**Synthetic Control assignment**

**Directions:** In this assignment, we will replicate the smoking results of Abadie, Diamond and Hainmueller (2010). If you finish soon, we will also do this for the Cheng and Hoekstra (2013) paper for Florida.

1. Construct a figure showing average cigarettes per capita for California and the rest of the US excluding California from the 1970 to 2000 with a line marking the year of Proposition 88.
2. Estimate the synthetic control model in ADH (2010).
   1. Plot the same type of picture as question 1 but using the synthetic California as the comparison group.
   2. Which covariate terms appear to be most responsible for shrinking the RMSPE in the pre-treatment period? Compare using different specifications without covariate.
   3. Can you improve on the fit using pre-treatment? Use eyeball and RSMPE as a guide.
   4. As you parts (b) and (c), what was your opinion about ADH claim that synth removes subjective researcher bias by picking the control units using optimal weights? What part of this process was under your control as a researcher and what parts were not under your control?
   5. Estimate the gap in prediction error across time for your different model from (c) and show it in a figure. Interpret the pre-treatment gap versus the post-treatment gap.
3. Estimate the new model’s (2c) placebo distribution:
   1. Use the same test statistic that ADH uses. Why do you think they scale the post-treatment RMSPE by the pre-treatment?
   2. Pick a second test statistic for your sharp null.
   3. Estimate the same model as 2c by looping through all donor pool units and save
      1. the test statistic that ADH use
      2. the one you chose in 3b
      3. and if you didn’t say this in 3b, just the post-treatment RMSPE. What’s your interpretation of this test statistic? Compare its meaning to the one you chose in 3cii and ADH own preferred one.
   4. Calculate the exact p-value under each. Compare yours to ADH’s preferred test statistic. Why do you think they suggest the scaled post RMSPE?
   5. Plot the placebo “gap” figure showing gap for all models in the placebo exercise as well as that of the true California gap. Interpret this figure.