Homework 7

Economics 7103

Due Monday, March 6th by 11:59 pm

I have provided you access to a small subsample (<10%) of the electricity consumption data used in one of my papers in (*electric_matching.dta*). Each observation is for a zone/region i during hour t. The data span from 2014-2020. Table 1 describes the variables in the data.

Variable	Description
datetime_beginning	Time string
time	Stata time
date	Stata date
month	Month of year
day	Day of month
year	Year
dow	Day of week
hour	Hour of day
mw	Megawat hours consumed
zone	Zone/region
temp	Temperature (degrees F)
pcp	Precipitation

Table 1: Variable descriptions for homework 7.

You are going to study the effect of the pandemic on electricity consumption using a matching estimator.

1 Stata

1. Generate a log outcome variable and a binary treatment variable that is equal to one for all time periods March 1, 2020 and after.

   (a) Estimate the following regression:

   $$log(MW_{i,t}) = \alpha_{i,m,d,h} + \beta treatment_t + \gamma X_{i,t} + \varepsilon_{i,t} \tag{1}$$

   where $\alpha_{i,m,d,h}$ includes indicator variables for zone, month of year, day of week, and hour of day and $X_{i,t}$ includes temperature and precipitation. Report the coefficient estimate and heteroskedasticity-robust standard error on $treatment_t$ (not in a table).

   (b) Using the command `teffects nnmatch`, estimate the treatment effect on $log(MW_{i,t})$ using the Mahalanobis distance norm and one nearest neighbor. Match on the continuous variables *temp* and *pcp*, and match exactly on zone, day of week, hour of day, and month of year. Report the coefficient estimate and heteroskedasticity-robust standard error (not in a table). *Hint*: You need to drop months 1 and 2 to get overlap for the matching estimate. The estimator may be slow, depending on your computer.

   (c) What issues do you think there are with these approaches?

2. Estimate the following regression:

$$log(MW_{i,t}) = \alpha_{i,m,d,h,y} + \beta treatment_t + \gamma X_{i,t} + \varepsilon_{i,t} \tag{2}$$

where you have now added an indicator for year of sample.

   (a) Report the coefficient estimate and heteroskedasticity-robust standard error on $treatment_t$ (not in a table).

   (b) How does this attempt to address the shortcoming in 1(c)?

3. Generate a new binary variable *year2020* equal to one during all of 2020. Using the command `teffects nnmatch`, match electricity consumption in 2020 to electricity consumption in 2019 using the most similar hour as defined by the Mahalanobis distance norm. Match on the continuous variables *temp* and *pcp*, and match exactly on zone, day of week, hour of day, and month of year. Generate a new variable *logmw_hat* equal to the matched electricity consumption. *Hint*: Use the `generate` option and in the case of ties, use the average matched consumption.

   (a) Denote $Y_{i,t} = log(MW_{i,t})$ and $\hat{Y}_{i,t}$ the matched log electricity consumption (*logmw_hat*). Estimate the following regression on the 2020 data only:

$$Y_{i,t} - \hat{Y}_{i,t} = \alpha + \beta treatment_t + e_{i,t} \tag{3}$$

   and report the estimate and heteroskedasticity robust standard error for the coefficient on $treatment_t$.

   (b) Why might you not trust the standard errors for the coefficient estimate from 3(a)?