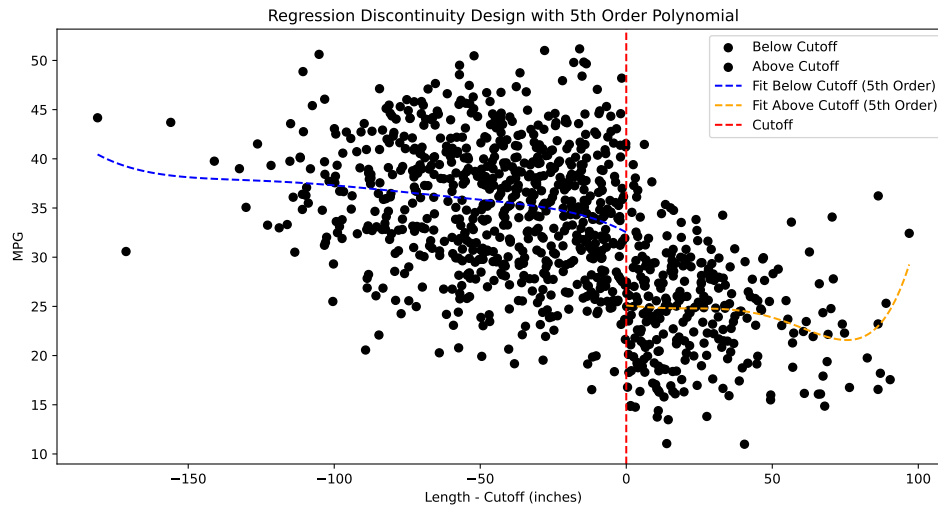The first stage treatment effect is 0.0123

Figure 4: Scatterplot of discontinuity

### 1.6

Using the discontinuity as an instrument for miles per gallon, estimate the impact of mpg on the vehicle's sale price using 2SLS by hand. Use whatever degree polynomial you see fit for the first stage and explain your choice. In the hedonic regression, control for the class of the vehicle by including car as in Homework 6. Report the average treatment effect from the second stage (no need to format your answer in a table).

The average treatment effect from the second stage is 132.007

## 2 Stata

### 2.1

Using the discontinuity as an instrument for miles per gallon, estimate the impact of mpg on the vehicle's sale price. Use the rdrobust command in Stata. Use whatever degree polynomial you see fit for the first stage. Use the CCT optimal bandwidth: bwselect(mserd). In the hedonic regression, control for the class of the vehicle by including carv as in Homework 6.

a. Report the average treatment effect from the second-stage regression results.

The average treatment effect from the second stage is 157.52
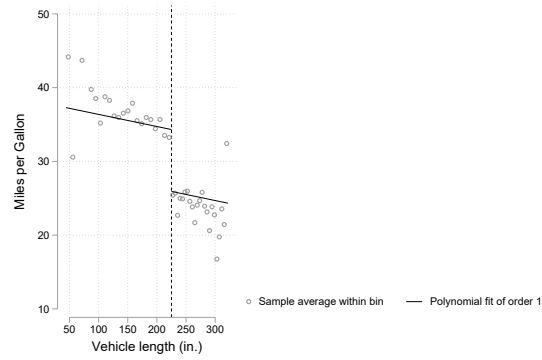
Generate and report a plot of the results using rdplot.

Figure 5: RD Plot

## 2.2

**Do you think this is a valid instrument?**
For an instrument to be considered valid it must meet the relevance and exclusion requirements. I am not concerned about relevance as the RD does seems to have a clear impact on mpg. In terms of exclusion, I don't imagine that the discontinuity would impact price through any channels other than mpg. Thus, I think this instrument is valid.