lab_9

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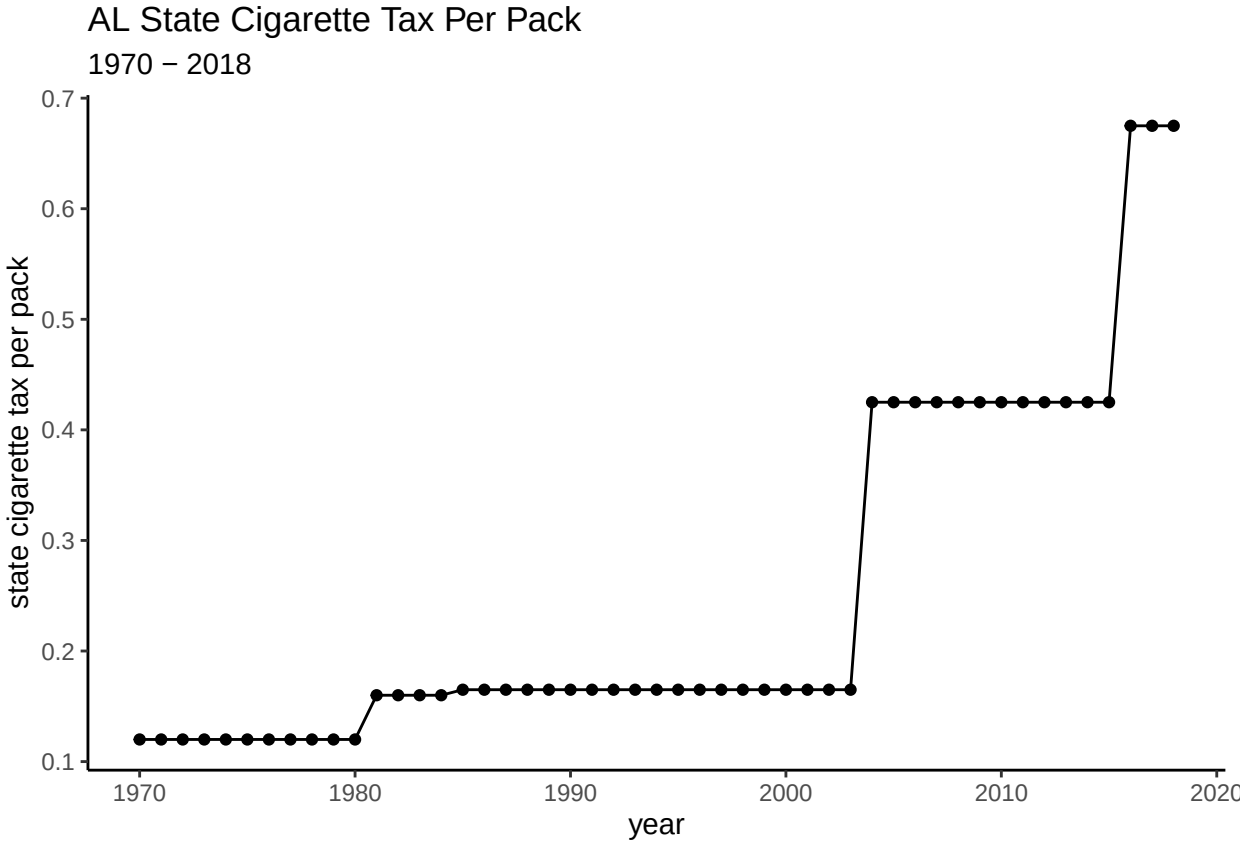
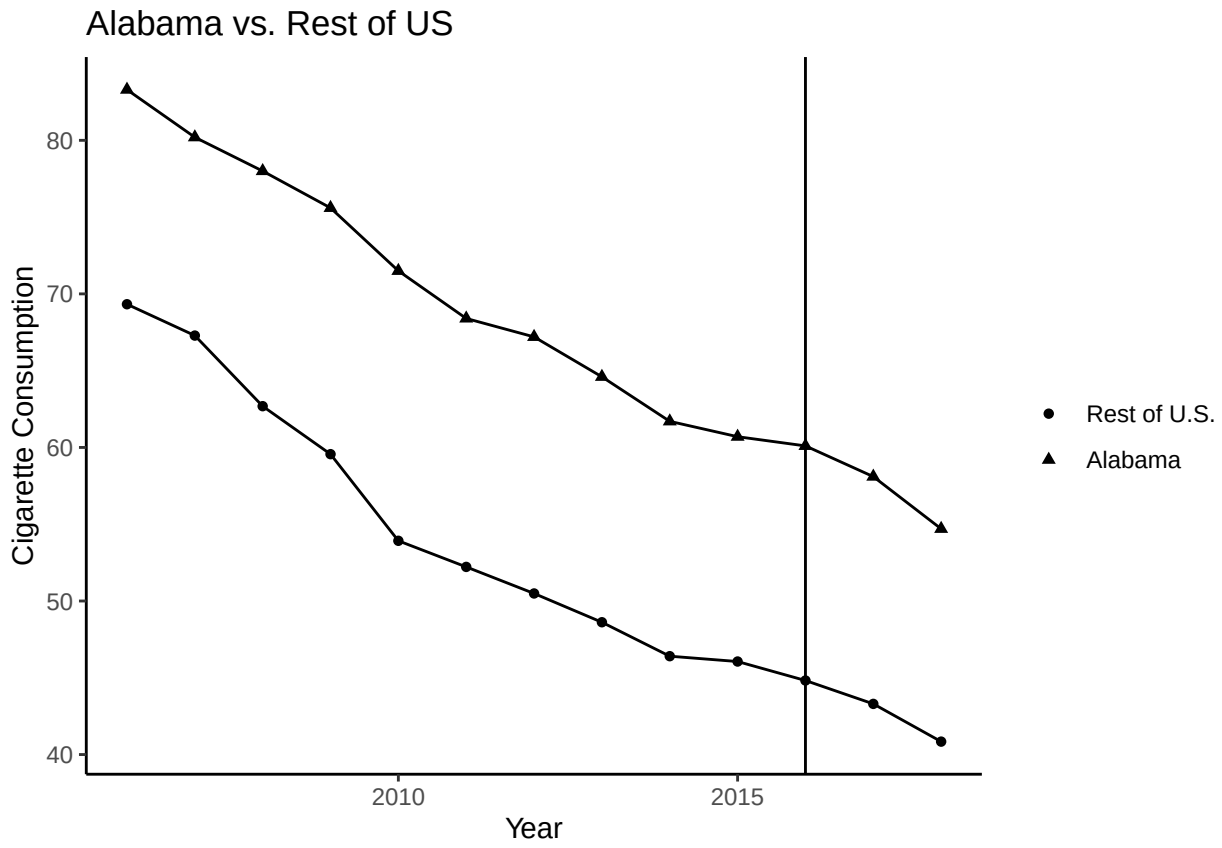
Question 1

I look at Alabama in this graph. There were tax hikes in 1981, 2004, and 2016. The largest of these hikes occured in 2004, when the tax rose from .165 in 2003 to .425 in 2004. The hike in 2015 was almost as large: the tax from from .425 in 2015 to .675 in 2016.

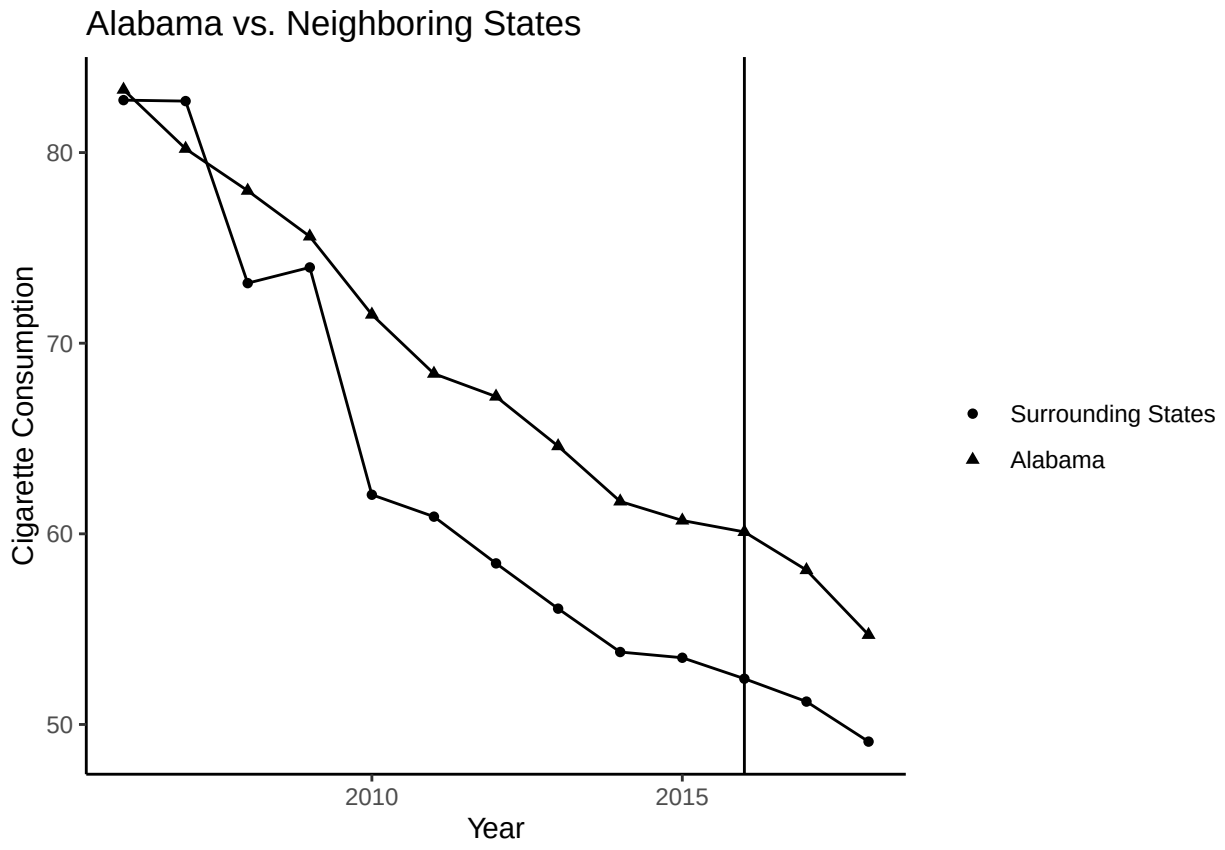


Question 2

Part a


Alabama vs. Rest of US
Cigarette Consumption
80
70
60
50
40
2010
2015
Year
Rest of U.S.
Alabama

Part b



Part c

The parallel trends assumption looks plausible for part a, but the the trends in the surrounding states look like they have some strange spikes that Alabama doesn't have.

Question 3

Based on the previous question, I am going to use the entirety of the US as my control group. See the table below for the statistics on the effect of the 2016 tax hike in Alabama vs. the Rest of the U.S.. Using the difference in differences calculation, I calculate that the impact of the ccigarette tax policy change = 6.88 - 5.77 = 1.11. In context, this implies that the 2016 policy results in a decrease of 1.11 in consumption in Alabama.

group	mean_consumption_before_2016	mean_consumption_after_2016	difference
Alabama	64.520	57.63333	6.886667
Rest of U.S.	48.758	42.98800	5.770000

Question 4

The coefficient for dd (11.11) is the same as what I calculated above.

% Table created by stargazer v.5.2.3 by Marek Hlavac, Social Policy Institute. E-mail: marek.hlavac at gmail.com % Date and time: Thu, Apr 21, 2022 - 13:55:15

	Dependent variable:
	pack_sales
post	-5.770^{***}
	(2.023)
al	15.762^{*}
	(8.846)
dd	-1.117
	(14.445)
Constant	48.758^{***}
	(1.239)
Observations	408
R^2	0.032
Adjusted R^2	0.024
Residual Std. Error	19.585 (df = 404)
F Statistic	4.394^{***} (df = 3; 404)
Note:	*p<0.1; **p<0.05; ***p<0.01

t test of coefficients:

```
        Estimate Std. Error t value  Pr(>|t|)
```

(Intercept) 48.7580 1.2938 37.6847 < 2.2e-16 ***post -5.7700 1.9941 -2.8936 0.004015*** *al 15.7620 1.8664 8.4453 5.516e-16* ** dd -1.1167 2.7310 -0.4089 0.682840
— Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Question 5

The difference in difference estimate is -1.11. This implies that Alabama's tax policy resulted on average in a 1.11 unit decrease in cigarette consumption, holding all else constant.

```
##
## t test of coefficients:
##
##                         Estimate Std. Error  t value  Pr(>|t|)
## (Intercept)             67.99020    0.57174 118.9177 < 2.2e-16 ***
## dd                      -1.11667    0.57285  -1.9493 0.0520581 .
## factor(year)2012        -1.71961    0.66412  -2.5893 0.0100194 *
## factor(year)2013        -3.60784    0.62701  -5.7540 1.908e-08 ***
## factor(year)2014        -5.83137    0.59125  -9.8627 < 2.2e-16 ***
## factor(year)2015        -6.19216    0.65224  -9.4936 < 2.2e-16 ***
## factor(year)2016        -7.39379    0.65010 -11.3733 < 2.2e-16 ***
## factor(year)2017        -8.92516    0.66002 -13.5225 < 2.2e-16 ***
## factor(year)2018       -11.40163    0.73750 -15.4599 < 2.2e-16 ***
## factor(state_fips)2    -25.34375    0.40323 -62.8514 < 2.2e-16 ***
## factor(state_fips)4    -38.61875    0.86619 -44.5847 < 2.2e-16 ***
## factor(state_fips)5     -6.81875    0.43597 -15.6404 < 2.2e-16 ***
## factor(state_fips)6    -39.95625    0.55572 -71.9006 < 2.2e-16 ***
## factor(state_fips)8    -25.49375    0.49379 -51.6291 < 2.2e-16 ***
## factor(state_fips)9    -32.54375    0.40102 -81.1518 < 2.2e-16 ***
## factor(state_fips)10    12.11875    1.78659   6.7832 5.044e-11 ***
## factor(state_fips)11   -45.39375    0.51374 -88.3599 < 2.2e-16 ***
## factor(state_fips)12   -19.26875    0.47466 -40.5947 < 2.2e-16 ***
## factor(state_fips)13   -13.33125    0.53550 -24.8950 < 2.2e-16 ***
## factor(state_fips)15   -35.28125    0.67630 -52.1678 < 2.2e-16 ***
## factor(state_fips)16   -20.96875    0.58923 -35.5869 < 2.2e-16 ***
## factor(state_fips)17   -27.23125    1.50743 -18.0647 < 2.2e-16 ***
## factor(state_fips)18     1.48125    0.47165   3.1406 0.0018300 **
## factor(state_fips)19   -15.41875    0.81087 -19.0151 < 2.2e-16 ***
## factor(state_fips)20   -23.83125    0.61434 -38.7917 < 2.2e-16 ***
## factor(state_fips)21    28.26875    1.63498  17.2900 < 2.2e-16 ***
## factor(state_fips)22     3.90625    2.33069   1.6760 0.0946328 .
## factor(state_fips)23   -14.01875    1.08665 -12.9009 < 2.2e-16 ***
## factor(state_fips)24   -31.00625    0.60990 -50.8380 < 2.2e-16 ***
## factor(state_fips)25   -34.13125    0.57945 -58.9031 < 2.2e-16 ***
## factor(state_fips)26   -17.44375    0.98295 -17.7464 < 2.2e-16 ***
## factor(state_fips)27   -27.55625    2.04207 -13.4943 < 2.2e-16 ***
## factor(state_fips)28    -0.23125    0.43928  -0.5264 0.5989282
## factor(state_fips)29    21.45625    0.71991  29.8040 < 2.2e-16 ***
## factor(state_fips)30   -19.73125    0.62246 -31.6990 < 2.2e-16 ***
## factor(state_fips)31   -14.33125    0.48219 -29.7210 < 2.2e-16 ***
## factor(state_fips)32   -22.50625    1.48386 -15.1674 < 2.2e-16 ***
## factor(state_fips)33    27.49375    0.76843  35.7792 < 2.2e-16 ***
## factor(state_fips)34   -33.16875    0.65098 -50.9518 < 2.2e-16 ***
## factor(state_fips)35   -36.98125    0.95647 -38.6645 < 2.2e-16 ***
## factor(state_fips)36   -47.01875    0.69636 -67.5205 < 2.2e-16 ***
## factor(state_fips)37    -5.85625    0.61826  -9.4721 < 2.2e-16 ***
## factor(state_fips)38     8.36875    1.56587   5.3445 1.641e-07 ***
## factor(state_fips)39    -9.69375    0.46626 -20.7904 < 2.2e-16 ***
## factor(state_fips)40     2.16875    0.63024   3.4411 0.0006495 ***
```

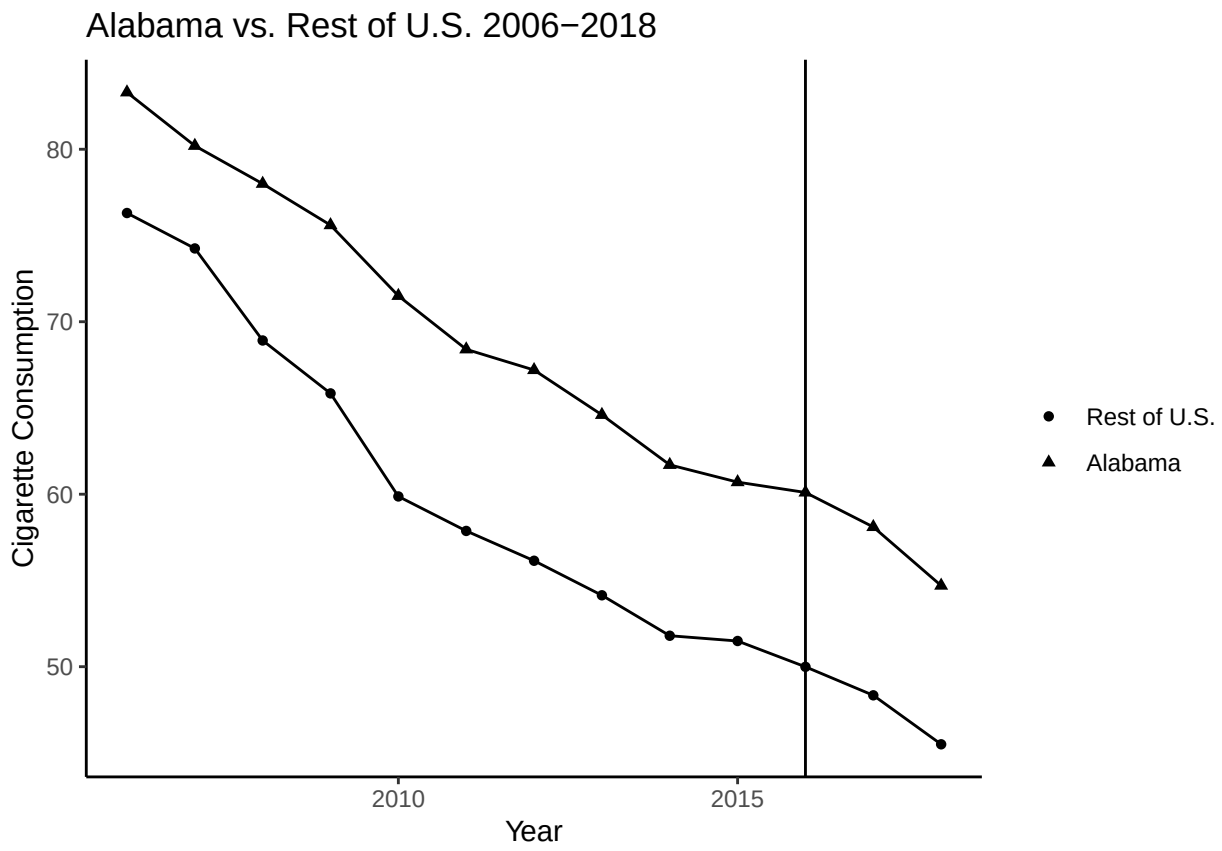
```
## factor(state_fips)41 -20.80625    0.42625 -48.8119 < 2.2e-16 ***
## factor(state_fips)42 -13.60625    1.18610 -11.4714 < 2.2e-16 ***
## factor(state_fips)44 -27.14375    1.06906 -25.3902 < 2.2e-16 ***
## factor(state_fips)45  -3.01875    0.87750  -3.4402 0.0006518 ***
## factor(state_fips)46 -20.01875    1.17458 -17.0433 < 2.2e-16 ***
## factor(state_fips)47   1.11875    0.60402   1.8522 0.0648435 .
## factor(state_fips)48 -28.24375    0.46635 -60.5629 < 2.2e-16 ***
## factor(state_fips)49 -42.33125    0.74983 -56.4544 < 2.2e-16 ***
## factor(state_fips)50 -21.88125    0.63347 -34.5421 < 2.2e-16 ***
## factor(state_fips)51   2.90625    1.02889   2.8247 0.0050052 **
## factor(state_fips)53 -43.60625    0.79675 -54.7305 < 2.2e-16 ***
## factor(state_fips)54  33.15625    2.75656  12.0281 < 2.2e-16 ***
## factor(state_fips)55 -22.50625    0.90588 -24.8446 < 2.2e-16 ***
## factor(state_fips)56  -4.20625    1.13148  -3.7175 0.0002343 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Question 6

Part a

GA, MO, and WV receive the most weight.

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
## `fun.y` is deprecated. Use `fun` instead.
```



```
##
## X1, X0, Z1, Z0 all come directly from dataprep object.
##
##
## ****************
##  searching for synthetic control unit
##
##
## ****************
## ****************
## ****************
##
## MSPE (LOSS V): 0.08925307
##
## solution.v:
##  0.0003520792 0.01976823 0.04610464 0.4863135 0.3487704 0.09869114
##
## solution.w:
##  0.01247814 0.01011409 0.01143573 0.005715295 0.006865332 0.2756672 0.005863837 0.007718212 0.013115
```

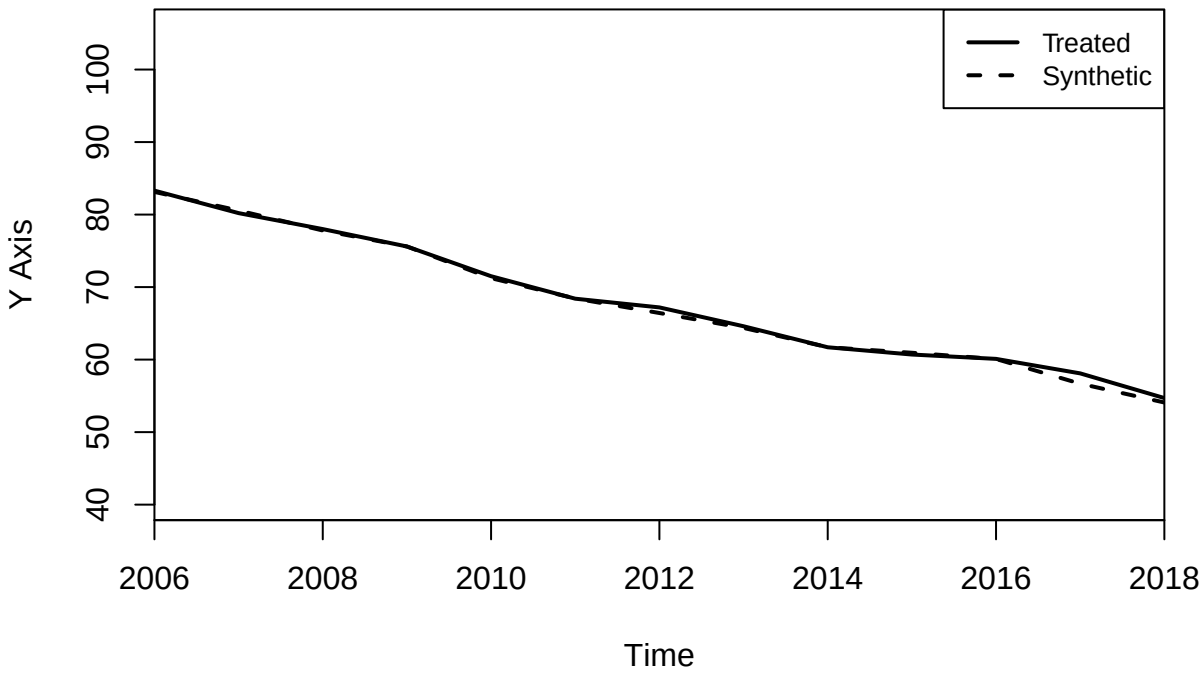
```
##    w.weight
## 5      0.01
## 6      0.01
## 8      0.01
## 9      0.01
## 10     0.01
## 13     0.28
## 16     0.01
## 17     0.01
## 18     0.01
## 19     0.01
## 20     0.01
## 21     0.01
## 22     0.02
## 23     0.01
## 27     0.01
## 28     0.03
## 29     0.14
## 30     0.01
## 31     0.01
## 32     0.01
## 33     0.00
## 35     0.01
## 37     0.00
## 38     0.04
## 39     0.01
## 40     0.01
## 42     0.01
## 44     0.00
## 45     0.09
## 46     0.01
## 47     0.02
## 48     0.01
## 49     0.01
```

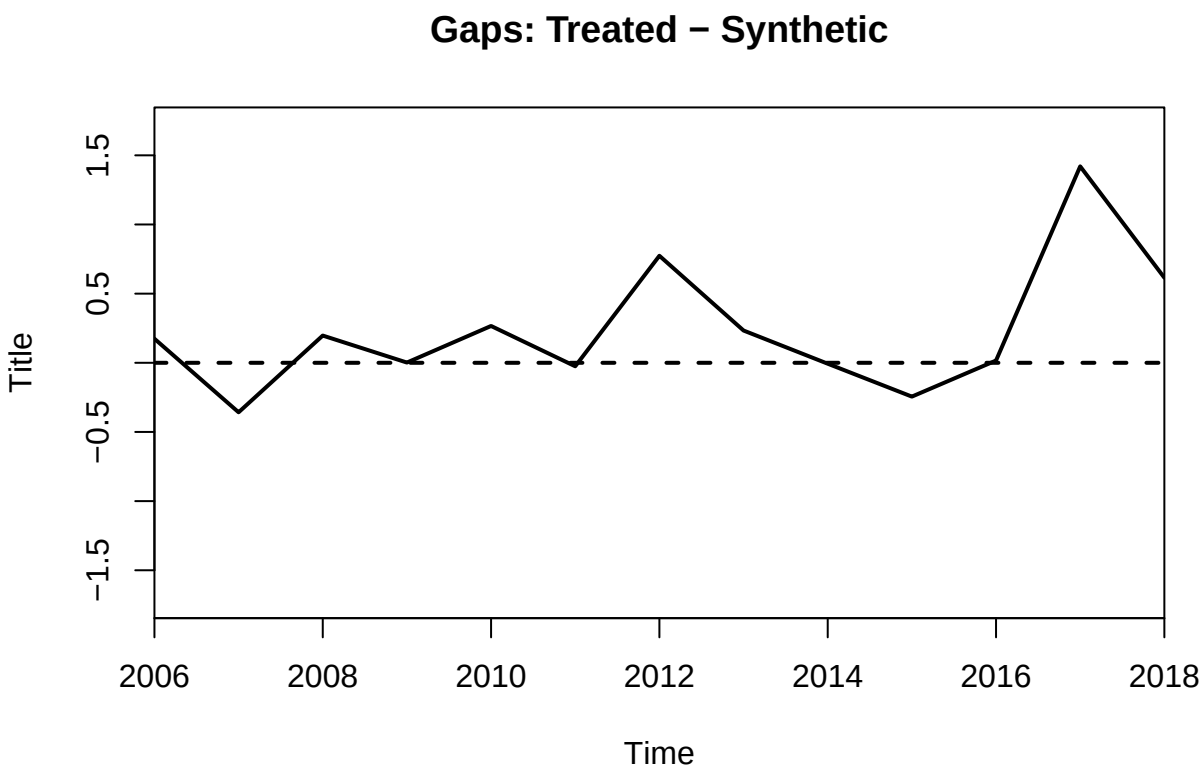
```
## 50     0.01
## 51     0.02
## 54     0.13
## 55     0.01
## 56     0.02
```

```
##                 1
## 2006  0.173922628
## 2007 -0.357885425
## 2008  0.196865123
## 2009  0.001691565
## 2010  0.266226727
## 2011 -0.025315749
## 2012  0.773742298
## 2013  0.233278552
## 2014 -0.006634100
## 2015 -0.244478848
## 2016  0.016323301
## 2017  1.420127516
## 2018  0.614968469
```

```
## $tab.pred
##                          Treated Synthetic Sample Mean
## wine                       1.499     1.728       2.347
## age15to24                  0.141     0.141       0.141
## cost_per_pack              4.615     4.618       5.238
## special.pack_sales.2009   75.600    75.598      65.845
## special.pack_sales.2014   61.700    61.707      51.795
## special.pack_sales.2016   60.100    60.084      49.992
##
## $tab.v
##                          v.weights
## wine                     0
## age15to24                0.02
## cost_per_pack            0.046
## special.pack_sales.2009 0.486
## special.pack_sales.2014 0.349
## special.pack_sales.2016 0.099
##
## $tab.w
##    w.weights unit.names unit.numbers
## 5      0.012         AR            5
## 6      0.010         CA            6
## 8      0.011         CO            8
## 9      0.006         CT            9
## 10     0.007         DE           10
## 13     0.276         GA           13
## 16     0.006         ID           16
## 17     0.008         IL           17
## 18     0.013         IN           18
## 19     0.011         IA           19
## 20     0.013         KS           20
## 21     0.005         KY           21
## 22     0.016         LA           22
```

```
## 23     0.008         ME           23
## 27     0.008         MN           27
## 28     0.026         MS           28
## 29     0.137         MO           29
## 30     0.008         MT           30
## 31     0.015         NE           31
## 32     0.011         NV           32
## 33     0.003         NH           33
## 35     0.010         NM           35
## 37     0.003         NC           37
## 38     0.040         ND           38
## 39     0.010         OH           39
## 40     0.011         OK           40
## 42     0.009         PA           42
## 44     0.005         RI           44
## 45     0.086         SC           45
## 46     0.010         SD           46
## 47     0.016         TN           47
## 48     0.011         TX           48
## 49     0.010         UT           49
## 50     0.006         VT           50
## 51     0.015         VA           51
## 54     0.126         WV           54
## 55     0.007         WI           55
## 56     0.015         WY           56
##
## $tab.loss
##            Loss W     Loss V
## [1,] 1.220398e-05 0.08925307
```


Treated
Synthetic
Y Axis
40
50
60
70
80
90
100
2006
2008
2010
2012
2014
2016
2018
Time


Gaps: Treated − Synthetic
Title
1.5
0.5
−0.5
−1.5
2006
2008
2010
2012
2014
2016
2018
Time