Homework 6

Economics 7103

Due Monday, February 27th by 11:59 pm

This assignment uses the same data as the previous assignment.

You have access to imaginary vehicle sales data from 2017 (*instrumentalvehicles.csv*). You are interested in estimating the hedonic price of an additional mile per gallon as part of a larger analysis of willingness to pay for fuel efficiency. In your data, you have the following variables:

Variable	Description
price	Sales price of the vehicle in USD
car	Class of the vehicle. =1 if the vehicle is a sedan, =0 if the vehicle is an SUV
mpg	Fuel efficiency in miles per gallon
weight	Weight of the vehicle in pounds
height	Height of the vehicle in inches
length	Length of the vehicle in inches

Table 1: Variable descriptions for homework 6.

New twist: You have been told that there is a strange policy that required a specific safety technology for vehicles longer than 225 inches. The side effect of the policy was that every vehicle equipped with the technology is significantly less fuel-efficient. You think you may be able to exploit the policy cutoff using a regression-discontinuity design.

1 Python

1. Do you think that this design should be a sharp or fuzzy RD? Explain.

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

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.

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

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.

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_v as in Homework 6. Report the average treatment effect from the second stage (no need to format your answer in a table).

2   Stata

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 car_v as in Homework 6.

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

   (b) Generate and report a plot of the results using `rdplot`.

2. Do you think this is a valid instrument?