Regression II
Vanderbilt University
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55 total points

Problem Set 7 *Solutions*

This problem will replicate analyses reported in Bifulco, Rubenstein, and Sohn (2017).[1] That study used a synthetic control design to estimate the impact of Say Yes to Education (a promise scholarship program in Syracuse, New York, which provided free college tuition to any student who graduated from a public high school in Syracuse) on total district enrollment and graduation rates. The program was implemented in 2008.

There are two separate datasets on Github containing panels of enrollment and graduation data for school districts in New York State:

```
use https://github.com/spcorcor18/LPO-8852/raw/main/data/nys_data_enroll.dta, clear
use https://github.com/spcorcor18/LPO-8852/raw/main/data/nys_data_grad.dta, clear
```

Most of the variables in these datasets should be self-explanatory from their variable names and labels (although I'm not 100% sure how *target_donor* and *small_index* are defined, as they don't appear to align with the paper's selection of potential donor districts).

The authors used two potential donor pools. The comprehensive donor pool included all 275 (non-Syracuse) districts, while the restricted donor pool included 22 districts categorized as "City–Large," "City–Midsize," or "City–Small." (Note these counts are a little smaller for the graduation rate panel, which also has fewer years). NYC is excluded from the dataset.

Using the `synth2` synthetic control package in Stata, replicate the findings in this paper by reporting the elements listed below. Note you do not need to run all 6 alternative specifications of the pre-treatment years as they do in the paper (Table 1). Rather, just use their Specification (2), which uses outcomes from the first, middle, and last year of the pre-treatment period. Also include the pre-treatment average percent of district students eligible for free or reduced price lunch, percent Black, and percent Hispanic in this procedure. Run these twice, first using the comprehensive donor pool, and then again using the restricted donor pool (where *target_donor==1*).

Taken together, you will have four sets of results: two outcomes (enrollment and graduation rates) $\times$ two potential donor pools. Brownie points to those who combine results in a pleasing-to-read format.

Include these things in your results, and be sure to submit your do-file:

[1] Thank you to Bob Bifulco and Hosung Song for providing the data used in their paper.

(a) The weights assigned to donor districts, as in Tables 2 and 5. Write a few sentences summarizing the resulting weighting used. Do they correspond to the weights reported in the paper? **(10 points)**

(b) The main synthetic control graph showing trends in Syracuse and its synthetic control, as in Figures 2 and 3. Briefly summarize what you see. **(10 points)**

(c) The treatment effect ("gap") version of the graphs in (b) showing the *difference* in mean outcomes between Syracuse and its synthetic control by year (these were not shown in the paper). **(5 points)**

(d) Point estimates of the treatment effect by year (2008, 2009, 2010, and 2011), as in Tables 3 and 6. Note the graduation rate data only include 3 post-treatment years. **(5 points)**

(e) The graph showing the gap in mean outcomes between Syracuse and its synthetic control overlaid on the placebo gaps. Briefly summarize what you see. **(10 points)**

(f) p-values from the placebo-based inference. Explain in words where these come from, and how they should be interpreted. (Note, you only need to provide a written explanation for one set of results, not every one). **(10 points)**

(g) The "leave-one-out" (loo) robustness test. Interpret the results. **(5 points)**

Notes: see the in-class exercise do-file for help, and it would (of course) help to refer to the original Bifulco et al paper. Be attentive to which district ID represents the Syracuse school district—it is not consistent across the two datasets.

MY SOLUTIONS:

General comments about the replication and synth commands:

- See the attached log file for all syntax and results (other than figures).
- I learned through trial and error that the results replicate best when using the provided *target_donor* flag for the restricted donor pool. This variable is not consistent with how the paper describes the restricted donor pool, at least as I read it. They say their restricted pool includes districts described as "small cities" by the NYS Association of Small City Districts, but according to their website, there are 57 of those. The target donor flag identifies only 22 districts other than Syracuse, and not all of these are coded as "small cities." The paper does note that there are 22 districts in their restricted donor pool, which is consistent with *target_donor*.
- The `synth` commands seem to be sensitive to the use of variable labels. I tried to use the provided district names as labels, but kept running into error messages. Concerned that the district name was too long, I created a new version that truncated it to 12 characters. This sometimes worked, but occasionally resulted in error messages with `synth2`. At the end of the day, I left off the district names and just used the ID numbers to determined which units received positive weights.
- In my .do file I included the option `frame(`*`filename`*`)` with `synth2`, which saves the results to another Stata data frame under the name you specify. This frame can be saved as a Stata datafile, which you can use later to create your own tables and figures, if you prefer not to use the canned ones.

Weights (part a):

- The synthetic control weights for the two outcomes and donor pools are shown in Table 1 below. For both the full and restricted donor pools, the cities receiving positive weights are almost identical to those in the paper's Tables 2 and 5. See my Table 2 below for comparison. For enrollment, Rochester gets the largest weight, in both the full (0.363) and restricted (0.392) donor pools. Beyond Rochester, there are differences in the districts receiving positive weights by donor pool, although Buffalo appears in both. For graduation rates, Buffalo gets the largest weight, in both the full (0.477) and restricted (0.789) donor pools. Beyond Buffalo, there are differences in the districts receiving positive weights by donor pool, although Niagara Falls appears in both. In the graduation rate case with the full donor pool, my weights matched the paper exactly.

Main SCM and treatment effects graphs (parts b-c):

- The lefthand figures in Figures 1 (enrollment) and 4 (graduation) below show the time path for Syracuse and its synthetic control. These look very similar to the figures in the paper.

- The righthand figures in Figures 2 (enrollment) and 5 (graduation) below show the estimated treatment effect in each year (i.e., the gap between Syracuse and its synthetic control). Figures of this type were not provided in the original paper. Rather, they reported their treatment effect estimates in Tables 3 and 6. For enrollment, a positive treatment effect appears to emerge after 2008. For graduation, if anything the treatment effect appears to be negative.

Treatment effects (part d):

- Estimated treatment effects by year were collected into Table 1 below.
- Enrollment: the estimated treatment effects by year (2008-2011) are quite close to those in the paper's Table 3 for Specification 2. Small differences are due to small differences in selected weights. Taking an average over the four post-treatment years, the enrollment effect appears to be about 530-730 students.
- Graduation: the estimated treatment effects by year (2008-2010) are quite close to those in the paper's Table 6 for Specification 2. Small differences are due to small differences in selected weights. Nearly all point estimates are *negative*, which is unexpected. However, the authors determined that the synthetic control for graduation was less reliable, due to the noise in this measure.

Placebo graphs (part e):

- Figures 2 (enrollment) and 5 (graduation) below show the estimated treatment effect by year for Syracuse based on the original synthetic control (the bold line). The gray lines represent placebo effects: they are the result of running the `synth` command for every other district as if it were the treated district. (Syracuse is removed from the donor pool for these placebo cases). In these graphs, compare Syracuse to the other placebo districts in the post-treatment period. Are its treatment effects larger than most of the others? If so, these effects are unlikely to have arisen by chance. (The placebo districts give you some idea of what the estimates would be in the absence of any effect). Note I limited these figures to placebos where the pre-"treatment" fit was not too poor, by including the option `cutoff(5)` in the `placebo()` option. This option leaves out the placebo cases where the pre-treatment MSPE was 5 or more times larger than that of Syracuse. The log file includes a note on which districts were excluded. There were 2 and 3 excluded districts for the enrollment full and restricted donor pools, respectively, based on this criteria. The number of excluded districts from Figure 5 for graduation was higher, due to the comparatively bad fit for this outcome.
- The full donor pool graphs are more difficult to read than the restricted donor pool, given the large number of donors. It is hard to judge visually, but Syracuse does look like an outlier in the enrollment Figure 2. The graduation result (Figure 5) is much less conclusive.

p-values (part f):

- Right-tail p-values for each treatment effect estimate are reported in Table 1 below. These are based on placebo inference: they represent the proportion of placebo districts that have a larger treatment effect estimate in that year. A small p-value suggests that the observed treatment effect was unusually large and unlikely to have arisen by chance. Most of the p-values in Table 1 are above the usual significance levels, although many point estimates for enrollment are significant when using the full donor pool. To take one example, the p-value for 2011 enrollment using the full donor pool is 0.007. This means fewer than 1% of placebo districts saw a treatment effect as large as Syracuse in 2011. According to the `synth2` output, these p-values exclude districts with a poor pre-treatment fit if the `cutoff` option was used (see part e). For more on placebo-based inference with `synth2`, see Yan and Chen (2023).

- Note the paper reported RMPSE and an "overall" p-value based on the ratio of the post-to-pre RMPSE. The former is reported as part of the `synth2` output. The latter does not appear to be calculated by `synth2`, but `synth` saves this as a scalar: e(pval_joint_post_std).

Leave one out robustness tests (part g):

- Figures 3 (enrollment) and 6 (graduation) below show the leave-one-out robustness tests. The faint gray lines on these figures represent iterated synthetic controls where one of the original districts with a positive weight is omitted from the donor pool. The aim here is to see how sensitive the findings are to the exclusion of arbitrary districts from the constructed synthetic control. On balance, for enrollment the results look robust to the original. (At the very least, they are not consistent with a zero treatment effect). The graduation results are much noisier.

- `synth2` reports the maximum and minimum treatment effect estimates observed by year using the leave-one-out procedure. These are collected in Table 1 below. In the case of enrollment, the minimum treatment effect is above 500 in all but the first year post-treatment.

Table 1: Treatment effect estimates, SCM weights, p-values, LOO

	K-12 enrollment		Graduation rates	
Specification	2	2	2	2
Donor pool	Full	Restricted	Full	Restricted
Treatment effect estimates:				
2008	130.7	35.5	-13.3	-9.4
2009	725.2	566.0	-6.3	-1.6
2010	938.8	660.7	0.4	-2.8
2011	1164.1	855.9		
Average	739.7	529.5	-6.4	-4.6
Synthetic control weights:				
Rochester (204)	0.363	0.392		
Hopevale (110)	0.239			
Smithtown (224)	0.179			
Buffalo (25/24)	0.167	0.088	0.477	0.789
Mt Vernon (161)	0.051			
Niagara Falls (168/143)		0.240	0.168	0.090
Utica (247)		0.233		
Albany (1)		0.048		
Rensselaer (./171)			0.189	
Greenburgh (./77)			0.166	
Schenectady (./186)				0.085
Hempstead (./88)				0.036
p-values (right-tail):				
2008	0.142	0.500	1.000	0.950
2009	**0.004**	0.150	0.969	0.350
2010	**0.004**	**0.050**	0.582	0.700
2011	**0.007**	0.100		
LOO (min TE)				
2008	-56.5	-59.1	-12.1	-9.7
2009	581.1	496.2	-6.9	-2.3
2010	678.1	609.7	-1.0	-3.7
2011	889.5	603.0		
LOO (max TE)				
2008	317.0	77.9	-1.8	-4.4
2009	920.2	683.4	-3.6	-0.1
2010	1172.3	832.1	5.2	-0.8
2011	1280.1	1016.2		

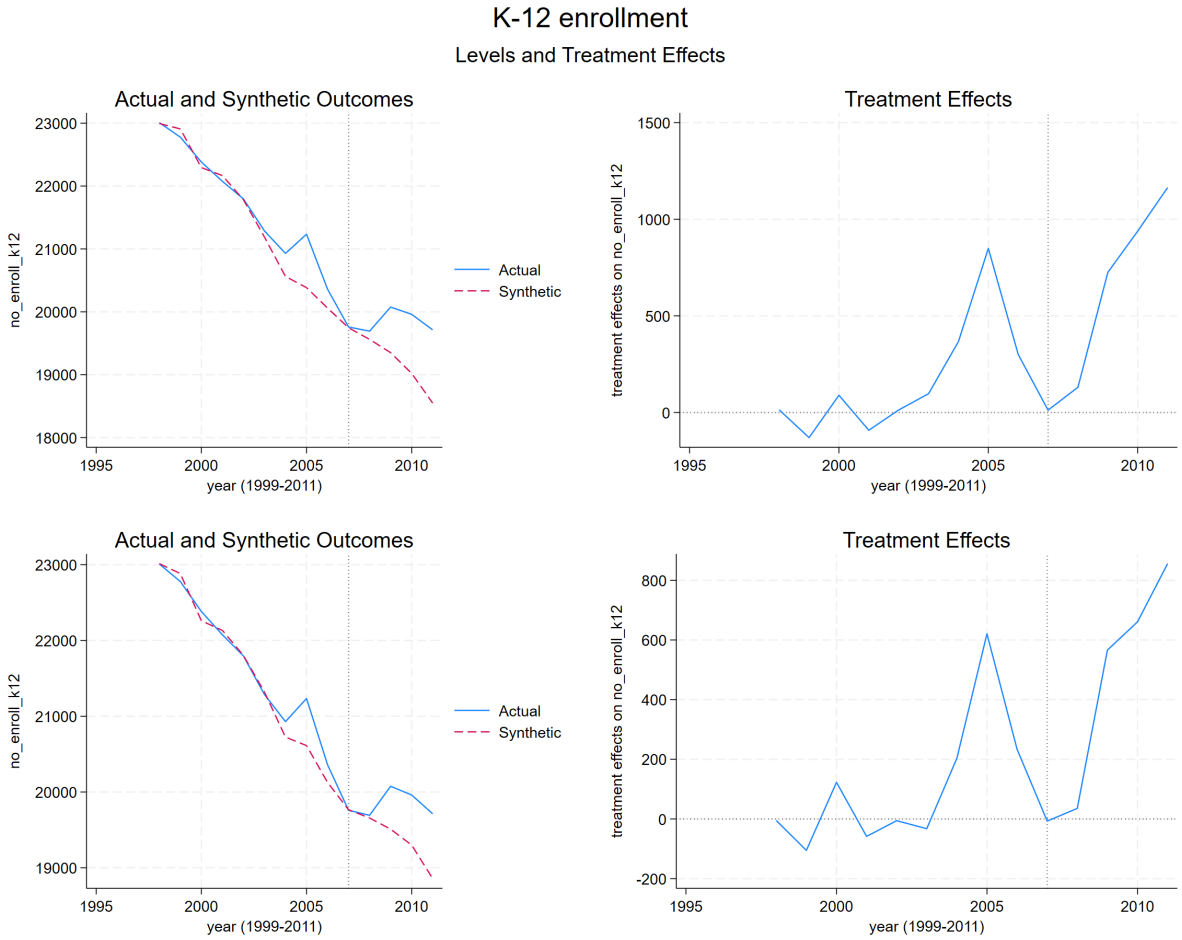
Note: district ID numbers in the two datasets are shown in parentheses.

Table 2: SCM weights reported in the original paper

	K-12 enrollment		Graduation rates	
Specification	2	2	2	2
Donor pool	Full	Restricted	Full	Restricted
Rochester (204)	0.341	0.406		
Hopevale (110)	0.197			
Smithtown (224)	0.156			
Buffalo (25/24)	0.174	0.078	0.477	0.800
Mt Vernon (161)	0.061			
Niagara Falls (168/143)		0.288	0.168	0.101
Utica (247)	0.069	0.207		
Albany (1)		0.021		
Rensselaer (./171)			0.189	
Greenburgh (./77)			0.166	
Schenectady (./186)				0.078
Hempstead (./88)				0.021

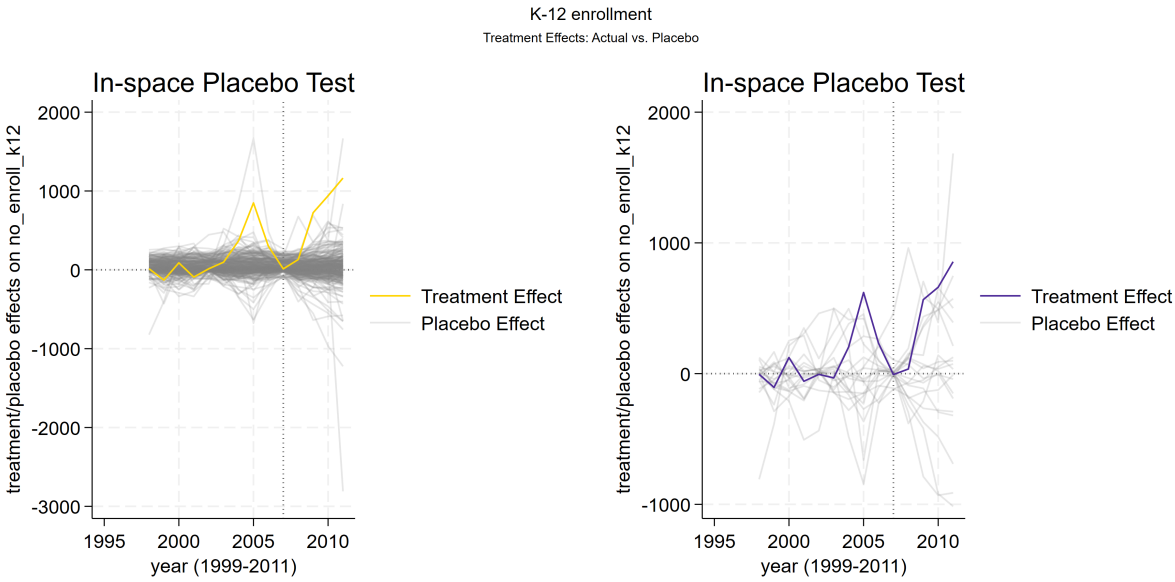
Note: district ID numbers in the two datasets are shown in parentheses.

Figure 1: Mean enrollment and treatment effects, Syracuse school district and synthetic control



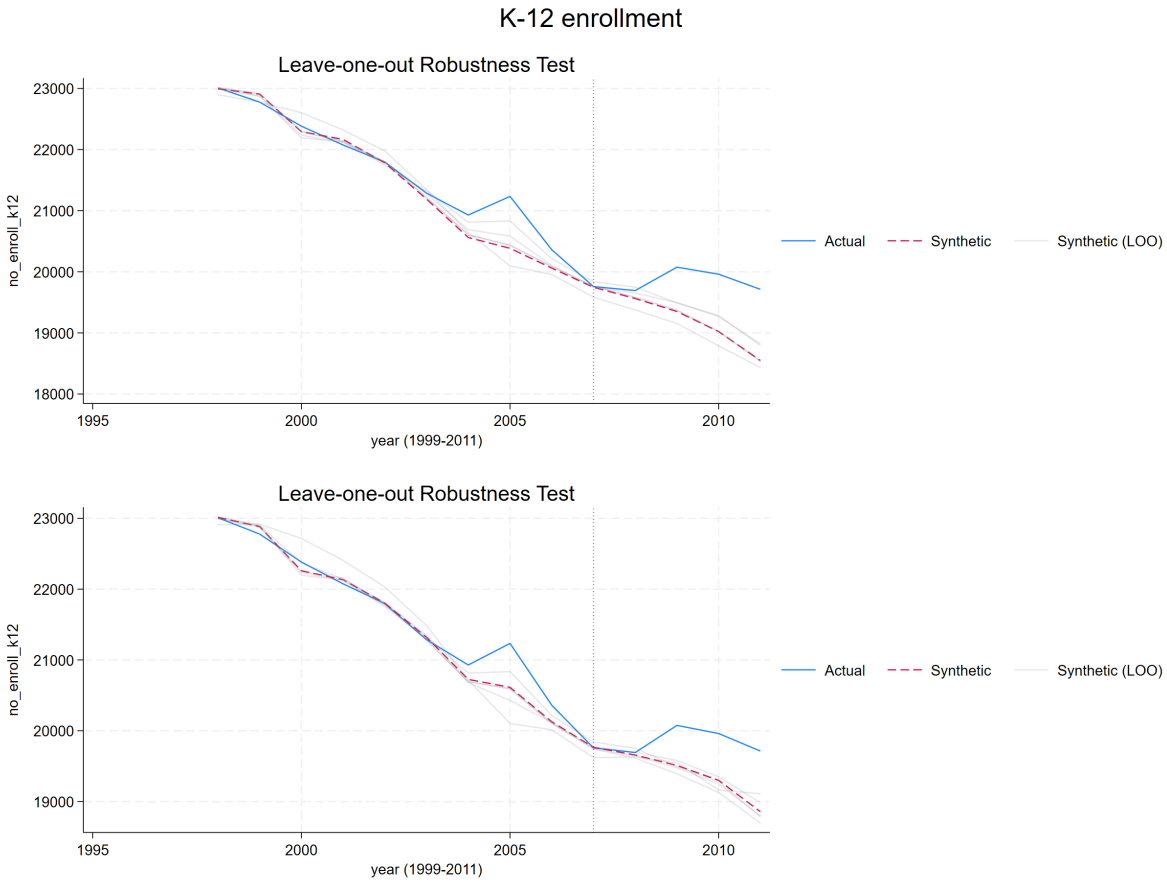
Note: Say Yes to Education implemented in 2008. Top panels: full donor pool. Bottom panels: restricted donor pool.

Figure 2: Mean enrollment treatment effects: Syracuse vs. placebos



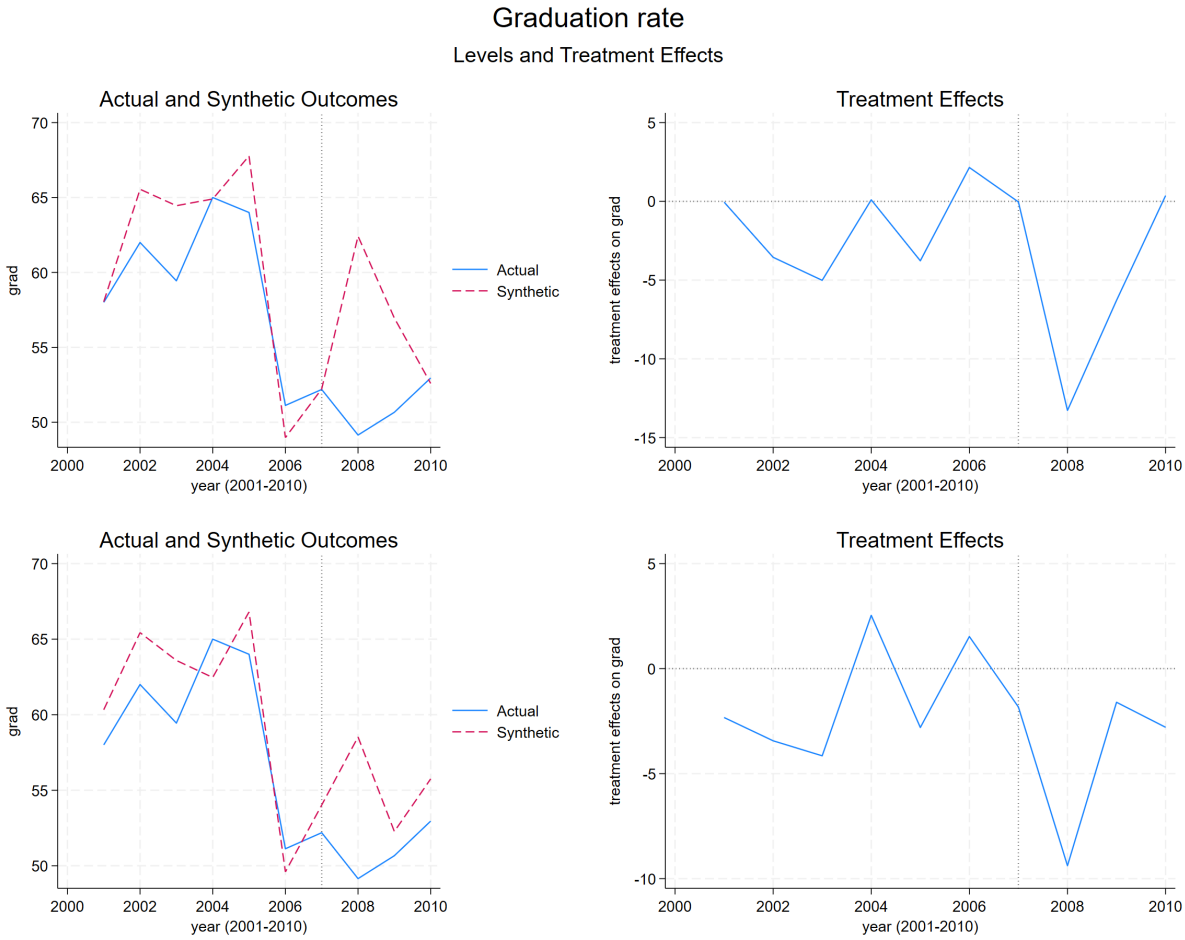
Note: Say Yes to Education implemented in 2008. Left panel: full donor pool. Right panel: restricted donor pool. Placebo cases where the pre-treatment MSPE was 5 or more times larger than that of Syracuse were excluded from this figure.

Figure 3: Enrolllment leave-one-out robustness test



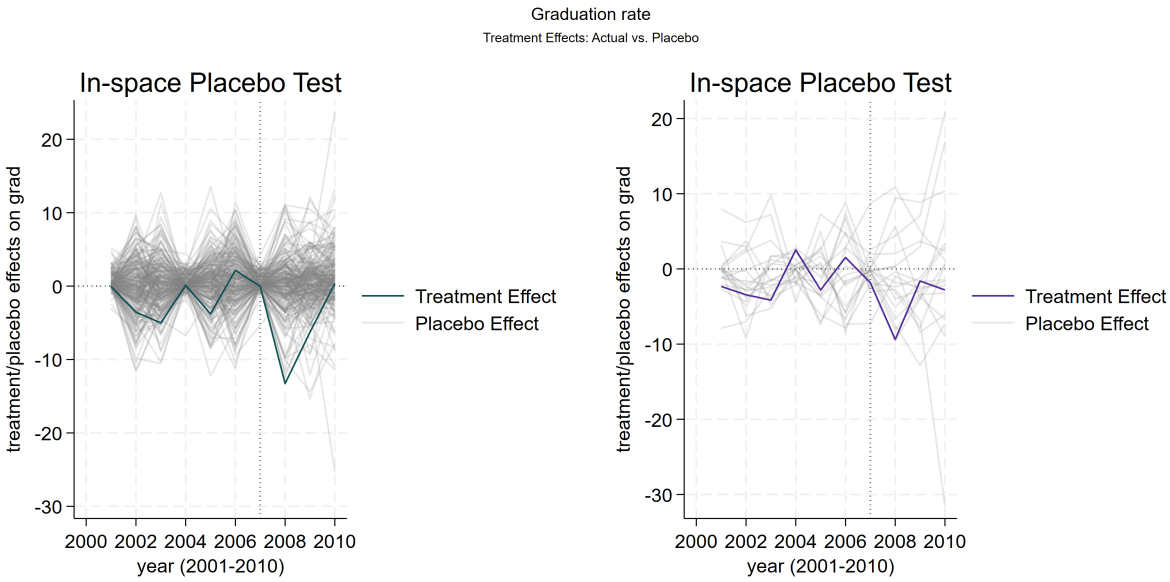
Note: Say Yes to Education implemented in 2008. Top panel: full donor pool. Bottom panel: restricted donor pool.

Figure 4: Mean graduation rate and treatment effects, Syracuse school district and synthetic control



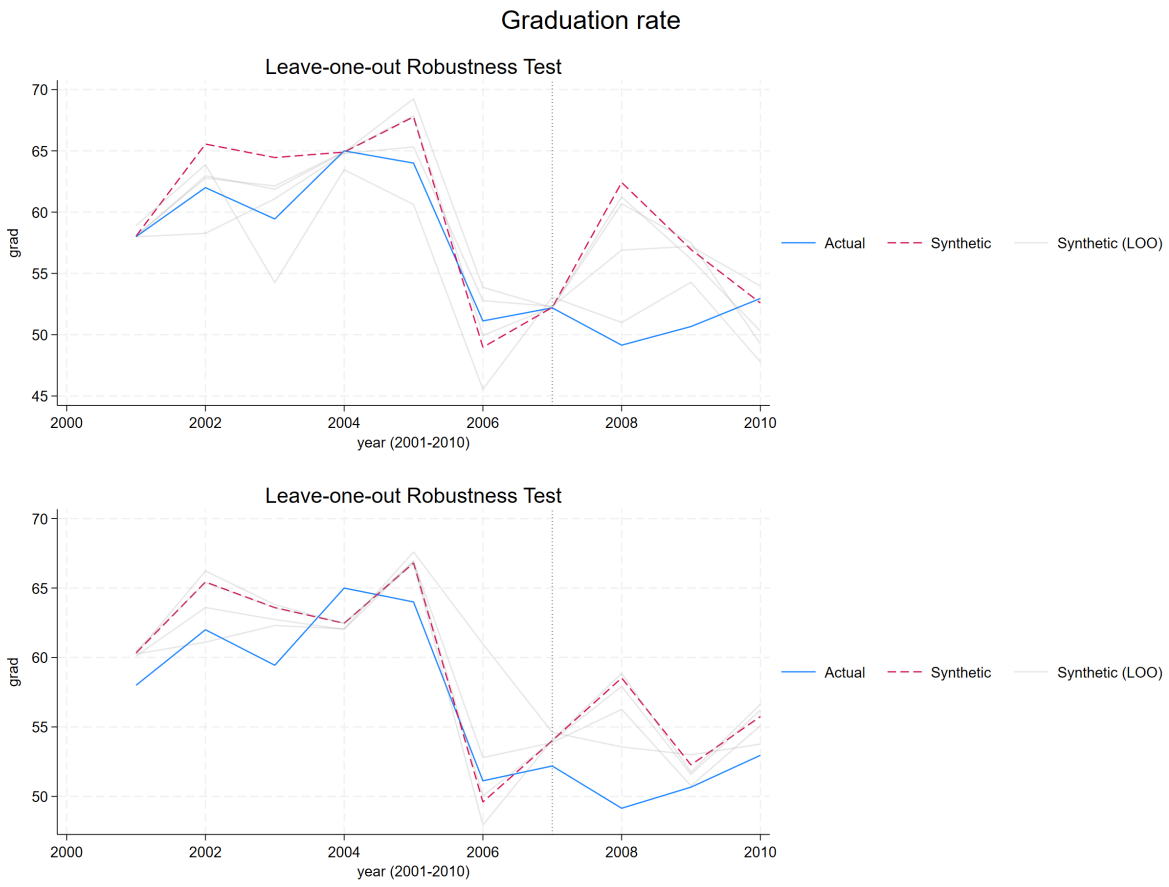
Note: Say Yes to Education implemented in 2008. Top panels: full donor pool. Bottom panels: restricted donor pool.

Figure 5: Graduation rate treatment effects: Syracuse vs. placebos



Note: Say Yes to Education implemented in 2008. Left panel: full donor pool. Right panel: restricted donor pool. Placebo cases where the pre-treatment MSPE was 5 or more times larger than that of Syracuse were excluded from this figure.

Figure 6: Graduation rates: leave-one-out robustness test



Note: Say Yes to Education implemented in 2008. Top panel: full donor pool. Bottom panel: restricted donor pool.

```
.
.
. // ***********************************************************************
. // Bifulco, Rubenstein, and Sohn (2017) replication - Problem Set 7
. // Last updated: November 4, 2024
. // ***********************************************************************
.
. // Enrollment data
. // ***********************************************************************
.
. // *****************
. // Setup
. // *****************
.
.         use https://github.com/spcorcor18/LPO-8852/raw/main/data/nys_data_enroll.dt
> a, clear

.
.         // There are 276 school districts x 14 years = 3864 observations
.         // Syracuse is id==238
.
.         tabulate year, miss

       year |
(1999-2011) |      Freq.     Percent        Cum.
------------+-----------------------------------
       1998 |        276        7.14        7.14
       1999 |        276        7.14       14.29
       2000 |        276        7.14       21.43
       2001 |        276        7.14       28.57
       2002 |        276        7.14       35.71
       2003 |        276        7.14       42.86
       2004 |        276        7.14       50.00
       2005 |        276        7.14       57.14
       2006 |        276        7.14       64.29
       2007 |        276        7.14       71.43
       2008 |        276        7.14       78.57
       2009 |        276        7.14       85.71
       2010 |        276        7.14       92.86
       2011 |        276        7.14      100.00
------------+-----------------------------------
      Total |      3,864      100.00

.         unique district
Number of unique values of district_name is  276
Number of records is  3864

.         unique id
Number of unique values of id is  276
Number of records is  3864

.         tabulate id if substr(district,1,4)=="SYRA"

group(distr |
  ict_name) |      Freq.     Percent        Cum.
------------+-----------------------------------
        238 |         14      100.00      100.00
------------+-----------------------------------
      Total |         14      100.00
```

```
.
.         // District name is too long to use as labels with synth command. I
.         // created a truncated version and ensured this didn't vary over time
.         // within id (below). However, synth produced an error when looping over
.         // the placebo districts ("invalid numlist has too many elements") that
.         // seems to resolve when I don't use this district label. Still seeking
.         // a way to bring in district name labels.
.
.         by id: gen temp=district_name if _n==1
(3,588 missing values generated)

.         egen district_name2=mode(temp), by(id)

.
.         gen district2=proper(substr(district_name2,1,12))

.         *labmask id, values(district2)
.         drop temp district_name2

.
.         xtset id year

Panel variable: id (strongly balanced)
 Time variable: year, 1998 to 2011
         Delta: 1 year

.
.         // ulocal07 codes 11, 12, and 13 are large, midsize, and small cities
.
.         tabulate ulocal07

 local type |
    code (7 |
categories) |
  - numeric |      Freq.     Percent        Cum.
------------+-----------------------------------
         11 |         14        0.36        0.36
         12 |         28        0.72        1.09
         13 |        280        7.25        8.33
         21 |      3,206       82.97       91.30
         22 |        168        4.35       95.65
         23 |        140        3.62       99.28
         32 |         28        0.72      100.00
------------+-----------------------------------
      Total |      3,864      100.00

.         tabulate local07

   locale type |
       code (7 |
 categories) - |
       string |      Freq.     Percent        Cum.
--------------+-----------------------------------
    City-Large |         14        0.36        0.36
  City-Midsize |         28        0.72        1.09
    City-Small |        280        7.25        8.33
  Suburb-Large |      3,206       82.97       91.30
Suburb-Midsize |        168        4.35       95.65
  Suburb-Small |        140        3.62       99.28
  Town-Distant |         28        0.72      100.00
---------------+-----------------------------------
         Total |      3,864      100.00
```

```
.         tabulate local07 if year==1998

   locale type |
       code (7 |
 categories) - |
        string |      Freq.     Percent        Cum.
---------------+-----------------------------------
    City-Large |          1        0.36        0.36
  City-Midsize |          2        0.72        1.09
    City-Small |         20        7.25        8.33
  Suburb-Large |        229       82.97       91.30
Suburb-Midsize |         12        4.35       95.65
  Suburb-Small |         10        3.62       99.28
  Town-Distant |          2        0.72      100.00
---------------+-----------------------------------
         Total |        276      100.00

.
.         // Note: use the dataset's target_donor flag, though not 100% clear
.         // how it is defined. The paper says the restricted donor pool includes
.         // Rochester, Buffalo, Yonkers, and the districts the NYS Association of
.         // Small City School Districts Defines as "small city" districts. Their
.         // n=22 total, but the NYSA says there are 57 small city dists.
.         // https://www.nyssba.org/clientuploads/nsbmx/forms/small_city_districts.pd
> f
.
.         // target_donor does not seem to line up with large/middle/small cities
.         // as it includes seom suburban and town districts
.
.         tabulate year target_donor

      year |
(1999-2011 |     target_donor
         ) |         0          1 |     Total
-----------+----------------------+----------
      1998 |       253         23 |       276
      1999 |       253         23 |       276
      2000 |       253         23 |       276
      2001 |       253         23 |       276
      2002 |       253         23 |       276
      2003 |       253         23 |       276
      2004 |       253         23 |       276
      2005 |       253         23 |       276
      2006 |       253         23 |       276
      2007 |       253         23 |       276
      2008 |       253         23 |       276
      2009 |       253         23 |       276
      2010 |       253         23 |       276
      2011 |       253         23 |       276
-----------+----------------------+----------
     Total |     3,542        322 |     3,864

.         tabulate year local07 if target_donor==1

      year |
(1999-2011 |        locale type code (7 categories) - string
         ) | City-La..  City-Mi..  City-Sm..  Suburb-..  Suburb-.. |     Total
-----------+-----------------------------------------------------------+----------
      1998 |         1          2          7         10          1 |        23
      1999 |         1          2          7         10          1 |        23
      2000 |         1          2          7         10          1 |        23
      2001 |         1          2          7         10          1 |        23
      2002 |         1          2          7         10          1 |        23
      2003 |         1          2          7         10          1 |        23
      2004 |         1          2          7         10          1 |        23
      2005 |         1          2          7         10          1 |        23
      2006 |         1          2          7         10          1 |        23
      2007 |         1          2          7         10          1 |        23
      2008 |         1          2          7         10          1 |        23
      2009 |         1          2          7         10          1 |        23
      2010 |         1          2          7         10          1 |        23
      2011 |         1          2          7         10          1 |        23
```

```
-----------+---------------------------------------------------------+----------
     Total |        14         28         98        140         14 |       322


           |   locale
           | type code
           |     (7
      year | categories
(1999-2011 | ) - string
         ) | Town-Di.. |     Total
-----------+-----------+----------
      1998 |         2 |        23
      1999 |         2 |        23
      2000 |         2 |        23
      2001 |         2 |        23
      2002 |         2 |        23
      2003 |         2 |        23
      2004 |         2 |        23
      2005 |         2 |        23
      2006 |         2 |        23
      2007 |         2 |        23
      2008 |         2 |        23
      2009 |         2 |        23
      2010 |         2 |        23
      2011 |         2 |        23
-----------+-----------+----------
     Total |        28 |       322

.         tabulate year small_index

      year |
(1999-2011 |      small_index
         ) |         0          1 |     Total
-----------+----------------------+----------
      1998 |       246         30 |       276
      1999 |       246         30 |       276
      2000 |       246         30 |       276
      2001 |       246         30 |       276
      2002 |       246         30 |       276
      2003 |       246         30 |       276
      2004 |       246         30 |       276
      2005 |       246         30 |       276
      2006 |       246         30 |       276
      2007 |       246         30 |       276
      2008 |       246         30 |       276
      2009 |       246         30 |       276
      2010 |       246         30 |       276
      2011 |       246         30 |       276
-----------+----------------------+----------
     Total |     3,444        420 |     3,864

.
.
. // ******************************************************
. // Synthetic control - for enrollment
. // ******************************************************
.
. // ***********************************************************************
. // Specification 2 - full donor pool
. // ***********************************************************************
```

```
. // Note: placebo cases take a while to run, given the size of the full
. // donor pool
.
.         synth2 no_enroll_k12 no_enroll_k12(1998) no_enroll_k12(2002) ///
>                 no_enroll_k12(2007) p_lunch p_black p_hispanic, ///
>                 trunit(238) trperiod(2008) mspeperiod(1998(1)2007) ///
>                 preperiod(1998(1)2007) postperiod(2008(1)2011) xperiod(1998(1)2007)
>  ///
>                 placebo(unit cutoff(5)) loo savegraph(spec2, replace) frame(espec2)
Fitting results in the pretreatment periods:
------------------------------------------------------------------------------
 Treated Unit             :        238     Treatment Time           :       2008
------------------------------------------------------------------------------
 Number of Control Units  =        275     Root Mean Squared Error  =  308.48246
 Number of Covariates     =          6     R-squared                =    0.92184
------------------------------------------------------------------------------

Covariate balance in the pretreatment periods:
------------------------------------------------------------------------------------------
> -
      Covariate      |  V.weight    Treated    Synthetic Control     Average Control
>
                     |                          Value          Bias   Value        Bias
>
---------------------+--------------------------------------------------------------------
> -
 no_enroll_k12(1998) |   0.2532  23009.0000  22994.9470    -0.06%  4117.3709   -82.11
> %
 no_enroll_k12(2002) |   0.4593  21796.0000  21782.8160    -0.06%  4258.1818   -80.46
> %
 no_enroll_k12(2007) |   0.2875  19759.0000  19746.5740    -0.06%  4153.2691   -78.98
> %
             p_lunch |   0.0000      0.6089      0.6029    -0.98%     0.1645   -72.98
> %
             p_black |   0.0000      0.4750      0.4560    -3.99%     0.1115   -76.52
> %
          p_hispanic |   0.0000      0.0776      0.1157    49.19%     0.0884    14.04
> %
------------------------------------------------------------------------------------------
> -
Note: "V.weight" is the optimal covariate weight in the diagonal of V matrix.
      "Synthetic Control" is the weighted average of donor units with optimal
      weights.
      "Average Control" is the simple average of all control units with equal
      weights.

Optimal Unit Weights:
-------------------
 Unit |    U.weight
------+------------
  204 |     0.3630
  110 |     0.2390
  224 |     0.1790
   25 |     0.1670
  161 |     0.0510
-------------------
Note: The unit 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 26 27
      28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
      54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79
      80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103
      104 105 106 107 108 109 111 112 113 114 115 116 117 118 119 120 121 122 123
      124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142
      143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 162
      163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181
      182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
      201 202 203 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220
      221 222 223 225 226 227 228 229 230 231 232 233 234 235 236 237 239 240 241
      242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260
      261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 in the donor
      pool get a weight of 0.
```

Prediction results in the posttreatment periods:

Time	Actual Outcome	Synthetic Outcome	Treatment Effect
2008	19693.0000	19562.2598	130.7402
2009	20076.0000	19350.8125	725.1875
2010	19961.0000	19022.2402	938.7598
2011	19713.0000	18548.8555	1164.1445
Mean	19860.7500	19121.0420	739.7080

Note: The average treatment effect over the posttreatment period is 739.7080.

Implementing placebo test using fake treatment unit 1...10...100...101...102...103...
> 104...105...106...107...108...109...11...110...111...112...113...114...115...116...
> 117...118...119...12...120...121...122...123...124...125...126...127...128...129...
> 13...130...131...132...133...134...135...136...137...138...139...14...140...141...1
> 42...143...144...145...146...147...148...149...15...150...151...152...153...154...1
> 55...156...157...158...159...16...160...161...162...163...164...165...166...167...1
> 68...169...17...170...171...172...173...174...175...176...177...178...179...18...18
> 0...181...182...183...184...185...186...187...188...189...19...190...191...192...19
> 3...194...195...196...197...198...199...2...20...200...201...202...203...204...205.
> ..206...207...208...209...21...210...211...212...213...214...215...216...217...218.
> ..219...22...220...221...222...223...224...225...226...227...228...229...23...230..
> .231...232...233...234...235...236...237...239...24...240...241...242...243...244..
> .245...246...247...248...249...25...250...251...252...253...254...255...256...257..
> .258...259...26...260...261...262...263...264...265...266...267...268...269...27...
> 270...271...272...273...274...275...276...28...29...3...30...31...32...33...34...35
> ...36...37...38...39...4...40...41...42...43...44...45...46...47...48...49...5...50
> ...51...52...53...54...55...56...57...58...59...6...60...61...62...63...64...65...6
> 6...67...68...69...7...70...71...72...73...74...75...76...77...78...79...8...80...8
> 1...82...83...84...85...86...87...88...89...9...90...91...92...93...94...95...96...
> 97...98...99...

In-space placebo test results using fake treatment units:

Unit	Pre MSPE	Post MSPE	Post/Pre MSPE	Pre MSPE of Fake Unit/ Pre MSPE of Treated Unit
238	9.52e+04	6.95e+05	7.3020	1.0000
1	7.34e+04	5.84e+04	0.7957	0.7713
10	3289.5608	2.94e+04	8.9264	0.0346
100	1.02e+04	3935.4399	0.3862	0.1071
101	1088.8965	1.30e+04	11.9099	0.0114
102	5.46e+04	1.47e+05	2.6830	0.5739
103	2022.2628	2.26e+04	11.1741	0.0213
104	4812.0347	1241.1132	0.2579	0.0506
105	995.6233	2941.0968	2.9540	0.0105
106	452.2944	2972.5255	6.5721	0.0048
107	2449.0048	2.52e+04	10.2735	0.0257
108	963.9097	1.47e+04	15.2616	0.0101
109	4403.5189	2.44e+04	5.5371	0.0463
11	93.9865	1.20e+04	127.3149	0.0010
110	43.4062	3017.2808	69.5127	0.0005
111	1274.9310	7.92e+04	62.1574	0.0134
112	1900.8423	3.42e+04	18.0096	0.0200
113	1724.7334	9384.4314	5.4411	0.0181
114	1748.0376	6185.2362	3.5384	0.0184
115	946.1330	5.12e+04	54.1496	0.0099
116	470.9372	1604.3244	3.4067	0.0049
117	478.2048	1458.6787	3.0503	0.0050
118	2098.5712	1592.9394	0.7591	0.0221
119	1010.4029	6938.3575	6.8669	0.0106
12	4495.2873	8312.7052	1.8492	0.0472
120	3250.9683	5274.3985	1.6224	0.0342
121	1248.1143	748.7775	0.5999	0.0131
122	336.2847	1020.9324	3.0359	0.0035
123	847.1957	2803.2187	3.3088	0.0089
124	263.1422	1650.1076	6.2708	0.0028
125	1.21e+04	1.81e+04	1.4961	0.1269
126	882.6451	7379.8243	8.3610	0.0093
127	3.01e+04	8930.2298	0.2963	0.3167

128	413.6550	6953.0803	16.8089	0.0043
129	5797.0123	4202.6482	0.7250	0.0609
13	457.1877	2265.1659	4.9546	0.0048
130	5223.5685	5721.1986	1.0953	0.0549
131	1506.1601	1145.5226	0.7606	0.0158
132	1077.1355	1737.1980	1.6128	0.0113
133	2733.5250	3.05e+04	11.1581	0.0287
134	2166.1003	993.4409	0.4586	0.0228
135	1.03e+04	2858.9627	0.2780	0.1081
136	346.6684	2668.9457	7.6988	0.0036
137	1.94e+04	1440.2910	0.0744	0.2034
138	650.0141	9168.4651	14.1050	0.0068
139	4913.5081	3461.8004	0.7045	0.0516
14	2049.2743	4270.3374	2.0838	0.0215
140	6427.9328	1.73e+04	2.6942	0.0675
141	247.2231	4639.1155	18.7649	0.0026
142	169.2261	430.6886	2.5450	0.0018
143	1913.3900	5054.2692	2.6415	0.0201
144	858.3910	8275.8966	9.6412	0.0090
145	2735.9088	3297.6790	1.2053	0.0288
146	2444.7583	3.71e+04	15.1816	0.0257
147	730.1927	1847.1996	2.5297	0.0077
148	224.9879	1018.6355	4.5275	0.0024
149	528.9086	541.1730	1.0232	0.0056
15	1450.4860	2.03e+04	13.9956	0.0152
150	2147.7714	6993.9445	3.2564	0.0226
151	97.8250	280.0847	2.8631	0.0010
152	1713.9673	4316.0383	2.5182	0.0180
153	5151.4490	1.05e+05	20.4602	0.0541
154	3608.5433	1.57e+04	4.3597	0.0379
155	1009.5611	2944.1337	2.9163	0.0106
156	2001.1052	8.16e+04	40.7664	0.0210
157	430.9741	774.0975	1.7962	0.0045
158	207.7563	4377.7793	21.0717	0.0022
159	640.2500	6495.0619	10.1446	0.0067
16	1189.2639	357.7496	0.3008	0.0125
160	1449.0708	1.66e+04	11.4543	0.0152
161	4.23e+04	2.82e+05	6.6681	0.4449
162	424.3383	306.2125	0.7216	0.0045
163	1037.2160	4.31e+04	41.5123	0.0109
164	526.0271	3481.9426	6.6193	0.0055
165	8133.1185	8.96e+04	11.0138	0.0855
166	266.0080	1335.4566	5.0204	0.0028
167	2.94e+04	7.09e+05	24.1526	0.3087
168	4.35e+04	4035.7219	0.0927	0.4575
169	478.1178	6884.9484	14.4001	0.0050
17	4063.0981	3.52e+04	8.6609	0.0427
170	6558.3202	5262.0120	0.8023	0.0689
171	675.1302	1.04e+04	15.3670	0.0071
172	1.00e+04	1.91e+04	1.9015	0.1055
173	199.2239	224.3333	1.1260	0.0021
174	456.0216	1.33e+04	29.1200	0.0048
175	5942.6126	7.51e+04	12.6457	0.0624
176	4575.1682	5558.7291	1.2150	0.0481
177	1007.6393	1865.8008	1.8517	0.0106
178	2481.2638	2565.1010	1.0338	0.0261
179	1264.5154	7393.9297	5.8472	0.0133
18	953.5684	1697.2637	1.7799	0.0100
180	6795.7935	5794.4557	0.8527	0.0714
181	46.5107	1.20e+04	258.7698	0.0005
182	5650.9544	7008.7140	1.2403	0.0594
183	2060.1643	4.81e+04	23.3287	0.0216
184	7188.3732	9627.3550	1.3393	0.0755
185	883.8177	4.11e+04	46.5194	0.0093
186	1.05e+04	3220.4672	0.3075	0.1101
187	844.1954	8.98e+04	106.4317	0.0089
188	323.7296	8435.3104	26.0567	0.0034
189	269.5049	3506.1144	13.0095	0.0028
19	3.94e+05	1.67e+05	0.4238	4.1400
190	1177.3951	3132.8723	2.6609	0.0124
191	1230.1198	1163.8073	0.9461	0.0129
192	721.6069	1851.9999	2.5665	0.0076

193	74.0595	9809.3422	132.4522	0.0008
194	44.5947	4651.6188	104.3087	0.0005
195	5333.6063	2.68e+04	5.0307	0.0560
196	359.8004	6891.5164	19.1537	0.0038
197	5401.6530	3.00e+04	5.5520	0.0568
198	2493.9239	866.8969	0.3476	0.0262
199	1.88e+04	1.34e+04	0.7128	0.1972
2	601.3629	1.53e+04	25.4469	0.0063
20	372.6404	298.1989	0.8002	0.0039
200	3467.4073	8617.4899	2.4853	0.0364
201	1792.0515	6091.3469	3.3991	0.0188
202	30.1590	1064.2227	35.2870	0.0003
203	360.8923	5.13e+04	142.1529	0.0038
204	2.30e+06	6.79e+06	2.9522	24.1667
205	712.3365	8711.3225	12.2292	0.0075
206	4555.3467	700.9804	0.1539	0.0479
207	2.04e+04	2.78e+04	1.3584	0.2148
208	525.2007	3384.3174	6.4439	0.0055
209	6120.1696	5675.3613	0.9273	0.0643
21	940.8141	1.89e+04	20.0435	0.0099
210	1.92e+04	2172.4514	0.1131	0.2018
211	578.0847	3.09e+04	53.5294	0.0061
212	174.6051	1.26e+04	72.1021	0.0018
213	2.26e+04	5.97e+04	2.6443	0.2374
214	3587.9006	2.40e+04	6.6881	0.0377
215	3926.0979	2.05e+04	5.2173	0.0413
216	973.6978	4776.0098	4.9050	0.0102
217	830.6585	1.33e+04	15.9573	0.0087
218	3.03e+04	2.07e+05	6.8154	0.3188
219	631.8711	3936.4281	6.2298	0.0066
22	2147.2707	3065.9413	1.4278	0.0226
220	678.6154	8009.1736	11.8022	0.0071
221	4857.1263	1.58e+05	32.6172	0.0510
222	1.09e+04	1.62e+04	1.4823	0.1146
223	3512.0880	1050.4108	0.2991	0.0369
224	1.62e+04	1.01e+05	6.2161	0.1700
225	777.5604	5529.8264	7.1118	0.0082
226	910.3022	1.98e+06	2169.7296	0.0096
227	3836.0337	2342.6188	0.6107	0.0403
228	7612.8414	2644.3925	0.3474	0.0800
229	1000.2299	223.9986	0.2239	0.0105
23	771.5647	1604.2230	2.0792	0.0081
230	1.14e+04	5.28e+04	4.6458	0.1195
231	515.9568	9169.7342	17.7723	0.0054
232	541.7272	798.5584	1.4741	0.0057
233	2425.0291	7928.6953	3.2695	0.0255
234	1115.5266	1.39e+04	12.4278	0.0117
235	2335.8373	1.16e+04	4.9703	0.0245
236	1844.1485	7363.9903	3.9932	0.0194
237	843.0534	4145.8035	4.9176	0.0089
239	2.33e+04	2.00e+05	8.5738	0.2451
24	866.1026	1853.5847	2.1401	0.0091
240	711.9386	2054.1365	2.8853	0.0075
241	2.34e+04	9.17e+04	3.9142	0.2461
242	98.0223	242.1660	2.4705	0.0010
243	121.2748	1.02e+04	84.2632	0.0013
244	1495.6356	8718.1611	5.8291	0.0157
245	1773.3981	1.85e+04	10.4180	0.0186
246	6.59e+04	8059.8379	0.1223	0.6926
247	1.05e+04	1.80e+05	17.1892	0.1099
248	339.2428	3241.1054	9.5539	0.0036
249	958.3365	380.4446	0.3970	0.0101
25	3.65e+07	3.71e+05	0.0102	384.0343
250	122.6996	506.4040	4.1272	0.0013
251	999.6052	317.8830	0.3180	0.0105
252	1993.0031	5.91e+04	29.6650	0.0209
253	3466.2919	658.3244	0.1899	0.0364
254	778.9146	7.21e+04	92.5422	0.0082
255	2488.1918	1.31e+04	5.2580	0.0261
256	375.9471	1.37e+04	36.3658	0.0040
257	8397.9748	1.28e+04	1.5228	0.0882
258	1311.9976	2.02e+04	15.3929	0.0138

259	157.6980	7.79e+04	493.8564	0.0017
26	814.7800	2756.4064	3.3830	0.0086
260	3422.6649	2758.5885	0.8060	0.0360
261	610.7638	2.17e+04	35.4534	0.0064
262	2544.5195	2485.3694	0.9768	0.0267
263	1256.2427	5216.8790	4.1528	0.0132
264	690.1975	1.02e+04	14.7224	0.0073
265	1448.3639	2385.1521	1.6468	0.0152
266	3440.4997	4525.3808	1.3153	0.0362
267	5488.9788	4.19e+04	7.6295	0.0577
268	2679.5554	7259.6269	2.7093	0.0282
269	473.9533	1.36e+04	28.7491	0.0050
27	355.4082	1705.8867	4.7998	0.0037
270	2646.1854	1.04e+04	3.9229	0.0278
271	3183.5153	1630.7928	0.5123	0.0335
272	1.73e+04	2.09e+05	12.0935	0.1814
273	5672.4250	3803.0335	0.6704	0.0596
274	3172.1355	4653.5855	1.4670	0.0333
275	221.4747	1221.6416	5.5159	0.0023
276	1.88e+05	8.56e+05	4.5600	1.9737
28	267.1407	3756.7635	14.0629	0.0028
29	1684.7319	3.35e+04	19.8867	0.0177
3	2549.3288	6059.5830	2.3769	0.0268
30	2.91e+04	9117.1993	0.3129	0.3062
31	259.1476	1.31e+04	50.5649	0.0027
32	1345.7564	1.17e+04	8.6784	0.0141
33	869.2778	6237.1023	7.1750	0.0091
34	467.9160	3.01e+04	64.4199	0.0049
35	871.3832	423.6305	0.4862	0.0092
36	425.9187	2.53e+04	59.4568	0.0045
37	3829.4940	7.85e+04	20.5026	0.0402
38	542.8456	1268.3297	2.3364	0.0057
39	543.0690	2.74e+04	50.4232	0.0057
4	1.00e+04	2.95e+04	2.9334	0.1056
40	4485.7955	2.58e+04	5.7606	0.0471
41	466.0344	2076.2843	4.4552	0.0049
42	1663.0048	1.05e+04	6.3015	0.0175
43	1284.8631	5609.2130	4.3656	0.0135
44	1.47e+04	1.36e+04	0.9265	0.1542
45	1060.1333	1.74e+04	16.4389	0.0111
46	510.7861	100.9503	0.1976	0.0054
47	4669.8657	1.11e+04	2.3731	0.0491
48	413.8481	744.5903	1.7992	0.0043
49	424.5615	444.7481	1.0475	0.0045
5	486.8856	4244.8645	8.7184	0.0051
50	1281.9497	3219.4748	2.5114	0.0135
51	531.7993	2196.0328	4.1294	0.0056
52	2773.2931	1270.7940	0.4582	0.0291
53	1310.3418	1.20e+04	9.1277	0.0138
54	5687.6934	3695.1513	0.6497	0.0598
55	8963.3497	5841.2586	0.6517	0.0942
56	1161.0785	1.17e+04	10.1127	0.0122
57	374.9402	8330.8115	22.2190	0.0039
58	2.51e+04	1.79e+05	7.1236	0.2635
59	696.0212	5.22e+04	75.0318	0.0073
6	1139.0913	1.32e+04	11.6043	0.0120
60	344.8514	5.38e+04	156.0898	0.0036
61	425.0555	3206.0645	7.5427	0.0045
62	1813.1251	1.79e+05	98.4739	0.0191
63	1291.9545	328.0782	0.2539	0.0136
64	509.6977	208.1130	0.4083	0.0054
65	5044.6254	5916.2700	1.1728	0.0530
66	1048.6817	721.0511	0.6876	0.0110
67	1945.3753	4.05e+04	20.8236	0.0204
68	398.9367	1755.7370	4.4010	0.0042
69	374.9162	1478.7276	3.9442	0.0039
7	2818.6771	3.15e+04	11.1785	0.0296
70	5518.0293	9256.3314	1.6775	0.0580
71	614.4113	1.34e+04	21.8424	0.0065
72	997.6129	5021.5427	5.0336	0.0105
73	321.3045	6726.5244	20.9350	0.0034
74	349.4507	1051.8623	3.0100	0.0037

75	748.2909	7980.6065	10.6651	0.0079
76	1.40e+04	1.37e+04	0.9792	0.1470
77	3634.8526	3.02e+04	8.3094	0.0382
78	363.6679	154.7377	0.4255	0.0038
79	2220.2923	1.04e+04	4.6772	0.0233
8	6076.8395	8427.7266	1.3869	0.0639
80	2151.0796	6.42e+04	29.8314	0.0226
81	2294.4521	1.13e+04	4.9268	0.0241
82	392.7501	4097.5682	10.4330	0.0041
83	349.6981	2.17e+04	61.9810	0.0037
84	1493.9385	8.06e+04	53.9615	0.0157
85	2.40e+04	2.91e+05	12.1457	0.2519
86	50.7979	389.5157	7.6680	0.0005
87	1479.2613	1154.5090	0.7805	0.0155
88	507.0087	1.36e+04	26.8935	0.0053
89	2685.3328	1290.1812	0.4805	0.0282
9	688.5169	1.32e+04	19.1700	0.0072
90	573.9534	1.39e+04	24.2613	0.0060
91	274.2629	226.9333	0.8274	0.0029
92	2949.5578	1339.3762	0.4541	0.0310
93	1.13e+04	4.96e+04	4.3963	0.1186
94	1018.5682	1602.6746	1.5735	0.0107
95	3489.4053	2.31e+04	6.6153	0.0367
96	1920.0275	3222.9861	1.6786	0.0202
97	923.9815	4650.1149	5.0327	0.0097
98	397.5576	8.07e+04	202.8846	0.0042
99	1101.2113	3.43e+04	31.1324	0.0116

Note: (1) Using all control units, the probability of obtaining a post/pretreatment MSPE ratio as large as 238's is 0.3804.
(2) Excluding control units with pretreatment MSPE 5 times larger than the treated unit, the probability of obtaining a post/pretreatment MSPE ratio as large as 238's is 0.3832.
(3) The pointwise p-values below are computed by excluding control units with pretreatment MSPE 5 times larger than the treated unit.
(4) There are total 2 units with pretreatment MSPE 5 times larger than the treated unit, including 204 25.

In-space placebo test results using fake treatment units (continued, cutoff = 5):

Time	Treatment Effect	p-value of Treatment Effect		
		Two-sided	Right-sided	Left-sided
2008	130.7402	0.1788	0.1423	0.8613
2009	725.1875	0.0036	0.0036	1.0000
2010	938.7598	0.0073	0.0036	1.0000
2011	1164.1445	0.0146	0.0073	0.9964

Note: (1) The two-sided p-value of the treatment effect for a particular period is defined as the frequency that the absolute values of the placebo effects are greater than or equal to the absolute value of treatment effect.
(2) The right-sided (left-sided) p-value of the treatment effect for a particular period is defined as the frequency that the placebo effects are greater (smaller) than or equal to the treatment effect.
(3) If the estimated treatment effect is positive, then the right-sided p-value is recommended; whereas the left-sided p-value is recommended if the estimated treatment effect is negative.

Implementing leave-one-out robustness test that excludes one control unit with a nonz
> ero weight 204...110...224...25...161...

```
Leave-one-out robustness test results in the posttreatment period:
-------------------------------------------------------
 Time |         Outcome         Synthetic Outcome (LOO)
      |     Actual   Synthetic         Min         Max
------+------------------------------------------------
 2008 | 19693.0000  19562.2598  19375.9785  19749.5000
 2009 | 20076.0000  19350.8125  19155.7852  19494.8594
 2010 | 19961.0000  19022.2402  18788.7012  19282.9258
 2011 | 19713.0000  18548.8555  18432.8828  18823.4629
-------------------------------------------------------
Note: The last two columns report the minimum and maximum synthetic outcomes when
      one control unit with a nonzero weight is excluded at a time.

-------------------------------------------------------
 Time |    Treatment Effect   Treatment Effect (LOO)
      |                            Min          Max
------+------------------------------------------------
 2008 |           130.7402      -56.5000      317.0215
 2009 |           725.1875      581.1406      920.2148
 2010 |           938.7598      678.0742     1172.2988
 2011 |          1164.1445      889.5371     1280.1172
-------------------------------------------------------
Note: The last two columns report the minimum and maximum treatment effects when
      one control unit with a nonzero weight is excluded at a time.

file spec2_bias.gph saved
file spec2_weight_vars.gph saved
file spec2_weight_unit.gph saved
file spec2_pred.gph saved
file spec2_eff.gph saved
file spec2_eff_pboUnit.gph saved
file spec2_ratio_pboUnit.gph saved
file spec2_pvalTwo_pboUnit.gph saved
file spec2_pvalRight_pboUnit.gph saved
file spec2_pvalLeft_pboUnit.gph saved
file spec2_pred_loo.gph saved
file spec2_eff_loo.gph saved

Finished.

.
.
. // ************************************************************************
. // Specification 2 - restricted donor pool
. // ************************************************************************
.
.         preserve

.         keep if target_donor==1
(3,542 observations deleted)

.
.         synth2 no_enroll_k12 no_enroll_k12(1998) no_enroll_k12(2002) ///
>                 no_enroll_k12(2007) p_lunch p_black p_hispanic, ///
>                 trunit(238) trperiod(2008) mspeperiod(1998(1)2007) ///
>                 preperiod(1998(1)2007) postperiod(2008(1)2011) xperiod(1998(1)2007)
>  ///
>                 placebo(unit cutoff(5)) loo savegraph(spec2r, replace) frame(espec2
> r)
Fitting results in the pretreatment periods:
------------------------------------------------------------------------------
 Treated Unit             :        238     Treatment Time           :       2008
------------------------------------------------------------------------------
 Number of Control Units  =         22     Root Mean Squared Error  =  229.55695
 Number of Covariates     =          6     R-squared                =    0.95576
------------------------------------------------------------------------------
```

Covariate balance in the pretreatment periods:

Covariate	V.weight	Treated	Synthetic Control		Average Control	
			Value	Bias	Value	Bias
no_enroll_k12(1998)	0.2588	23009.0000	23014.0100	0.02%	10497.2273	-54.38 %
no_enroll_k12(2002)	0.4474	21796.0000	21801.6100	0.03%	10459.3182	-52.01 %
no_enroll_k12(2007)	0.2937	19759.0000	19766.0960	0.04%	9519.4091	-51.82 %
p_lunch	0.0000	0.6089	0.5931	-2.59%	0.5279	-13.30 %
p_black	0.0000	0.4750	0.4687	-1.32%	0.4471	-5.86 %
p_hispanic	0.0000	0.0776	0.1221	57.43%	0.2318	198.94 %

Note: "V.weight" is the optimal covariate weight in the diagonal of V matrix.
"Synthetic Control" is the weighted average of donor units with optimal weights.
"Average Control" is the simple average of all control units with equal weights.

Optimal Unit Weights:

Unit	U.weight
204	0.3920
168	0.2400
247	0.2330
25	0.0880
1	0.0480

Note: The unit 4 19 30 50 58 102 112 154 161 167 198 207 218 241 267 274 276 in the donor pool get a weight of 0.

Prediction results in the posttreatment periods:

Time	Actual Outcome	Synthetic Outcome	Treatment Effect
2008	19693.0000	19657.4941	35.5059
2009	20076.0000	19510.0137	565.9863
2010	19961.0000	19300.3457	660.6543
2011	19713.0000	18857.0996	855.9004
Mean	19860.7500	19331.2383	529.5117

Note: The average treatment effect over the posttreatment period is 529.5117.

Implementing placebo test using fake treatment unit 1...102...112...154...161...167..
> .168...19...198...204...207...218...241...247...25...267...274...276...30...4...50.
> ..58...

In-space placebo test results using fake treatment units:

Unit	Pre MSPE	Post MSPE	Post/Pre MSPE	Pre MSPE of Fake Unit/ Pre MSPE of Treated Unit
238	5.27e+04	3.73e+05	7.0718	1.0000
1	6.49e+04	5.27e+04	0.8127	1.2313
102	5.57e+04	1.82e+05	3.2595	1.0578
112	7807.4552	6.59e+04	8.4422	0.1482
154	4533.9273	1.77e+04	3.8980	0.0860
161	2.30e+04	6.01e+05	26.1582	0.4361
167	1.00e+05	5.26e+05	5.2487	1.9035
168	3.94e+04	1.05e+04	0.2672	0.7483

19	7.13e+05	2.30e+05	0.3219	13.5342
198	2617.2128	2.20e+05	84.1605	0.0497
204	2.30e+06	6.57e+06	2.8536	43.6656
207	1.75e+04	8028.9462	0.4593	0.3318
218	8.48e+04	3.91e+05	4.6024	1.6102
241	1.84e+04	5.24e+04	2.8548	0.3484
247	2.71e+04	1.92e+05	7.1061	0.5139
25	3.65e+07	3.71e+05	0.0102	693.5058
267	2714.1546	2.37e+05	87.4914	0.0515
274	1.05e+04	3723.7911	0.3538	0.1997
276	1.88e+05	8.81e+05	4.6819	3.5700
30	1.66e+04	1.08e+04	0.6517	0.3142
4	1.07e+04	6760.9592	0.6335	0.2025
50	1.47e+04	1971.5488	0.1339	0.2794
58	1.35e+04	1.49e+05	11.0567	0.2564

Note: (1) Using all control units, the probability of obtaining a post/pretreatment MSPE ratio as large as 238's is 0.3043.
(2) Excluding control units with pretreatment MSPE 5 times larger than the treated unit, the probability of obtaining a post/pretreatment MSPE ratio as large as 238's is 0.3500.
(3) The pointwise p-values below are computed by excluding control units with pretreatment MSPE 5 times larger than the treated unit.
(4) There are total 3 units with pretreatment MSPE 5 times larger than the treated unit, including 19 204 25.

In-space placebo test results using fake treatment units (continued, cutoff = 5):

Time	Treatment Effect	p-value of Treatment Effect		
		Two-sided	Right-sided	Left-sided
2008	35.5059	0.9500	0.5000	0.5500
2009	565.9863	0.2000	0.1500	0.9000
2010	660.6543	0.1500	0.0500	1.0000
2011	855.9004	0.2000	0.1000	0.9500

Note: (1) The two-sided p-value of the treatment effect for a particular period is defined as the frequency that the absolute values of the placebo effects are greater than or equal to the absolute value of treatment effect.
(2) The right-sided (left-sided) p-value of the treatment effect for a particular period is defined as the frequency that the placebo effects are greater (smaller) than or equal to the treatment effect.
(3) If the estimated treatment effect is positive, then the right-sided p-value is recommended; whereas the left-sided p-value is recommended if the estimated treatment effect is negative.

Implementing leave-one-out robustness test that excludes one control unit with a nonz
> ero weight 204...168...247...25...1...

Leave-one-out robustness test results in the posttreatment period:

Time	Outcome		Synthetic Outcome (LOO)	
	Actual	Synthetic	Min	Max
2008	19693.0000	19657.4941	19615.1191	19752.1172
2009	20076.0000	19510.0137	19392.5820	19579.7520
2010	19961.0000	19300.3457	19128.8828	19351.2988
2011	19713.0000	18857.0996	18696.8379	19110.0410

Note: The last two columns report the minimum and maximum synthetic outcomes when one control unit with a nonzero weight is excluded at a time.

```
-------------------------------------------------------
 Time |    Treatment Effect   Treatment Effect (LOO)
      |                              Min          Max
------+------------------------------------------------
 2008 |            35.5059      -59.1172       77.8809
 2009 |           565.9863      496.2480      683.4180
 2010 |           660.6543      609.7012      832.1172
 2011 |           855.9004      602.9590     1016.1621
-------------------------------------------------------
Note: The last two columns report the minimum and maximum treatment effects when
      one control unit with a nonzero weight is excluded at a time.

file spec2r_bias.gph saved
file spec2r_weight_vars.gph saved
file spec2r_weight_unit.gph saved
file spec2r_pred.gph saved
file spec2r_eff.gph saved
file spec2r_eff_pboUnit.gph saved
file spec2r_ratio_pboUnit.gph saved
file spec2r_pvalTwo_pboUnit.gph saved
file spec2r_pvalRight_pboUnit.gph saved
file spec2r_pvalLeft_pboUnit.gph saved
file spec2r_pred_loo.gph saved
file spec2r_eff_loo.gph saved

Finished.

.
.         restore

.
.
. // ***********************************************************************
. // Specification 2 - GRAPHS (enrollment)
. // ***********************************************************************
.
.         // enrollment: main SCM and gaps graphs
.         graph combine spec2_pred.gph spec2_eff.gph spec2r_pred.gph spec2r_eff.gph,
> ///
>                 cols(2) altshrink xsize(10) ysize(8) title("K-12 enrollment",size(s
> mall)) ///
>                 subtitle("Levels and Treatment Effects",size(vsmall))

.         graph export ecomb1.png, as(png) replace
file ecomb1.png saved as PNG format

.
.         // enrollment: SCM vs placebo graphs
.         graph combine spec2_eff_pboUnit.gph spec2r_eff_pboUnit.gph, ///
>                 rows(1) altshrink xsize(8) ysize(4) title("K-12 enrollment",size(sm
> all)) ///
>                 subtitle("Treatment Effects: Actual vs. Placebo",size(vsmall))

.         graph export ecomb2.png, as(png) replace
file ecomb2.png saved as PNG format

.
.         // enrollment: p-value graphs
.         graph combine spec2_pvalRight_pboUnit.gph spec2r_pvalRight_pboUnit.gph, ///
>                 rows(1) altshrink xsize(8) ysize(4) title("K-12 enrollment",size(sm
> all)) ///
>                 subtitle("p-values by year",size(vsmall))
```

```
.         graph export ecomb3.png, as(png) replace
file ecomb3.png saved as PNG format

.
.         // enrollment: LOO graphs
.         graph combine spec2_pred_loo.gph spec2r_pred_loo.gph, ///
>                 cols(1) altshrink xsize(8) ysize(6) title("K-12 enrollment",size(sm
> all))

.         graph export ecomb4.png, as(png) replace
file ecomb4.png saved as PNG format

.
.
.
. // Graduation data
. // ***************************************************************************
.
. // *****************
. // Setup
. // *****************
.
.         use https://github.com/spcorcor18/LPO-8852/raw/main/data/nys_data_grad.dta,
>  clear

.
.         // There are 237 school districts x 10 years = 2370 observations
.         // Syracuse is id==205
.
.         table year

------------------------------
                 |  Frequency
-----------------+------------
year (2001-2010) |
  2001           |        237
  2002           |        237
  2003           |        237
  2004           |        237
  2005           |        237
  2006           |        237
  2007           |        237
  2008           |        237
  2009           |        237
  2010           |        237
  Total          |      2,370
------------------------------

.         unique district
Number of unique values of district_name is  237
Number of records is  2370

.         unique id
Number of unique values of id is  237
Number of records is  2370

.         tabulate id if substr(district,1,4)=="SYRA"

group(distr |
  ict_name) |      Freq.     Percent        Cum.
------------+-----------------------------------
        205 |         10      100.00      100.00
------------+-----------------------------------
      Total |         10      100.00
```

```
.
.         // District name is too long to use as labels with synth command. I
.         // created a truncated version and ensured this didn't vary over time
.         // within id (below). However, synth produced an error when looping over
.         // the placebo districts ("invalid numlist has too many elements") that
.         // seems to resolve when I don't use this district label. Still seeking
.         // a way to bring in district name labels.
.
.         by id: gen temp=district_name if _n==1
(2,133 missing values generated)

.         egen district_name2=mode(temp), by(id)

.
.         gen district2=proper(substr(district_name2,1,12))

.         *labmask id, values(district2)
.         drop temp district_name2

.
.         xtset id year

Panel variable: id (strongly balanced)
 Time variable: year, 2001 to 2010
         Delta: 1 unit

.
.         // ulocal07 codes 11, 12, and 13 are large, midsize, and small cities
.
.         tabulate ulocal07

 local type |
    code (7 |
categories) |
  - numeric |      Freq.     Percent        Cum.
------------+-----------------------------------
         11 |         10        0.42        0.42
         12 |         20        0.84        1.27
         13 |        190        8.02        9.28
         21 |      1,910       80.59       89.87
         22 |        120        5.06       94.94
         23 |        100        4.22       99.16
         32 |         20        0.84      100.00
------------+-----------------------------------
      Total |      2,370      100.00

.         tabulate local07

   locale type |
       code (7 |
 categories) - |
       string |      Freq.     Percent        Cum.
--------------+-----------------------------------
    City-Large |         10        0.42        0.42
  City-Midsize |         20        0.84        1.27
    City-Small |        190        8.02        9.28
  Suburb-Large |      1,910       80.59       89.87
Suburb-Midsize |        120        5.06       94.94
  Suburb-Small |        100        4.22       99.16
  Town-Distant |         20        0.84      100.00
---------------+-----------------------------------
         Total |      2,370      100.00
```

```
.
.         // Note: use the dataset's target_donor flag, though not 100% clear
.         // how it is defined. See earlier note.
.
.         tabulate year target_donor

      year |
(2001-2010 |     target_donor
         ) |         0          1 |     Total
-----------+----------------------+----------
      2001 |       214         23 |       237
      2002 |       214         23 |       237
      2003 |       214         23 |       237
      2004 |       214         23 |       237
      2005 |       214         23 |       237
      2006 |       214         23 |       237
      2007 |       214         23 |       237
      2008 |       214         23 |       237
      2009 |       214         23 |       237
      2010 |       214         23 |       237
-----------+----------------------+----------
     Total |     2,140        230 |     2,370

.         tabulate year small_index

      year |
(2001-2010 |      small_index
         ) |         0          1 |     Total
-----------+----------------------+----------
      2001 |       208         29 |       237
      2002 |       208         29 |       237
      2003 |       208         29 |       237
      2004 |       208         29 |       237
      2005 |       208         29 |       237
      2006 |       208         29 |       237
      2007 |       208         29 |       237
      2008 |       208         29 |       237
      2009 |       208         29 |       237
      2010 |       208         29 |       237
-----------+----------------------+----------
     Total |     2,080        290 |     2,370

.
.
. // ****************************************************
. // Synthetic control - for graduation rates
. // ****************************************************
.
. // ***********************************************************************
. // Specification 2 - full donor pool
. // ***********************************************************************
.
.         synth2 grad grad(2001) grad(2004) grad(2007) ///
>                 p_lunch p_black p_hispanic, ///
>                 trunit(205) trperiod(2008) mspeperiod(2001(1)2007) ///
>                 preperiod(2001(1)2007) postperiod(2008(1)2010) xperiod(2001(1)2007)
>  ///
>                 placebo(unit cutoff(5)) loo savegraph(gspec2, replace) frame(gspec2
> )
Fitting results in the pretreatment periods:
------------------------------------------------------------------------------
 Treated Unit             :        205     Treatment Time           :       2008
------------------------------------------------------------------------------
 Number of Control Units  =        236     Root Mean Squared Error  =    2.84058
 Number of Covariates     =          6     R-squared                =    0.82321
------------------------------------------------------------------------------
```

Covariate balance in the pretreatment periods:

Covariate	V.weight	Treated	Synthetic Control Value	Synthetic Control Bias	Average Control Value	Average Control Bias
grad(2001)	0.2689	58.0000	58.0450	0.08%	87.9364	51.61%
grad(2004)	0.3062	65.0000	64.9020	-0.15%	86.3184	32.80%
grad(2007)	0.4071	52.1912	52.2290	0.07%	84.4661	61.84%
p_lunch	0.0103	0.6195	0.5975	-3.55%	0.1540	-75.15%
p_black	0.0039	0.4892	0.4511	-7.79%	0.1029	-78.96%
p_hispanic	0.0035	0.0867	0.1184	36.46%	0.0886	2.16%

Note: "V.weight" is the optimal covariate weight in the diagonal of V matrix.
"Synthetic Control" is the weighted average of donor units with optimal weights.
"Average Control" is the simple average of all control units with equal weights.

Optimal Unit Weights:

Unit	U.weight
24	0.4770
171	0.1890
143	0.1680
77	0.1660

Note: The unit 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 in the donor pool get a weight of 0.

Prediction results in the posttreatment periods:

Time	Actual Outcome	Synthetic Outcome	Treatment Effect
2008	49.1492	62.4229	-13.2737
2009	50.6684	56.9542	-6.2859
2010	52.9588	52.5918	0.3669
Mean	50.9254	57.3230	-6.3975

Note: The average treatment effect over the posttreatment period is -6.3975.

Implementing placebo test using fake treatment unit 1...10...100...101...102...103...
> 104...105...106...107...108...109...11...110...111...112...113...114...115...116...
> 117...118...119...12...120...121...122...123...124...125...126...127...128...129...
> 13...130...131...132...133...134...135...136...137...138...139...14...140...141...1
> 42...143...144...145...146...147...148...149...15...150...151...152...153...154...1
> 55...156...157...158...159...16...160...161...162...163...164...165...166...167...1
> 68...169...17...170...171...172...173...174...175...176...177...178...179...18...18
> 0...181...182...183...184...185...186...187...188...189...19...190...191...192...19
> 3...194...195...196...197...198...199...2...20...200...201...202...203...204...206.
> ..207...208...209...21...210...211...212...213...214...215...216...217...218...219.
> ..22...220...221...222...223...224...225...226...227...228...229...23...230...231..
> .232...233...234...235...236...237...24...25...26...27...28...29...3...30...31...32
> ...33...34...35...36...37...38...39...4...40...41...42...43...44...45...46...47...4
> 8...49...5...50...51...52...53...54...55...56...57...58...59...6...60...61...62...6
> 3...64...65...66...67...68...69...7...70...71...72...73...74...75...76...77...78...
> 79...8...80...81...82...83...84...85...86...87...88...89...9...90...91...92...93...
> 94...95...96...97...98...99...

In-space placebo test results using fake treatment units:

Unit	Pre MSPE	Post MSPE	Post/Pre MSPE	Pre MSPE of Fake Unit/ Pre MSPE of Treated Unit
205	8.0689	71.9457	8.9164	1.0000
1	13.3555	123.3675	9.2372	1.6552
10	18.1318	9.1885	0.5068	2.2471
100	3.0680	16.0486	5.2309	0.3802
101	3.9480	14.8335	3.7572	0.4893
102	7.4905	1.6711	0.2231	0.9283
103	4.6906	5.9279	1.2638	0.5813
104	1.0339	2.8616	2.7676	0.1281
105	4.3029	0.8050	0.1871	0.5333
106	16.9329	13.8116	0.8157	2.0986
107	0.2491	2.5205	10.1168	0.0309
108	18.9161	16.2094	0.8569	2.3443
109	3.3042	4.7506	1.4377	0.4095
11	1.8268	2.8818	1.5775	0.2264
110	15.0434	55.5048	3.6897	1.8644
111	19.9474	50.1540	2.5143	2.4721
112	3.5695	6.2091	1.7395	0.4424
113	1.2885	30.6055	23.7536	0.1597
114	21.1923	87.9076	4.1481	2.6264
115	10.4601	96.5512	9.2305	1.2963
116	3.9167	1.0419	0.2660	0.4854
117	19.0157	3.5800	0.1883	2.3567
118	2.6745	2.1696	0.8112	0.3315
119	10.9444	14.5513	1.3296	1.3564
12	21.1619	15.1748	0.7171	2.6227
120	6.6063	77.7202	11.7646	0.8187
121	12.2106	32.8828	2.6930	1.5133
122	17.5009	15.9757	0.9128	2.1689
123	2.7219	8.5970	3.1585	0.3373
124	1.5120	7.5702	5.0067	0.1874
125	21.4827	19.4897	0.9072	2.6624
126	5.2251	1.9452	0.3723	0.6476
127	0.3587	2.5668	7.1564	0.0445
128	1.3363	2.1308	1.5946	0.1656
129	5.1780	4.0628	0.7846	0.6417
13	5.9181	0.9840	0.1663	0.7335
130	2.0315	1.1396	0.5610	0.2518
131	2.1043	10.1618	4.8290	0.2608
132	8.1608	88.7024	10.8694	1.0114
133	2.3256	1.4336	0.6164	0.2882
134	17.1338	34.0381	1.9866	2.1234
135	4.9362	10.7395	2.1757	0.6118
136	0.7600	1.8101	2.3818	0.0942
137	29.2532	40.5283	1.3854	3.6254
138	6.0516	17.5480	2.8997	0.7500
139	2.4951	3.6266	1.4535	0.3092
14	7.0272	7.6752	1.0922	0.8709
140	9.1420	8.9948	0.9839	1.1330
141	18.3012	23.8777	1.3047	2.2681
142	7.8823	42.1207	5.3437	0.9769
143	63.6855	9.0696	0.1424	7.8927
144	2.1832	1.0624	0.4866	0.2706
145	1.2741	4.9226	3.8636	0.1579
146	6.3213	1.1468	0.1814	0.7834
147	13.8790	7.3641	0.5306	1.7201
148	3.3190	34.1944	10.3027	0.4113
149	9.6279	7.2304	0.7510	1.1932
15	5.7200	2.4314	0.4251	0.7089
150	6.4974	2.3334	0.3591	0.8052
151	1.6668	8.2400	4.9436	0.2066
152	2.9328	0.8002	0.2729	0.3635
153	12.3356	45.8498	3.7169	1.5288
154	37.6264	97.2451	2.5845	4.6632
155	8.2537	17.5745	2.1293	1.0229
156	18.2266	0.9849	0.0540	2.2589
157	1.4481	1.2287	0.8485	0.1795
158	7.5837	0.4011	0.0529	0.9399

159	2.2432	1.5622	0.6964	0.2780
16	58.6390	67.8831	1.1576	7.2673
160	11.7274	7.0539	0.6015	1.4534
161	0.4811	0.1728	0.3592	0.0596
162	1.9985	1.8043	0.9028	0.2477
163	1.3582	0.8650	0.6369	0.1683
164	5.1756	2.3964	0.4630	0.6414
165	15.5606	63.3508	4.0712	1.9285
166	10.1571	5.6250	0.5538	1.2588
167	4.1329	4.2974	1.0398	0.5122
168	34.8212	3.8790	0.1114	4.3155
169	2.2255	1.3058	0.5868	0.2758
17	1.1899	0.6909	0.5806	0.1475
170	4.0118	9.4428	2.3537	0.4972
171	108.7316	43.1008	0.3964	13.4754
172	7.6363	63.8701	8.3640	0.9464
173	4.8455	0.3249	0.0670	0.6005
174	4.7596	1.8292	0.3843	0.5899
175	5.5461	190.6131	34.3687	0.6873
176	3.3215	0.4497	0.1354	0.4116
177	4.4250	3.4096	0.7705	0.5484
178	4.1011	10.3421	2.5218	0.5083
179	2.2294	5.3493	2.3994	0.2763
18	2.0372	32.6636	16.0339	0.2525
180	4.0968	7.8284	1.9109	0.5077
181	1.3028	1.3586	1.0428	0.1615
182	7.6443	1.5860	0.2075	0.9474
183	14.5732	8.3060	0.5699	1.8061
184	5.2568	0.5338	0.1015	0.6515
185	0.5900	1.4727	2.4963	0.0731
186	15.3304	22.2141	1.4490	1.8999
187	14.9063	1.6363	0.1098	1.8474
188	31.9310	13.2510	0.4150	3.9573
189	6.7716	3.9415	0.5821	0.8392
19	1.0816	1.3651	1.2622	0.1340
190	1.0504	16.7484	15.9444	0.1302
191	8.9492	1.2400	0.1386	1.1091
192	2.1432	3.7572	1.7531	0.2656
193	10.1792	24.3386	2.3910	1.2615
194	2.5733	5.3732	2.0880	0.3189
195	2.3844	3.8305	1.6065	0.2955
196	20.7657	7.2499	0.3491	2.5736
197	16.4572	7.8765	0.4786	2.0396
198	11.4713	4.2211	0.3680	1.4217
199	8.6194	3.5822	0.4156	1.0682
2	4.2414	22.8023	5.3761	0.5257
20	0.2754	0.3077	1.1171	0.0341
200	6.4160	4.1114	0.6408	0.7952
201	7.6217	5.8088	0.7621	0.9446
202	6.0879	39.6924	6.5199	0.7545
203	7.2356	20.1942	2.7909	0.8967
204	0.1652	2.0518	12.4171	0.0205
206	8.2351	9.9383	1.2068	1.0206
207	17.8965	9.1935	0.5137	2.2180
208	21.7785	33.1549	1.5224	2.6991
209	10.9774	22.8891	2.0851	1.3605
21	4.9410	0.8169	0.1653	0.6124
210	32.7164	6.9568	0.2126	4.0546
211	4.7763	1.4127	0.2958	0.5919
212	14.6432	9.6636	0.6599	1.8148
213	3.7609	7.2591	1.9301	0.4661
214	1.0226	3.4843	3.4071	0.1267
215	6.1259	6.6671	1.0883	0.7592
216	3.9226	23.3272	5.9469	0.4861
217	10.3624	7.3796	0.7122	1.2842
218	5.2993	1.4739	0.2781	0.6568
219	1.2692	7.8536	6.1876	0.1573
22	0.6067	1.1066	1.8240	0.0752
220	2.1586	0.7854	0.3638	0.2675
221	48.6364	106.9444	2.1989	6.0276
222	1.0364	2.5949	2.5037	0.1284
223	4.0659	0.4361	0.1072	0.5039

224	6.3619	1.8800	0.2955	0.7885
225	9.1036	8.9848	0.9869	1.1282
226	5.8341	5.4294	0.9306	0.7230
227	0.5044	3.6052	7.1476	0.0625
228	0.4490	2.4700	5.5012	0.0556
229	42.2603	41.8837	0.9911	5.2374
23	1.2636	17.8934	14.1602	0.1566
230	8.2882	4.0912	0.4936	1.0272
231	4.8999	2.2698	0.4632	0.6073
232	13.0884	16.4854	1.2595	1.6221
233	3.0383	11.4805	3.7785	0.3766
234	2.3238	4.1341	1.7790	0.2880
235	0.9703	8.8545	9.1250	0.1203
236	29.8214	57.5734	1.9306	3.6959
237	5.3921	62.0950	11.5158	0.6683
24	7.6573	12.9397	1.6899	0.9490
25	3.4499	2.0675	0.5993	0.4276
26	0.9406	4.8612	5.1683	0.1166
27	11.5992	5.0320	0.4338	1.4375
28	6.5287	29.5287	4.5229	0.8091
29	40.0871	5.5203	0.1377	4.9681
3	3.8434	6.2885	1.6362	0.4763
30	1.9120	1.2288	0.6427	0.2370
31	6.9948	14.9472	2.1369	0.8669
32	0.4784	16.7189	34.9442	0.0593
33	10.1916	52.6993	5.1709	1.2631
34	8.0334	9.1062	1.1335	0.9956
35	2.8446	9.5095	3.3431	0.3525
36	0.6369	2.2414	3.5194	0.0789
37	13.9058	17.2969	1.2439	1.7234
38	4.9733	5.4046	1.0867	0.6164
39	9.9270	86.4426	8.7078	1.2303
4	4.6493	20.0761	4.3181	0.5762
40	3.9322	0.8086	0.2056	0.4873
41	2.0100	12.1660	6.0527	0.2491
42	5.2237	8.7228	1.6699	0.6474
43	14.8057	19.3672	1.3081	1.8349
44	5.8237	2.8811	0.4947	0.7217
45	10.8429	4.7194	0.4352	1.3438
46	3.7942	43.5461	11.4769	0.4702
47	5.1594	41.5588	8.0550	0.6394
48	8.1331	0.1811	0.0223	1.0080
49	9.9257	26.6004	2.6799	1.2301
5	4.5481	16.9675	3.7307	0.5637
50	2.2137	1.9827	0.8956	0.2744
51	36.0793	34.5880	0.9587	4.4714
52	6.6571	7.4853	1.1244	0.8250
53	22.8158	8.6107	0.3774	2.8276
54	7.1731	9.8549	1.3739	0.8890
55	6.1110	23.6066	3.8630	0.7574
56	12.8807	0.6483	0.0503	1.5963
57	1.5975	5.5165	3.4532	0.1980
58	0.7925	6.0396	7.6210	0.0982
59	66.0437	5.2231	0.0791	8.1850
6	4.8065	3.2053	0.6669	0.5957
60	14.9085	50.7220	3.4022	1.8477
61	30.9180	15.0203	0.4858	3.8318
62	3.5985	2.6088	0.7250	0.4460
63	0.8071	5.4835	6.7944	0.1000
64	7.6861	2.7504	0.3578	0.9526
65	156.8682	85.7872	0.5469	19.4411
66	34.6683	52.2048	1.5058	4.2965
67	3.2135	2.4486	0.7620	0.3983
68	0.2314	0.2851	1.2318	0.0287
69	1.5766	14.6998	9.3236	0.1954
7	1.7535	4.8786	2.7822	0.2173
70	10.6213	20.4013	1.9208	1.3163
71	73.1136	46.5583	0.6368	9.0612
72	3.3856	6.6974	1.9782	0.4196
73	2.6953	0.5686	0.2110	0.3340
74	4.0552	3.6263	0.8942	0.5026
75	57.2156	37.0957	0.6483	7.0909

76	89.8029	16.9502	0.1887	11.1295
77	242.9787	629.4935	2.5907	30.1131
78	2.1776	0.2588	0.1188	0.2699
79	0.1249	3.8047	30.4599	0.0155
8	3.5175	4.3890	1.2478	0.4359
80	4.9067	19.3325	3.9400	0.6081
81	8.3463	30.7327	3.6822	1.0344
82	3.7777	18.9541	5.0174	0.4682
83	3.1101	13.6201	4.3793	0.3854
84	0.7991	25.2754	31.6296	0.0990
85	1.6205	3.5256	2.1756	0.2008
86	3.8552	21.9965	5.7056	0.4778
87	361.3500	925.2058	2.5604	44.7832
88	24.0684	217.3640	9.0311	2.9829
89	3.7630	1.7776	0.4724	0.4664
9	6.7023	2.8736	0.4288	0.8306
90	3.8017	2.5760	0.6776	0.4712
91	1.6452	5.7801	3.5134	0.2039
92	12.6483	10.6170	0.8394	1.5675
93	14.3280	12.2273	0.8534	1.7757
94	1.1826	0.8165	0.6904	0.1466
95	18.7863	35.2889	1.8784	2.3282
96	1.1669	6.5227	5.5899	0.1446
97	2.1255	49.1908	23.1426	0.2634
98	19.5923	6.4929	0.3314	2.4281
99	5.7615	8.1877	1.4211	0.7140

Note: (1) Using all control units, the probability of obtaining a post/pretreatment MSPE ratio as large as 205's is 0.0928.
(2) Excluding control units with pretreatment MSPE 5 times larger than the treated unit, the probability of obtaining a post/pretreatment MSPE ratio as large as 205's is 0.0978.
(3) The pointwise p-values below are computed by excluding control units with pretreatment MSPE 5 times larger than the treated unit.
(4) There are total 12 units with pretreatment MSPE 5 times larger than the treated unit, including 143 16 171 221 229 59 65 71 75 76 77 87.

In-space placebo test results using fake treatment units (continued, cutoff = 5):

Time	Treatment Effect	p-value of Treatment Effect		
		Two-sided	Right-sided	Left-sided
2008	-13.2737	0.0044	1.0000	0.0044
2009	-6.2859	0.0667	0.9689	0.0356
2010	0.3669	0.8844	0.5822	0.4222

Note: (1) The two-sided p-value of the treatment effect for a particular period is defined as the frequency that the absolute values of the placebo effects are greater than or equal to the absolute value of treatment effect.
(2) The right-sided (left-sided) p-value of the treatment effect for a particular period is defined as the frequency that the placebo effects are greater (smaller) than or equal to the treatment effect.
(3) If the estimated treatment effect is positive, then the right-sided p-value is recommended; whereas the left-sided p-value is recommended if the estimated treatment effect is negative.

Implementing leave-one-out robustness test that excludes one control unit with a nonz
> ero weight 24...171...143...77...

Leave-one-out robustness test results in the posttreatment period:

Time	Outcome		Synthetic Outcome (LOO)	
	Actual	Synthetic	Min	Max
2008	49.1492	62.4229	50.9983	61.2375
2009	50.6684	56.9542	54.2866	57.5187
2010	52.9588	52.5918	47.7861	53.9745

Note: The last two columns report the minimum and maximum synthetic outcomes when one control unit with a nonzero weight is excluded at a time.

```
-------------------------------------------------------
 Time |    Treatment Effect   Treatment Effect (LOO)
      |                              Min          Max
------+------------------------------------------------
 2008 |           -13.2737      -12.0882       -1.8491
 2009 |            -6.2859       -6.8503       -3.6183
 2010 |             0.3669       -1.0157        5.1727
-------------------------------------------------------
Note: The last two columns report the minimum and maximum treatment effects when
      one control unit with a nonzero weight is excluded at a time.

file gspec2_bias.gph saved
file gspec2_weight_vars.gph saved
file gspec2_weight_unit.gph saved
file gspec2_pred.gph saved
file gspec2_eff.gph saved
file gspec2_eff_pboUnit.gph saved
file gspec2_ratio_pboUnit.gph saved
file gspec2_pvalTwo_pboUnit.gph saved
file gspec2_pvalRight_pboUnit.gph saved
file gspec2_pvalLeft_pboUnit.gph saved
file gspec2_pred_loo.gph saved
file gspec2_eff_loo.gph saved

Finished.

.
.
. // ***********************************************************************
. // Specification 2 - restricted donor pool
. // ***********************************************************************
.
.         preserve

.         keep if target_donor==1
(2,140 observations deleted)

.
.         synth2 grad grad(2001) grad(2004) grad(2007) ///
>                 p_lunch p_black p_hispanic, ///
>                 trunit(205) trperiod(2008) mspeperiod(2001(1)2007) ///
>                 preperiod(2001(1)2007) postperiod(2008(1)2010) xperiod(2001(1)2007)
>  ///
>                 placebo(unit cutoff(5)) loo savegraph(gspec2r, replace) frame(gspec
> 2)
Fitting results in the pretreatment periods:
------------------------------------------------------------------------------
 Treated Unit             :        205     Treatment Time           :       2008
------------------------------------------------------------------------------
 Number of Control Units  =         22     Root Mean Squared Error  =    2.79198
 Number of Covariates     =          6     R-squared                =    0.77148
------------------------------------------------------------------------------

Covariate balance in the pretreatment periods:
------------------------------------------------------------------------------
  Covariate |  V.weight    Treated    Synthetic Control     Average Control
            |                          Value          Bias   Value        Bias
------------+-----------------------------------------------------------------
 grad(2001) |   0.3926     58.0000     60.3280     4.01%    68.0455    17.32%
 grad(2004) |   0.2755     65.0000     62.4640    -3.90%    65.0976     0.15%
 grad(2007) |   0.2301     52.1912     54.0214     3.51%    62.4187    19.60%
    p_lunch |   0.0206      0.6195      0.6335     2.25%     0.5325   -14.04%
    p_black |   0.0388      0.4892      0.5095     4.15%     0.4433    -9.39%
 p_hispanic |   0.0424      0.0867      0.1296    49.37%     0.2491   187.17%
------------------------------------------------------------------------------
Note: "V.weight" is the optimal covariate weight in the diagonal of V matrix.
      "Synthetic Control" is the weighted average of donor units with optimal
      weights.
      "Average Control" is the simple average of all control units with equal
      weights.
```

Optimal Unit Weights:

Unit	U.weight
24	0.7890
143	0.0900
186	0.0850
88	0.0360

Note: The unit 1 4 18 29 49 53 96 132 137 142 168 172 175 208 212 229 236 237 in the donor pool get a weight of 0.

Prediction results in the posttreatment periods:

Time	Actual Outcome	Synthetic Outcome	Treatment Effect
2008	49.1492	58.5313	-9.3821
2009	50.6684	52.2702	-1.6019
2010	52.9588	55.7528	-2.7940
Mean	50.9254	55.5181	-4.5927

Note: The average treatment effect over the posttreatment period is -4.5927.

Implementing placebo test using fake treatment unit 1...132...137...142...143...168..
> .172...175...18...186...208...212...229...236...237...24...29...4...49...53...88...
> 96...

In-space placebo test results using fake treatment units:

Unit	Pre MSPE	Post MSPE	Post/Pre MSPE	Pre MSPE of Fake Unit/ Pre MSPE of Treated Unit
205	7.7952	32.7990	4.2076	1.0000
1	12.4765	91.1745	7.3077	1.6005
132	11.4181	92.0430	8.0611	1.4648
137	18.4562	35.9332	1.9469	2.3676
142	3.8418	23.6301	6.1508	0.4928
143	85.8124	7.0922	0.0826	11.0084
168	22.9402	3.6142	0.1576	2.9429
172	16.6597	49.3690	2.9634	2.1372
175	7.4269	168.1188	22.6365	0.9528
18	6.3373	41.5463	6.5559	0.8130
186	9.2592	1.6855	0.1820	1.1878
208	14.0266	7.8685	0.5610	1.7994
212	3.8706	4.6361	1.1978	0.4965
229	60.1010	132.2106	2.1998	7.7100
236	48.7676	44.6184	0.9149	6.2561
237	1.4982	98.4435	65.7098	0.1922
24	7.6759	15.9684	2.0803	0.9847
29	25.4157	6.2014	0.2440	3.2604
4	15.8451	48.5448	3.0637	2.0327
49	38.9096	34.9508	0.8983	4.9915
53	14.8148	12.4224	0.8385	1.9005
88	25.2921	350.1243	13.8432	3.2446
96	10.4346	22.0084	2.1092	1.3386

Note: (1) Using all control units, the probability of obtaining a post/pretreatment MSPE ratio as large as 205's is 0.3478.
(2) Excluding control units with pretreatment MSPE 5 times larger than the treated unit, the probability of obtaining a post/pretreatment MSPE ratio as large as 205's is 0.4000.
(3) The pointwise p-values below are computed by excluding control units with pretreatment MSPE 5 times larger than the treated unit.
(4) There are total 3 units with pretreatment MSPE 5 times larger than the treated unit, including 143 229 236.

In-space placebo test results using fake treatment units (continued, cutoff = 5):

Time	Treatment Effect	p-value of Treatment Effect		
		Two-sided	Right-sided	Left-sided
2008	-9.3821	0.2000	0.9500	0.1000
2009	-1.6019	0.9500	0.3500	0.7000
2010	-2.7940	0.6500	0.7000	0.3500

Note: (1) The two-sided p-value of the treatment effect for a particular period is defined as the frequency that the absolute values of the placebo effects are greater than or equal to the absolute value of treatment effect.
(2) The right-sided (left-sided) p-value of the treatment effect for a particular period is defined as the frequency that the placebo effects are greater (smaller) than or equal to the treatment effect.
(3) If the estimated treatment effect is positive, then the right-sided p-value is recommended; whereas the left-sided p-value is recommended if the estimated treatment effect is negative.

Implementing leave-one-out robustness test that excludes one control unit with a nonz
> ero weight 24...143...186...88...

Leave-one-out robustness test results in the posttreatment period:

Time	Outcome		Synthetic Outcome (LOO)	
	Actual	Synthetic	Min	Max
2008	49.1492	58.5313	53.5667	58.8621
2009	50.6684	52.2702	50.7567	53.0035
2010	52.9588	55.7528	53.7653	56.6365

Note: The last two columns report the minimum and maximum synthetic outcomes when one control unit with a nonzero weight is excluded at a time.

Time	Treatment Effect	Treatment Effect (LOO)	
		Min	Max
2008	-9.3821	-9.7128	-4.4175
2009	-1.6019	-2.3352	-0.0884
2010	-2.7940	-3.6778	-0.8066

Note: The last two columns report the minimum and maximum treatment effects when one control unit with a nonzero weight is excluded at a time.

file gspec2r_bias.gph saved
file gspec2r_weight_vars.gph saved
file gspec2r_weight_unit.gph saved
file gspec2r_pred.gph saved
file gspec2r_eff.gph saved
file gspec2r_eff_pboUnit.gph saved
file gspec2r_ratio_pboUnit.gph saved
file gspec2r_pvalTwo_pboUnit.gph saved
file gspec2r_pvalRight_pboUnit.gph saved
file gspec2r_pvalLeft_pboUnit.gph saved
file gspec2r_pred_loo.gph saved
file gspec2r_eff_loo.gph saved

Finished.

```
.
.         restore

.
.
. // ***********************************************************************
. // Specification 2 - GRAPHS (graduation)
. // ***********************************************************************
.
.         // enrollment: main SCM and gaps graphs
.         graph combine gspec2_pred.gph gspec2_eff.gph gspec2r_pred.gph gspec2r_eff.g
> ph, ///
>                 cols(2) altshrink xsize(10) ysize(8) title("Graduation rate",size(s
> mall)) ///
>                 subtitle("Levels and Treatment Effects",size(vsmall))

.         graph export gcomb1.png, as(png) replace
file gcomb1.png saved as PNG format

.
.         // enrollment: SCM vs placebo graphs
.         graph combine gspec2_eff_pboUnit.gph gspec2r_eff_pboUnit.gph, ///
>                 rows(1) altshrink xsize(8) ysize(4) title("Graduation rate",size(sm
> all)) ///
>                 subtitle("Treatment Effects: Actual vs. Placebo",size(vsmall))

.         graph export gcomb2.png, as(png) replace
file gcomb2.png saved as PNG format

.
.         // enrollment: p-value graphs
.         graph combine gspec2_pvalRight_pboUnit.gph gspec2r_pvalRight_pboUnit.gph, /
> //
>                 rows(1) altshrink xsize(8) ysize(4) title("Graduation rate",size(sm
> all)) ///
>                 subtitle("p-values by year",size(vsmall))

.         graph export gcomb3.png, as(png) replace
file gcomb3.png saved as PNG format

.
.         // enrollment: LOO graphs
.         graph combine gspec2_pred_loo.gph gspec2r_pred_loo.gph, ///
>                 cols(1) altshrink xsize(8) ysize(6) title("Graduation rate",size(sm
> all))

.         graph export gcomb4.png, as(png) replace
file gcomb4.png saved as PNG format

.
.
.
. // Close log and convert to PDF
.         capture log close
```