

Lecture 8 – Synthetic Control

Intuition

Often we may want to examine the effect of a policy that really only applies to a single group. This is sometimes called a comparative case study. We already discussed one way that this can be done—a 2x2 difference in differences (or a 2xT).

These kinds of set ups have the drawback that the researcher has to pick the comparison group. This means that researchers could potentially choose a lot of different potential comparison groups until they find one that gives them the answer they want.

Synthetic Control was developed by Alberto Abadie in a series of papers. Intuitively it creates a “synthetic” version of the treated group by putting weights between 0 and 1 on several of the potential donor or control groups. The choice of these weights is done using an algorithm designed to minimize the distance between the synthetic and actual group.

So, if we want to examine the effect of a policy change in Utah we do the following:

1. Pick the potential set of donor groups (a natural choice in this example would be all states)
2. Pick the list of X 's that are used to match on (natural choices would include the level of the outcome in the pre period).
3. Estimate the optimal weights using the algorithm.
4. Compare the difference in outcomes for Utah and Synthetic Utah

What is the assumption that is necessary for identification? You must assume that whatever happens to the synthetic group represents the counterfactual for the actual group. A violation of this would occur if the group and synthetic group have different trends (can't test in the post period) or if there was a shock to one or the other that is correlated with treatment

Benefits and Drawbacks

A benefit of Synthetic Control is that you can clearly see what the counterfactual is. This includes the weights and the way that the weights were chosen.

In principle, Synthetic Control reduces the researcher's ability to choose the comparison group. However, in practice, the researcher can still restrict the donor pool or change the X s.

Inference is a bit tricky with Synthetic Control. In practice, people generate placebo tests for the entire donor pool. Then they look to see how extreme the observed difference is relative to the differences for all of the placebo exercises (which should

have no effect). If your estimate is the 4th biggest out of 50 states the p value would be .08.

Synthetic Control is probably considered to be the best tool to use if you have a single policy change. If you have multiple policy changes, a generalized differences in differences is typically preferred.