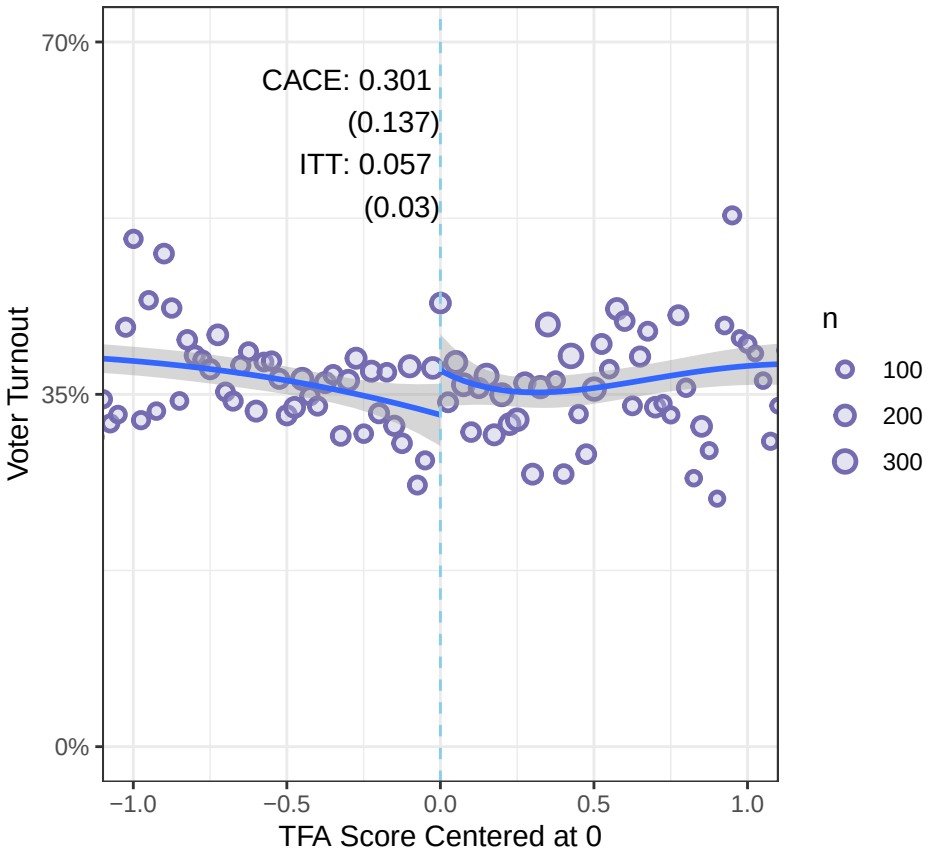
Analysis and Results: TFA and Voter Participation

This document produces the results and figures reported in the main text and appendix of "Civilian National Service Programs Can Powerfully Increase Youth Voter Turnout." Compile the file to produce figures in the /116_analysis-files folder.

Match Strategy 1: Survey Variables

1) Use survey-based (not application) birth year to find matches within states; use only matches from survey-based states for the post-treatment results; use application-based state for pre-treatment results, but always restrict to the sample of survey respondents to ensure results are comparable across models. This is Match Strategy 1 in the paper, reported in figure 2 (though see below for the code to generate the coefficient plot in figure 1) and Section A7 of the appendix..

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.252 (0.125) \nConventional ITT: 0.047 (0.026)"
```

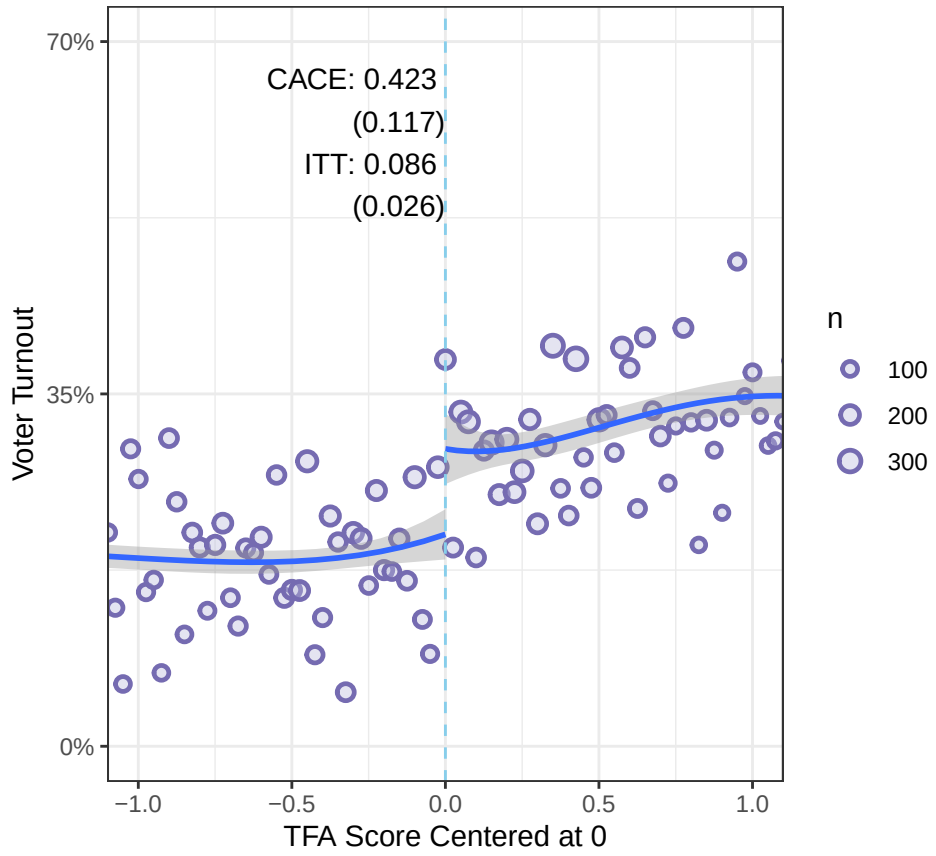


```
## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                17668
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 9321         8347
## Eff. Number of Obs.            2116         2679
## Order est. (p)                    1            1
## Order bias  (q)                   2            2
## BW est. (h)                   0.332        0.332
## BW bias (b)                   0.718        0.718
## rho (h/b)                     0.462        0.462
## Unique Obs.                    7126         5650
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional     0.252     0.125     2.012     0.044     [0.007 , 0.498]
## Bias-Corrected     0.301     0.125     2.402     0.016     [0.055 , 0.547]
##         Robust     0.301     0.137     2.197     0.028     [0.033 , 0.570]
## ===============================================================================

## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                17668
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 9321         8347
## Eff. Number of Obs.            3080         3842
## Order est. (p)                    1            1
## Order bias  (q)                   2            2
## BW est. (h)                   0.476        0.476
## BW bias (b)                   0.846        0.846
## rho (h/b)                     0.563        0.563
## Unique Obs.                    7126         5650
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional     0.047     0.026     1.851     0.064    [-0.003 , 0.098]
## Bias-Corrected     0.057     0.026     2.216     0.027     [0.007 , 0.107]
##         Robust     0.057     0.030     1.923     0.055    [-0.001 , 0.115]
## ===============================================================================
```

Match Strategy 2: Survey and Application Variables

2) Use application-based birth year (including graduation year proxies for 2010-2013 cohorts) to find matches within states. Use only survey-based state for the treatment results, but state and application-based survey for pretreatment results, and restrict to sample of survey respondents for comparability with match 1. This is Match 2 reported in Figure 2 in the paper (but see below for code to generate coefficient plots) and the figure reported in section A7 of the appendix.

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.375 (0.104) \nConventional ITT: 0.083 (0.021)"
```



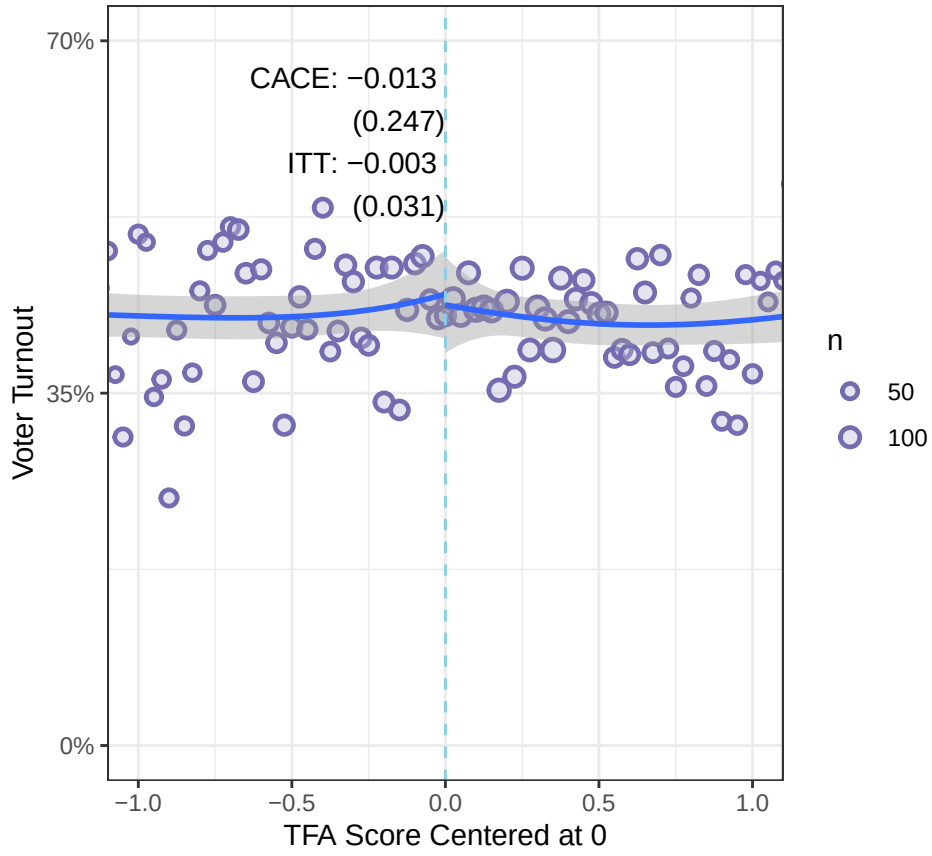

```
## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                17668
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 9321         8347
## Eff. Number of Obs.            2281         2926
```

```
## Order est. (p)                   1           1
## Order bias  (q)                  2           2
## BW est. (h)                  0.358       0.358
## BW bias (b)                  0.687       0.687
## rho (h/b)                    0.521       0.521
## Unique Obs.                   7126        5650
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional     0.375     0.104     3.616     0.000     [0.172 , 0.579]
## Bias-Corrected     0.423     0.104     4.074     0.000     [0.219 , 0.626]
##         Robust     0.423     0.117     3.627     0.000     [0.194 , 0.651]
## ===============================================================================

## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                17668
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 9321        8347
## Eff. Number of Obs.            3373        4207
## Order est. (p)                    1           1
## Order bias  (q)                   2           2
## BW est. (h)                   0.522       0.522
## BW bias (b)                   0.819       0.819
## rho (h/b)                     0.638       0.638
## Unique Obs.                    7126        5650
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional     0.083     0.021     3.866     0.000     [0.041 , 0.125]
## Bias-Corrected     0.086     0.021     4.027     0.000     [0.044 , 0.128]
##         Robust     0.086     0.026     3.367     0.001     [0.036 , 0.136]
## ===============================================================================
```

Strategies 1 and 2: Pre-Treatment Results

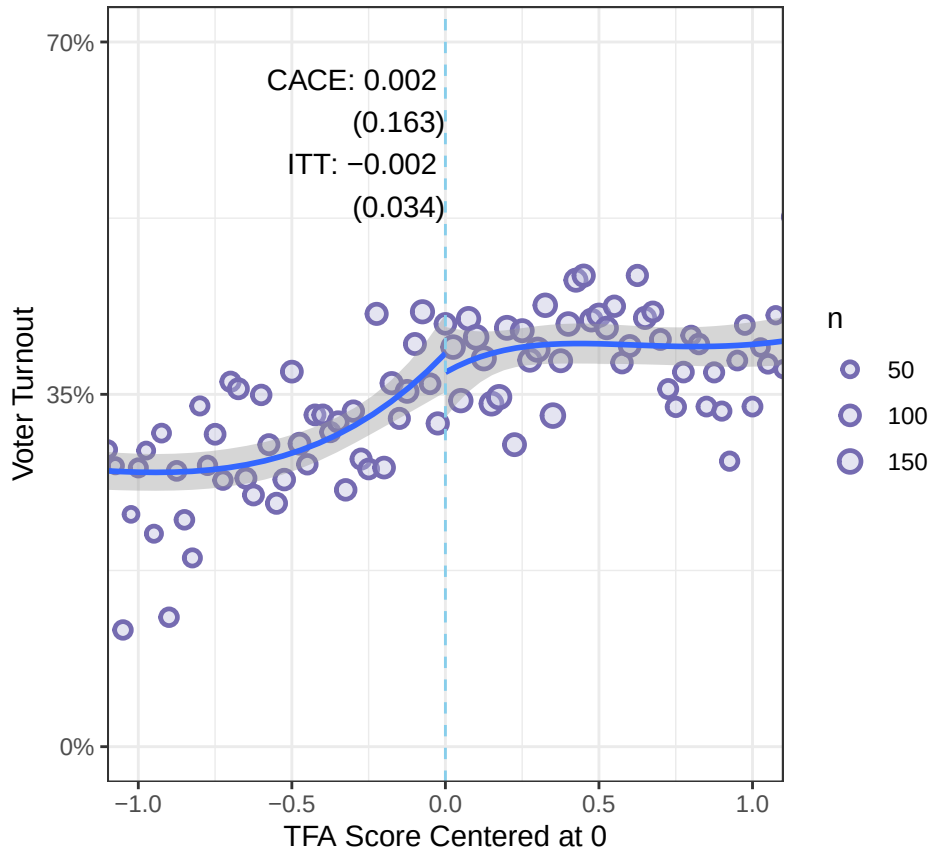
Strategy 1 and 2 matches for birth year, but focus now on analyzing pre-application turnout with hybrid application-based state matches. These results are reported in Figure 2 in the main text and in Section A7 of the Appendix.

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: -0.01 (0.222) \nConventional ITT: -0.005 (0.026)"
```




```
## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                 9825
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 4636         5189
## Eff. Number of Obs.            1597         2168
## Order est. (p)                    1            1
## Order bias  (q)                   2            2
```

```
## BW est. (h)                   0.459        0.459
## BW bias (b)                   0.935        0.935
## rho (h/b)                     0.491        0.491
## Unique Obs.                    4187         4447
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional    -0.010     0.222    -0.047     0.963    [-0.445 , 0.424]
## Bias-Corrected    -0.013     0.222    -0.057     0.954    [-0.447 , 0.422]
##         Robust    -0.013     0.247    -0.051     0.959    [-0.497 , 0.472]
## ===============================================================================

## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                 9825
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 4636         5189
## Eff. Number of Obs.            2796         3529
## Order est. (p)                    1            1
## Order bias  (q)                   2            2
## BW est. (h)                   0.861        0.861
## BW bias (b)                   1.449        1.449
## rho (h/b)                     0.595        0.595
## Unique Obs.                    4187         4447
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional    -0.005     0.026    -0.205     0.838    [-0.057 , 0.046]
## Bias-Corrected    -0.003     0.026    -0.097     0.923    [-0.054 , 0.049]
##         Robust    -0.003     0.031    -0.082     0.934    [-0.063 , 0.058]
## ===============================================================================

## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.023 (0.151) \nConventional ITT: 0.004 (0.029)"
```



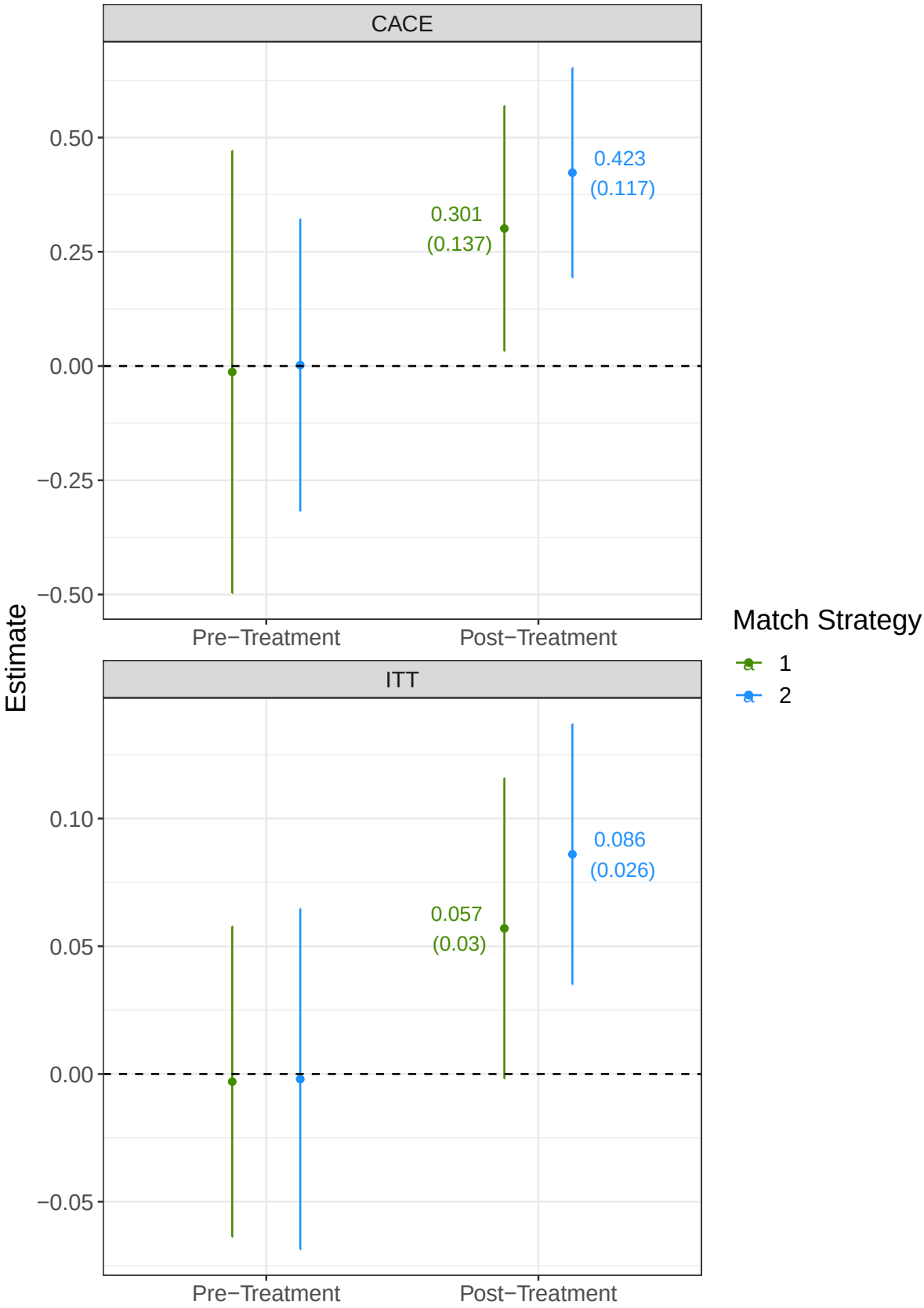

```
## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                10963
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 5195         5768
## Eff. Number of Obs.            2339         3024
## Order est. (p)                    1            1
## Order bias  (q)                   2            2
## BW est. (h)                   0.604        0.604
## BW bias (b)                   1.480        1.480
## rho (h/b)                     0.408        0.408
## Unique Obs.                    4640         4866
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional     0.023     0.151     0.152     0.879     [-0.273 , 0.319]
## Bias-Corrected     0.002     0.151     0.013     0.989     [-0.294 , 0.298]
##         Robust     0.002     0.163     0.012     0.990     [-0.318 , 0.322]
```

```
## ===============================================================================

## [1] "Mass points detected in the running variable."
## Call: rdrobust
##
## Number of Obs.                10963
## BW type                       mserd
## Kernel                   Triangular
## VCE method                       NN
##
## Number of Obs.                 5195         5768
## Eff. Number of Obs.            2348         3037
## Order est. (p)                    1            1
## Order bias  (q)                   2            2
## BW est. (h)                   0.606        0.606
## BW bias (b)                   0.999        0.999
## rho (h/b)                     0.607        0.607
## Unique Obs.                    4640         4866
##
## ===============================================================================
##         Method     Coef. Std. Err.         z     P>|z|      [ 95% C.I. ]
## ===============================================================================
##   Conventional     0.004     0.029     0.153     0.879    [-0.052 , 0.061]
## Bias-Corrected    -0.002     0.029    -0.065     0.948    [-0.059 , 0.055]
##         Robust    -0.002     0.034    -0.055     0.956    [-0.069 , 0.065]
## ===============================================================================
```

Coefficient Plot

This code generates Figure 2 in the main text, the key results plot. It calculates the effect estimate and standard error for Match 1 and Match 2 posttreatment results, then the Match 1 and Match 2 pretreatment results. It then reshapes the results and presents them in a coefficient plot.

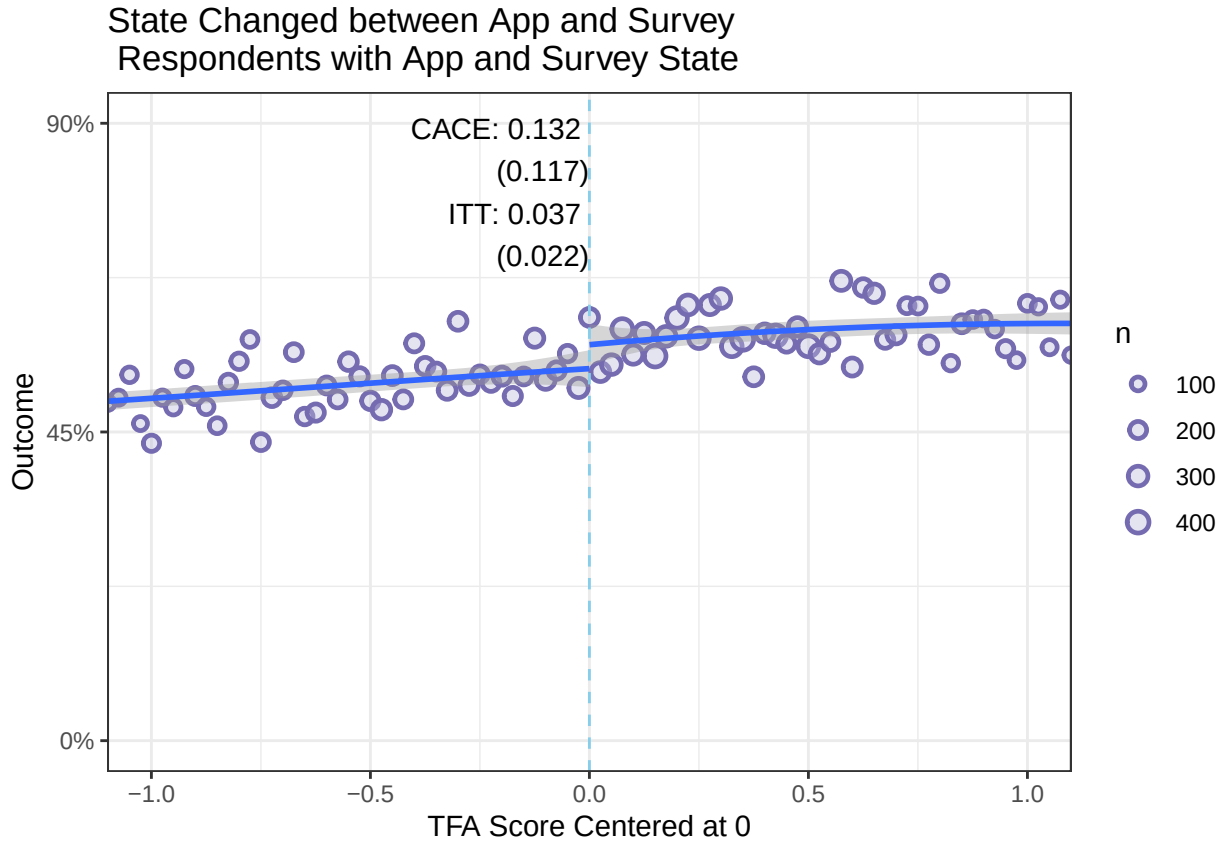
```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
```


CACE
ITT
Estimate
0.50
0.25
0.00
−0.25
−0.50
0.10
0.05
0.00
−0.05
0.301
(0.137)
0.423
(0.117)
0.057
(0.03)
0.086
(0.026)
Pre−Treatment
Post−Treatment
Match Strategy
1
2

Alternative Outcome: Changed Address

This section tests whether applicants admitted to TFA moved states at a higher rate than applicants who were not admitted. This analysis is referenced in the fourth paragraph of the Materials and Methods section of the main text.

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.123 (0.107) \nConventional ITT: 0.037 (0.019)"
```



Heterogeneity

This section tests whether the estimates reported in the text are heterogeneous across demographic groups. These analyses are presented in section A8 of the appendix.

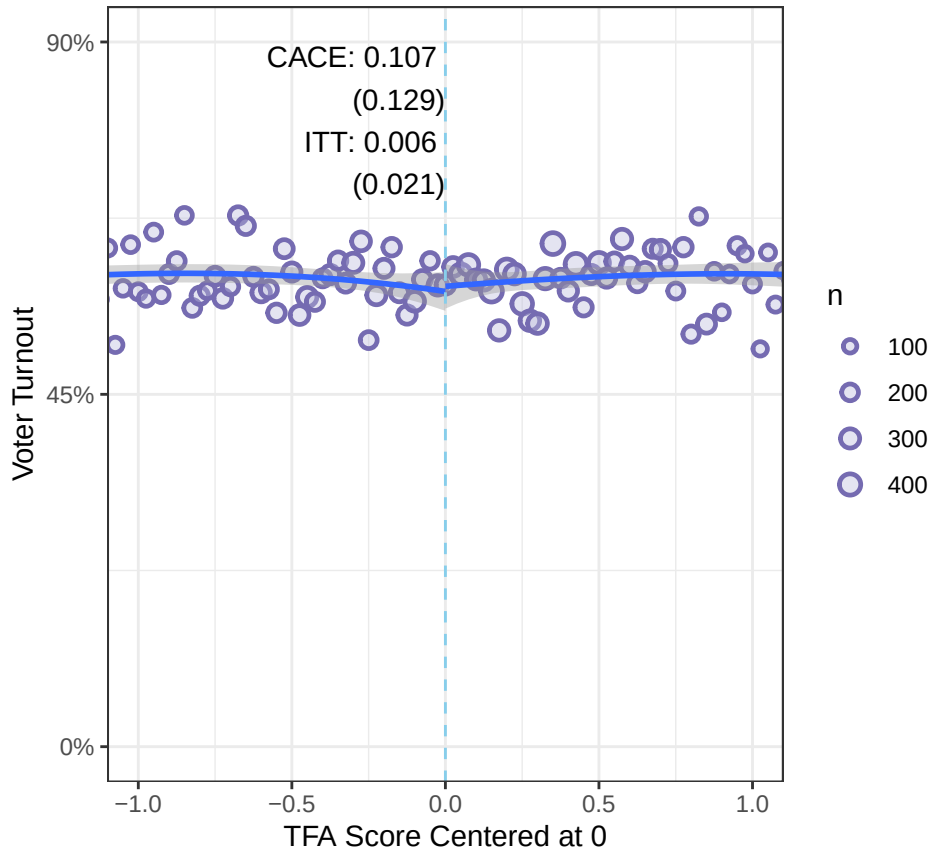
```
## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."
```

```
## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."

## pdf
##   2
```

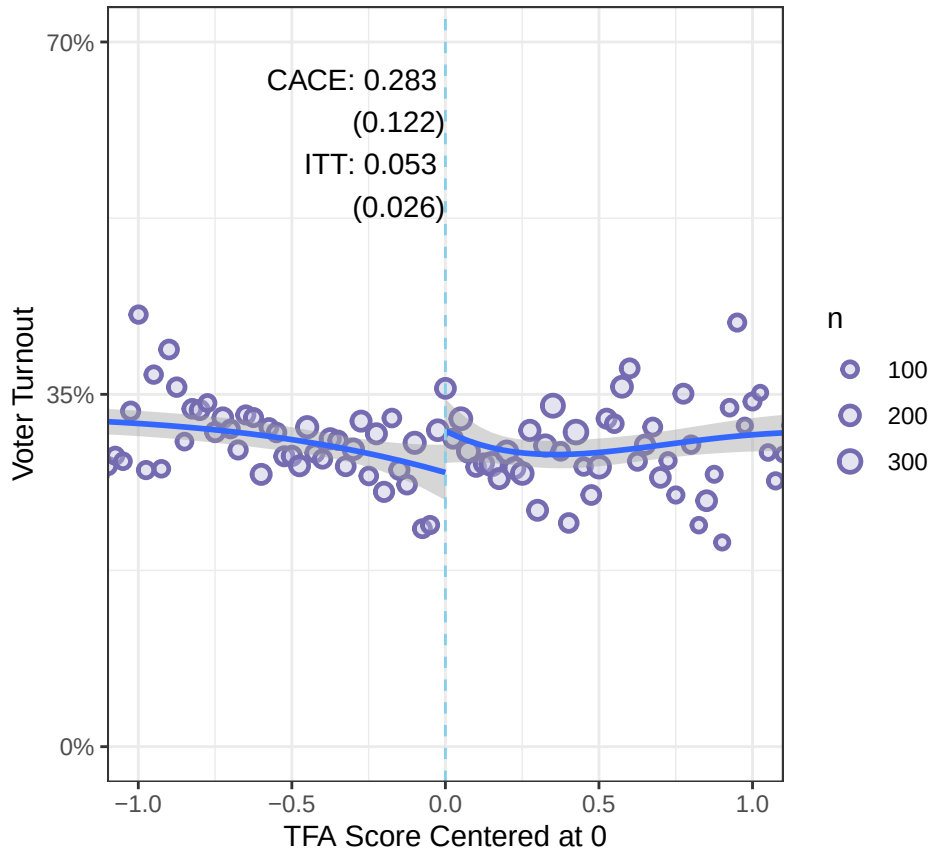
Alternate outcome: registration and prop. voted

This section calculates the effect of the treatment on two alternative outcomes: whether an applicant was registered to vote, and the proportion of elections in which the applicant voted after TFA participation (or the equivalent 2-year window for non-matriculants). These results are reported in section A9 of the appendix.

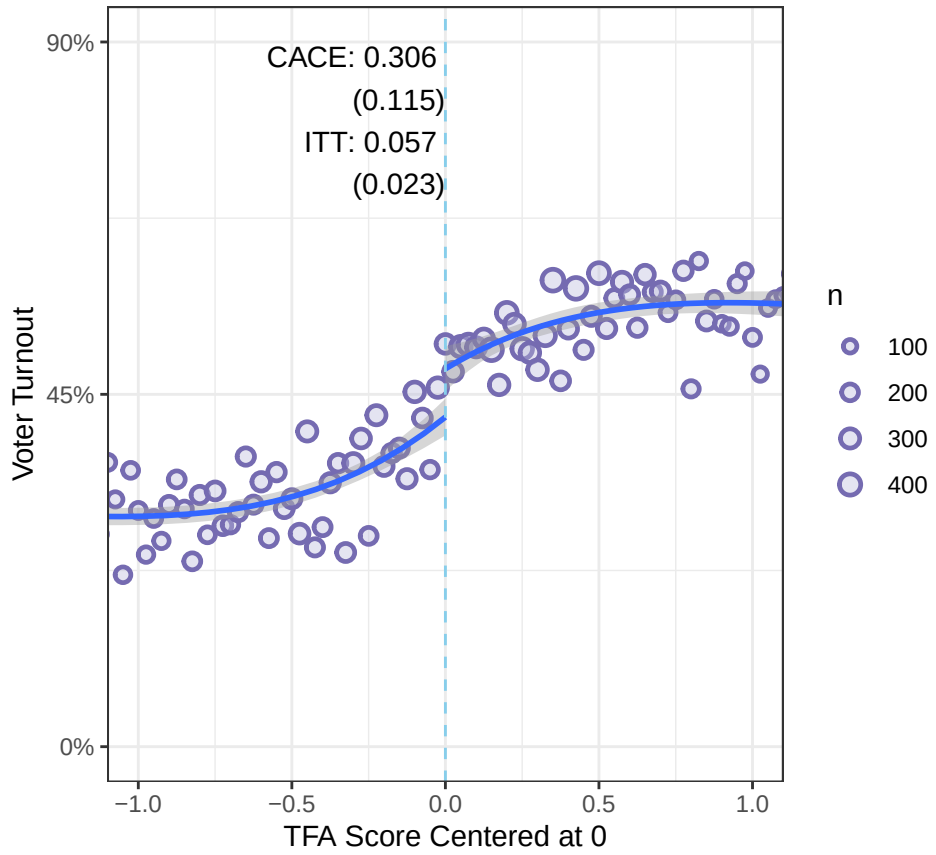
```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.085 (0.12) \nConventional ITT: 0.004 (0.018)"
```



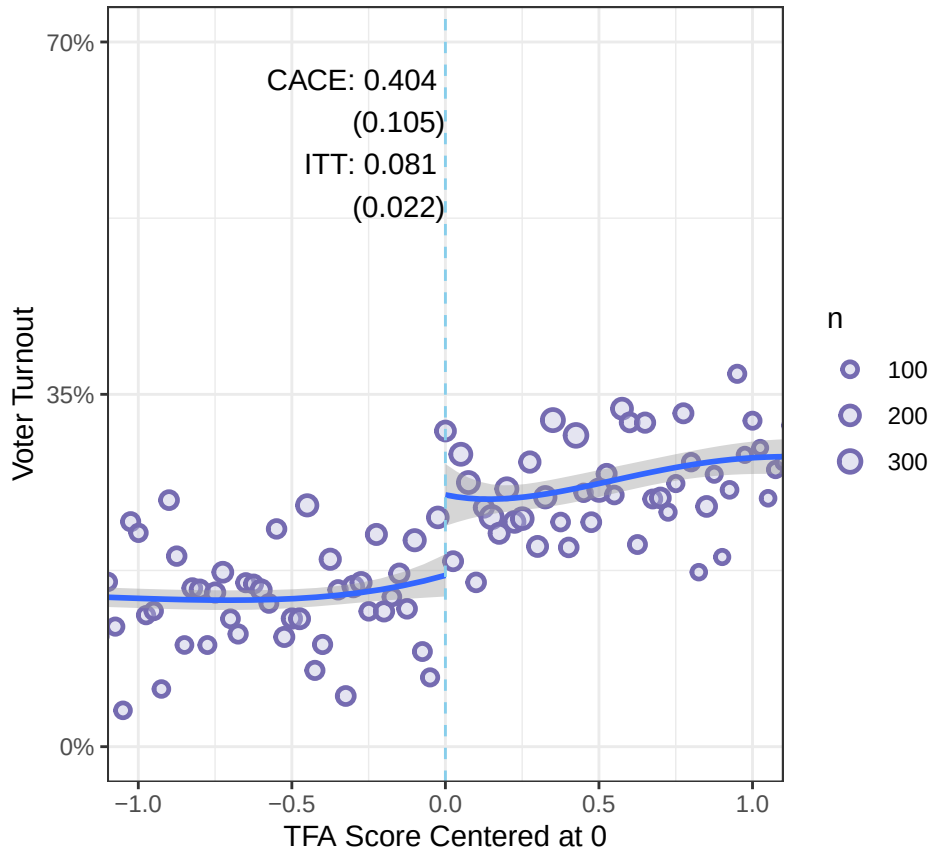

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.237 (0.111) \nConventional ITT: 0.045 (0.022)"
```




```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.296 (0.105) \nConventional ITT: 0.065 (0.02)"
```



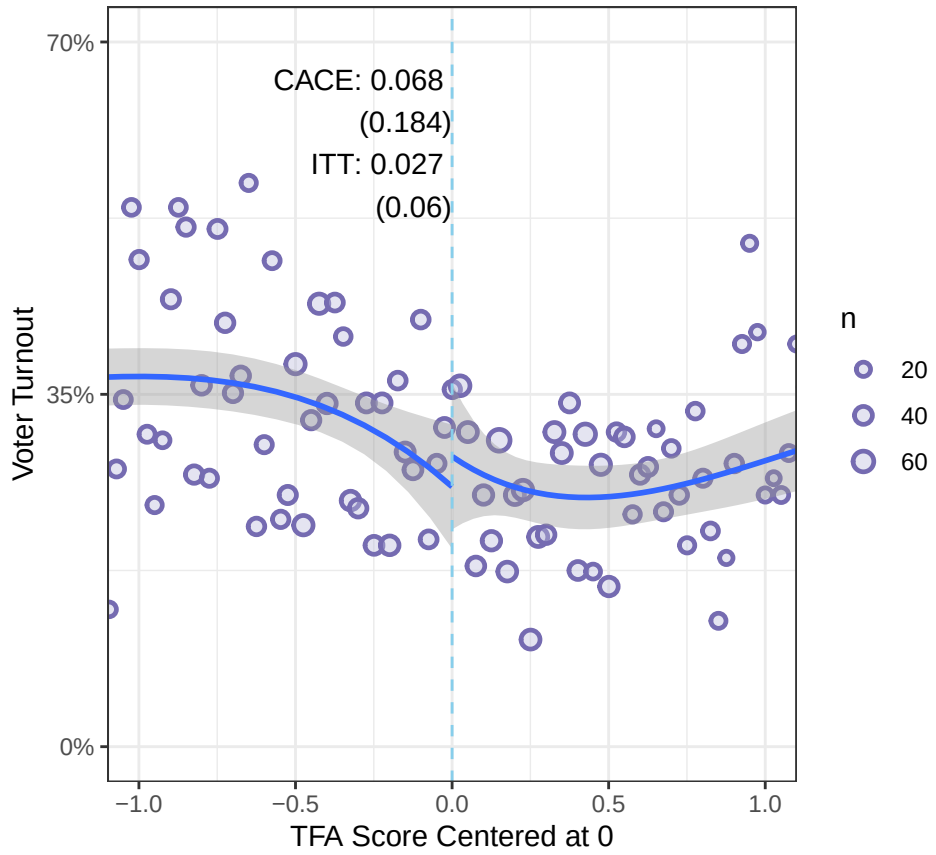

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.359 (0.093) \nConventional ITT: 0.078 (0.018)"
```



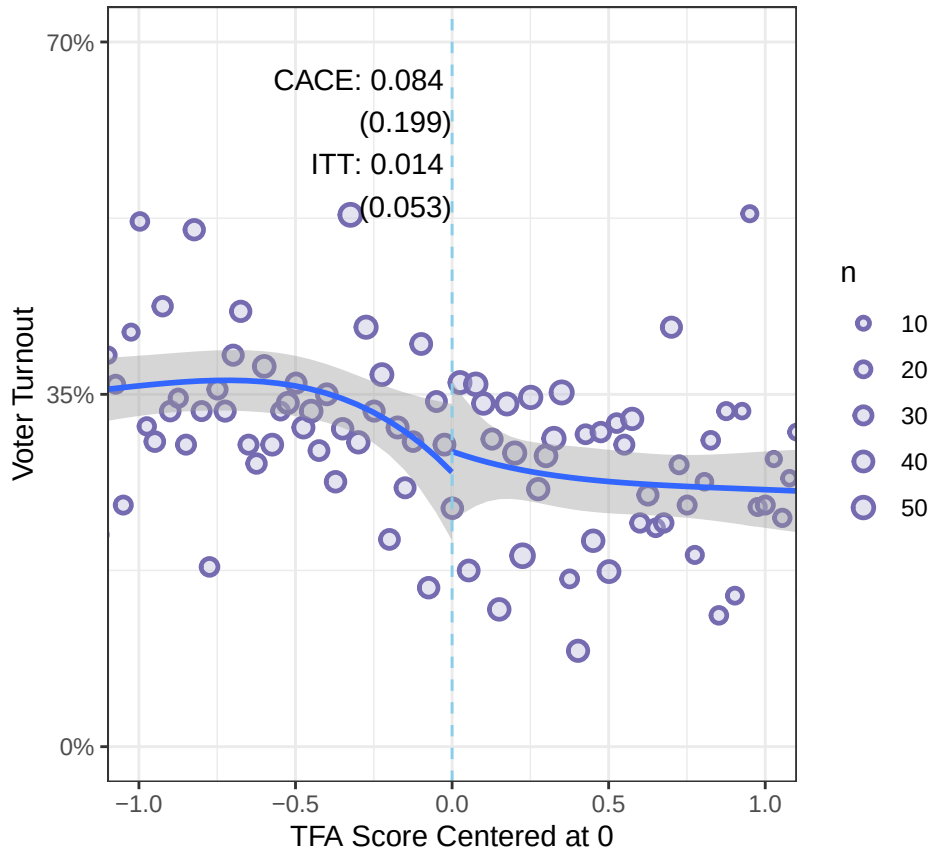
Alternate outcome: dosage response

This section calculates treatment effects for voting records measured at time periods before TFA matriculants had completed the full program, or an equivalent period for non-matriculants. This analysis is reported in section A9 of the appendix.

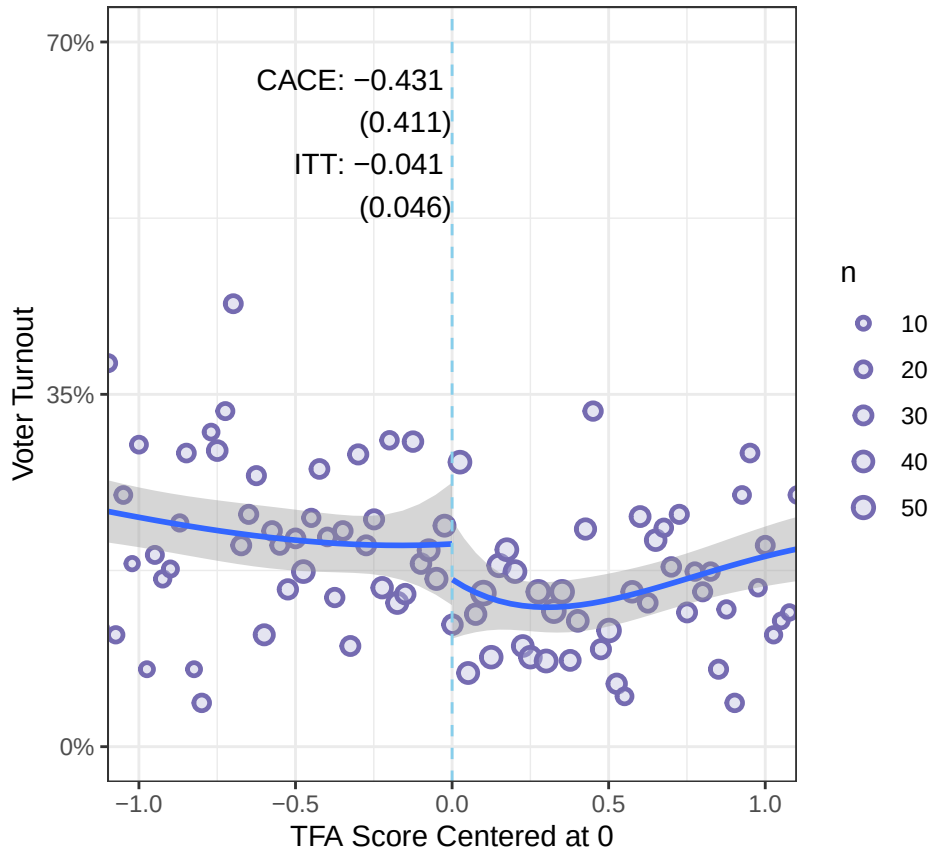
```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.037 (0.155) \nConventional ITT: 0.015 (0.051)"
```



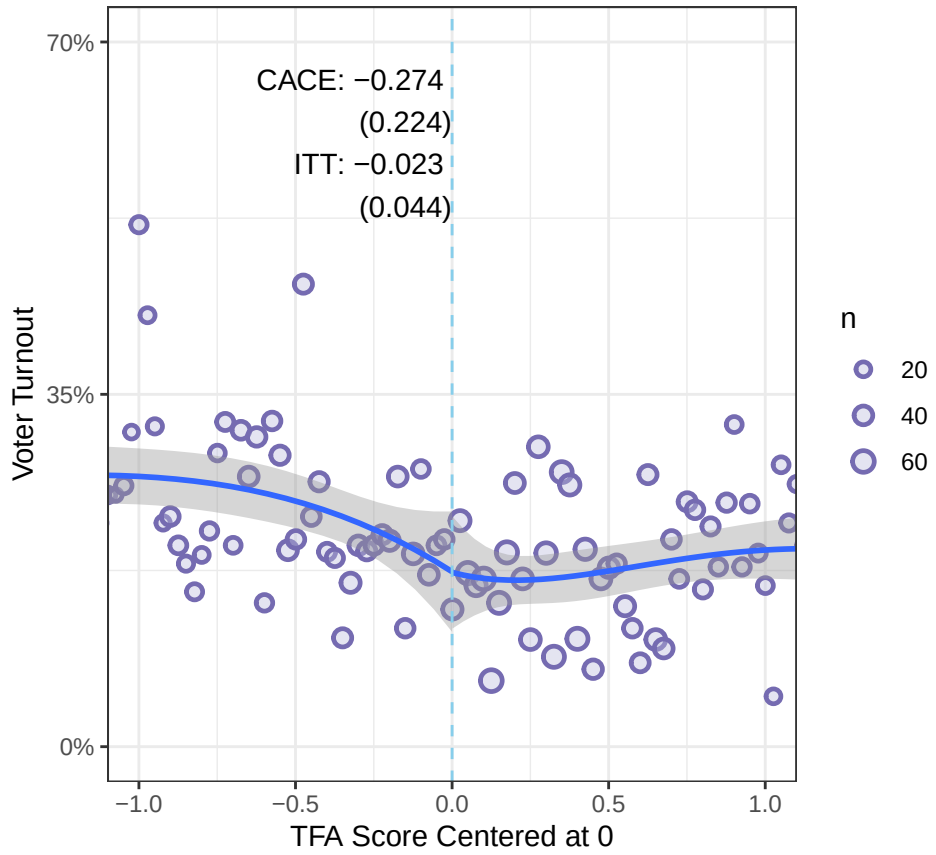

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.046 (0.174) \nConventional ITT: 0.002 (0.044)"
```



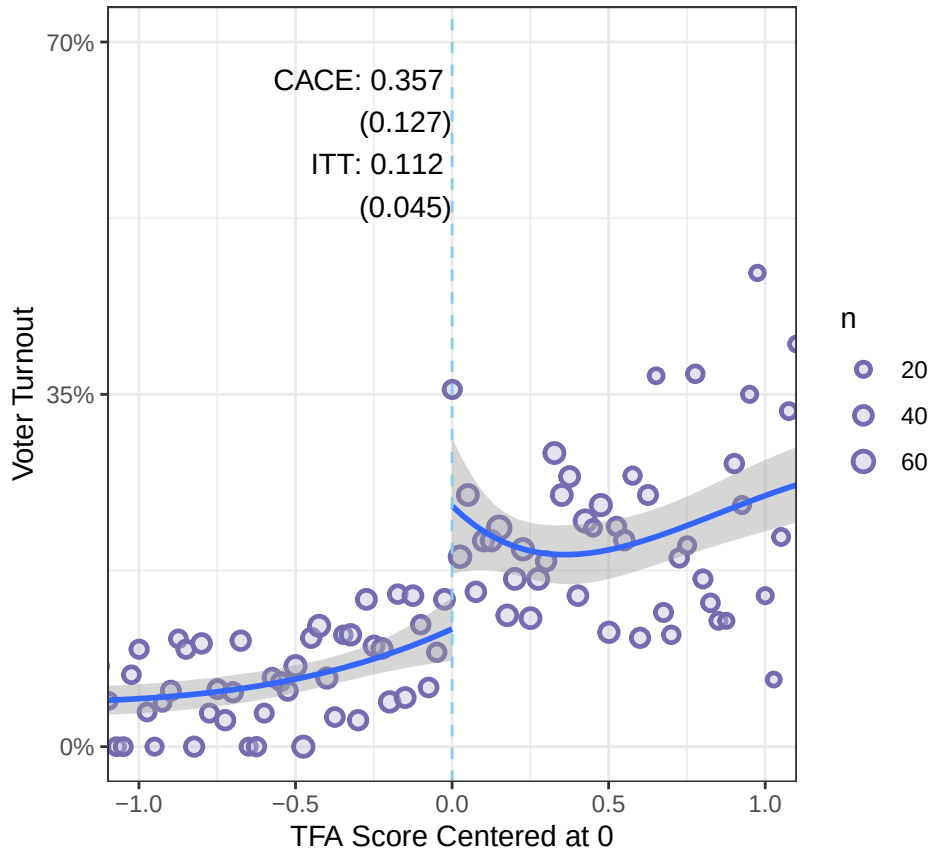

```
## [1] "Conventional CACE: -0.367 (0.349) \nConventional ITT: -0.044 (0.038)"
```



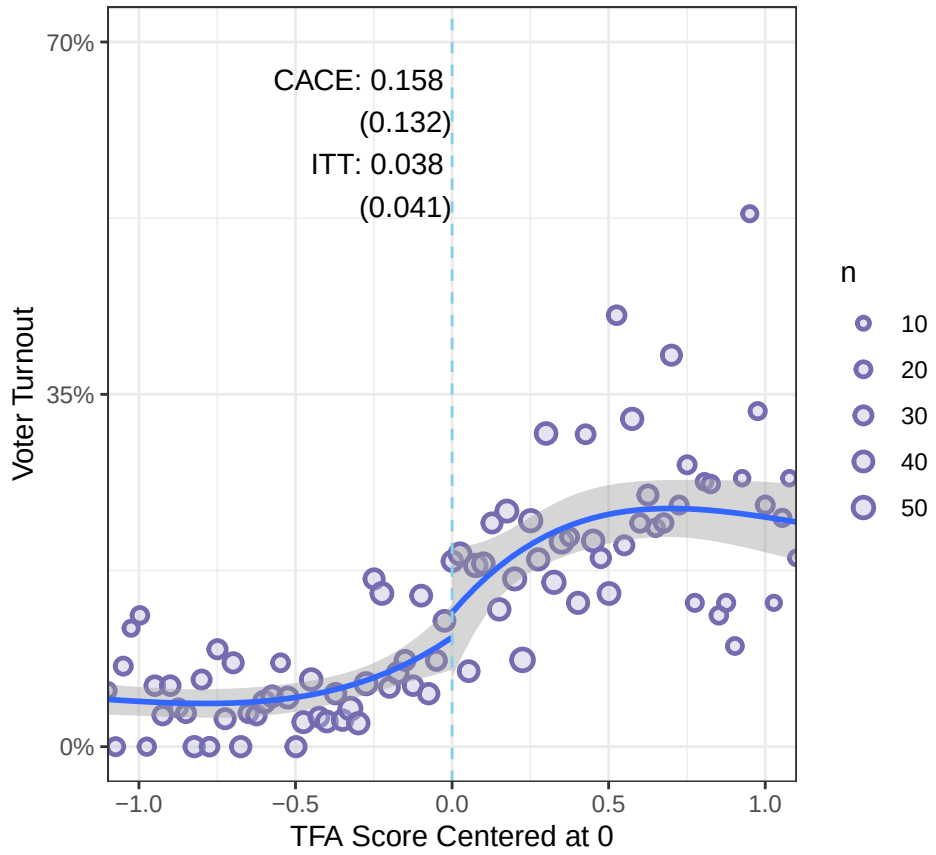

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: -0.175 (0.184) \nConventional ITT: -0.025 (0.037)"
```



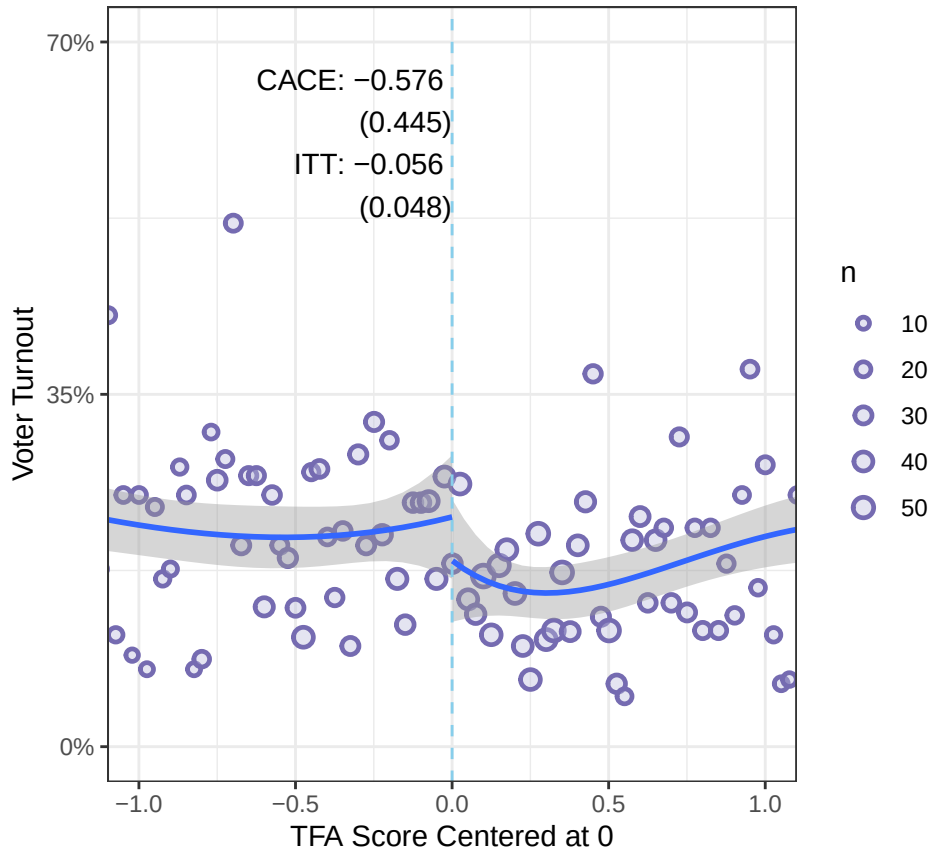

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.318 (0.108) \nConventional ITT: 0.106 (0.038)"
```



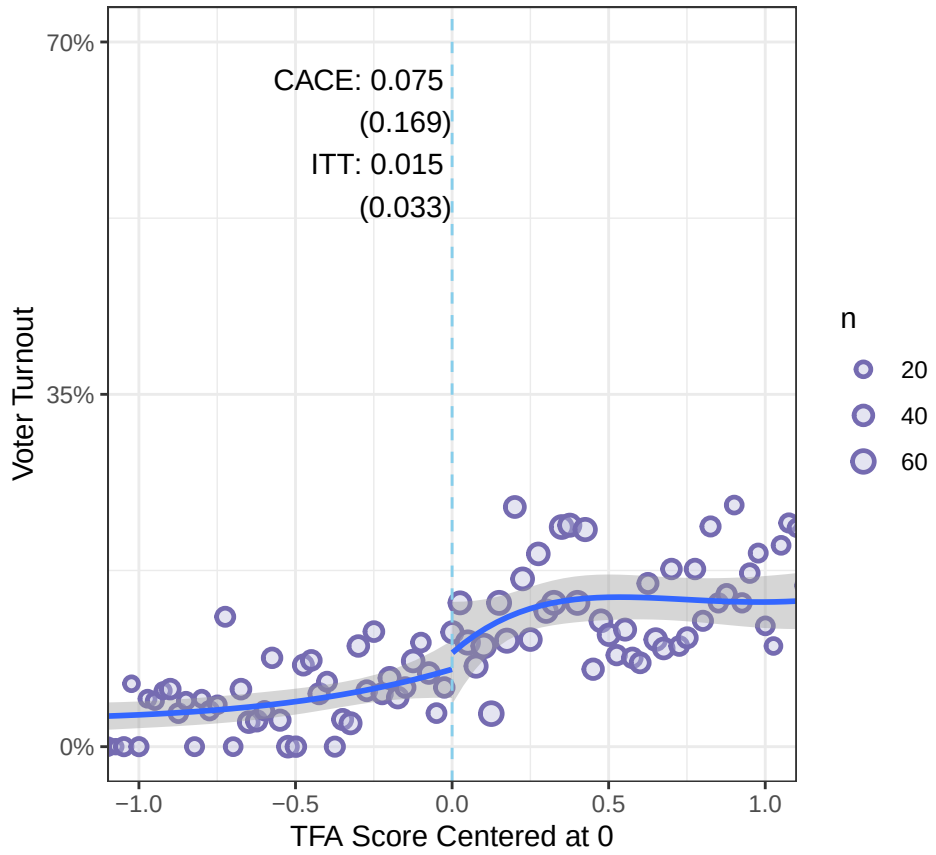

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.149 (0.109) \nConventional ITT: 0.045 (0.034)"
```




```
## [1] "Conventional CACE: -0.481 (0.378) \nConventional ITT: -0.057 (0.04)"
```



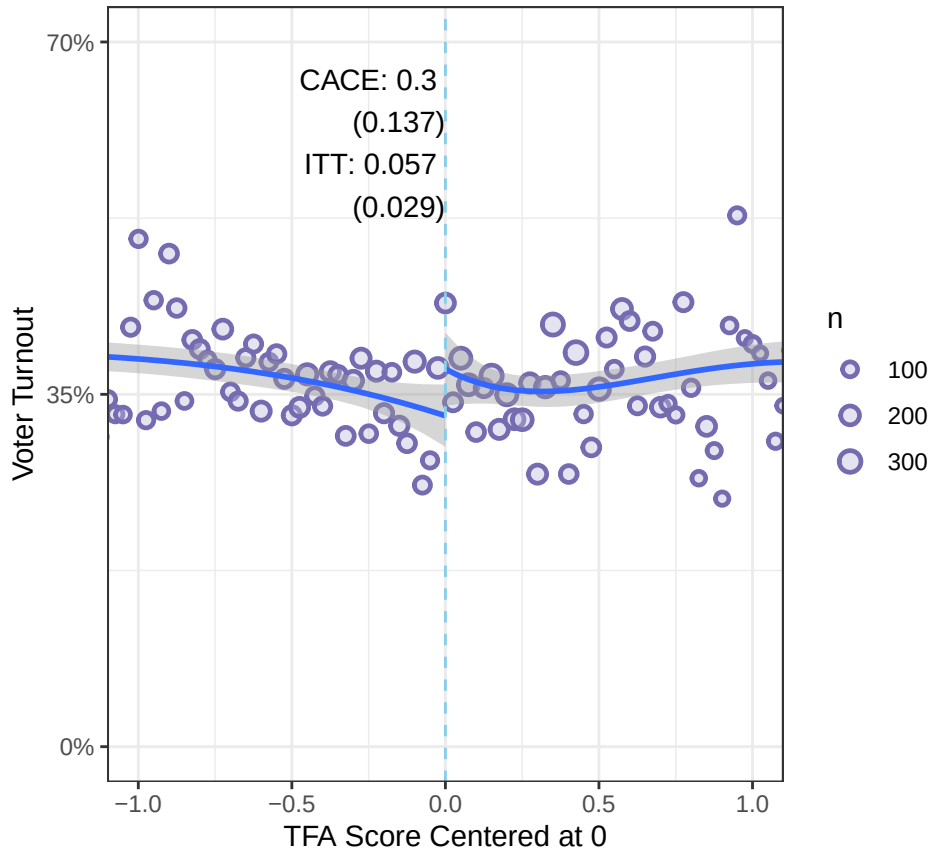

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.101 (0.139) \nConventional ITT: 0.023 (0.028)"
```



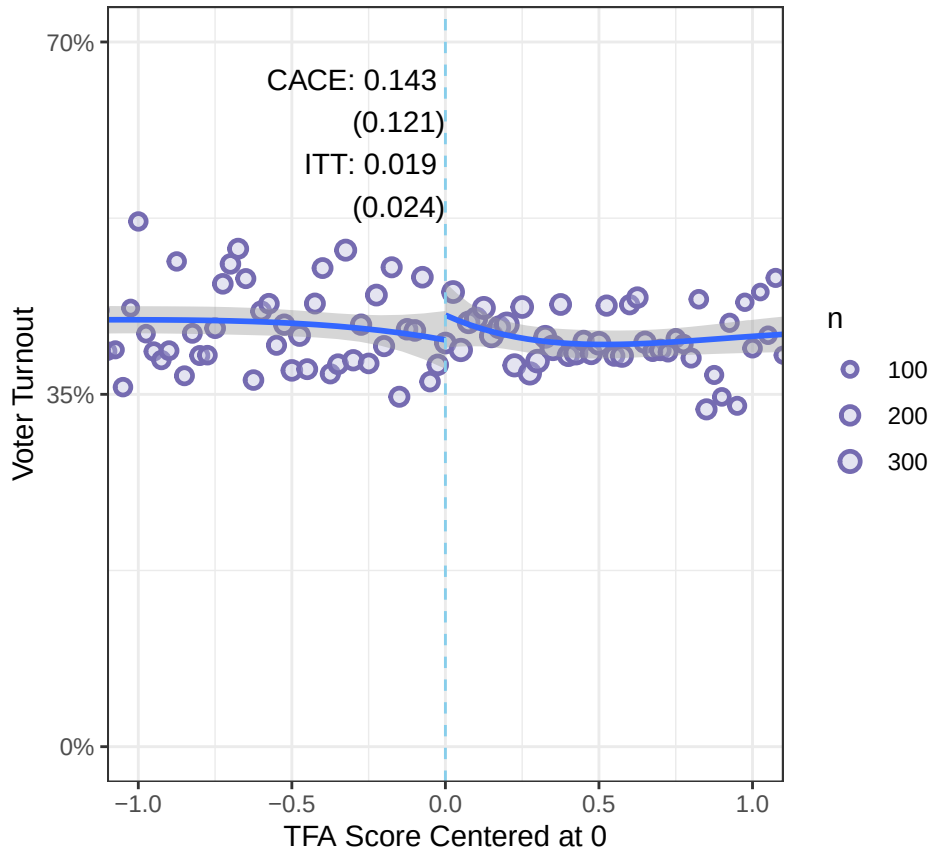
Alternate outcome: include 2008 and 2010

This analysis adds turnout in the 2008 and 2010 elections to the outcome variables. The main text reports only elections 2012 and later, because a 2016 voter file snapshot has more accurate representations of these later elections, especially for a mobile sample like ours. This analysis is reported in section A9 of the appendix.

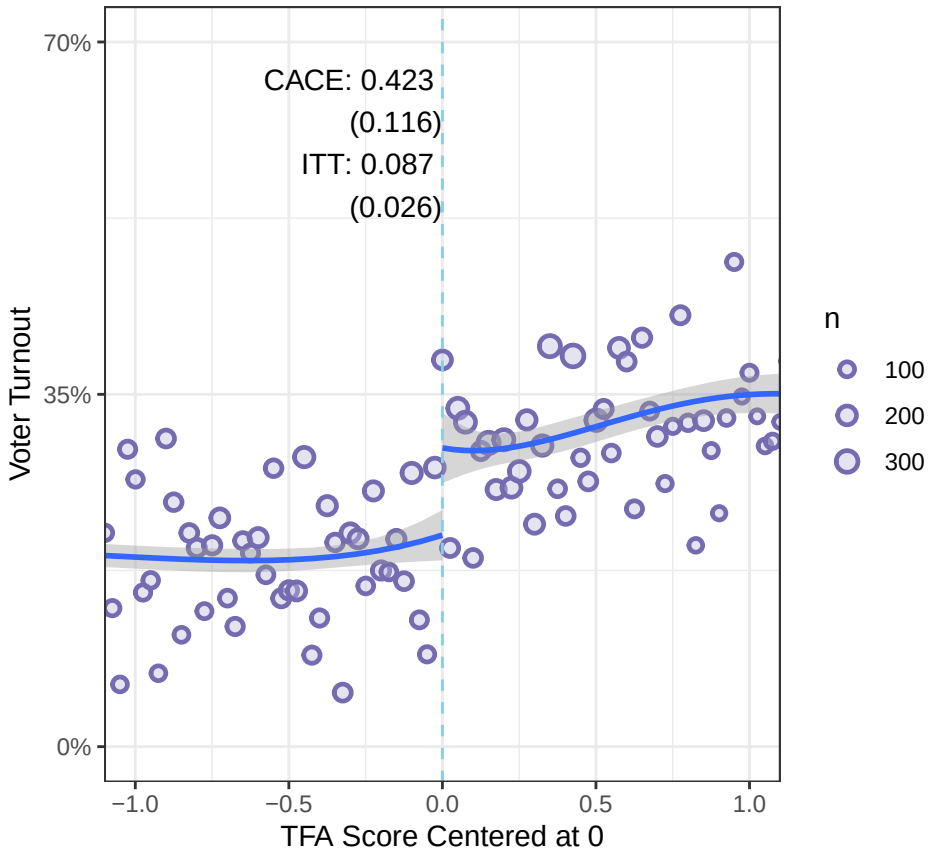
```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.252 (0.125) \nConventional ITT: 0.048 (0.026)"
```



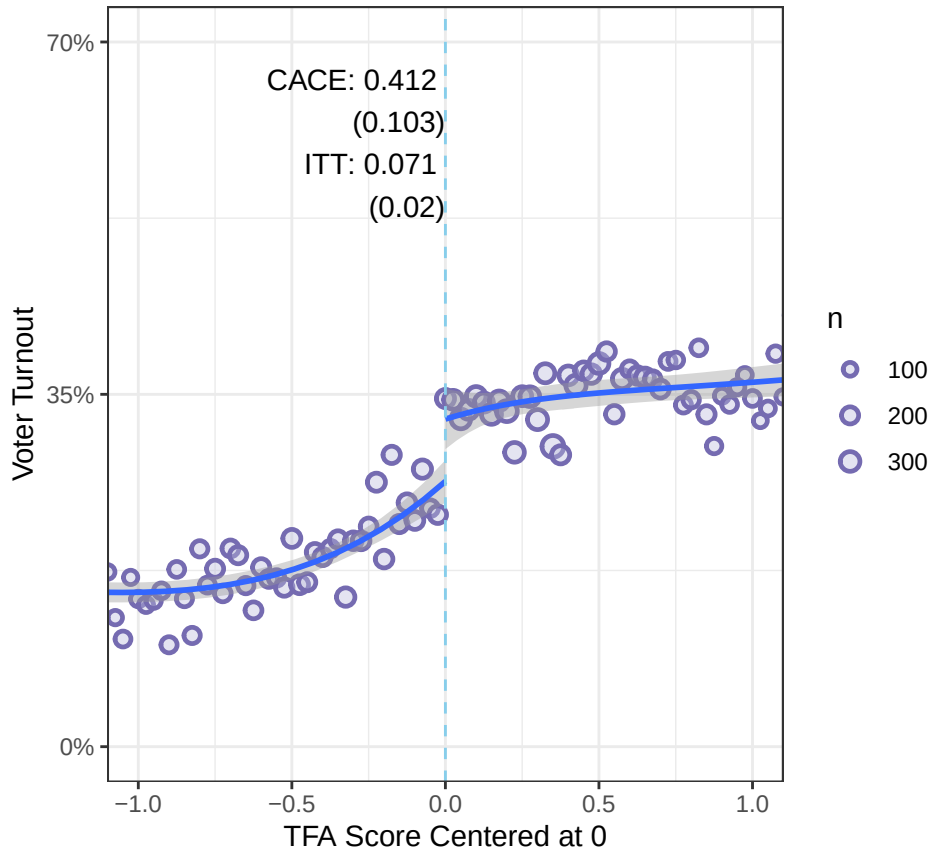

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.116 (0.106) \nConventional ITT: 0.015 (0.02)"
```



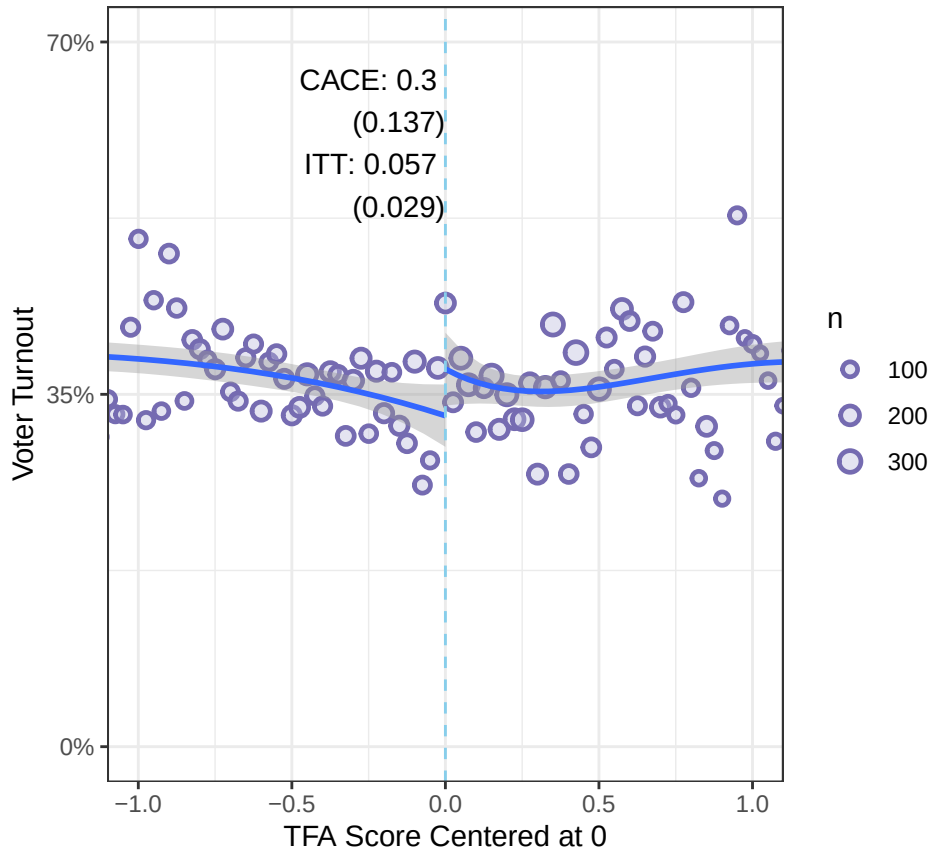

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.375 (0.104) \nConventional ITT: 0.083 (0.021)"
```



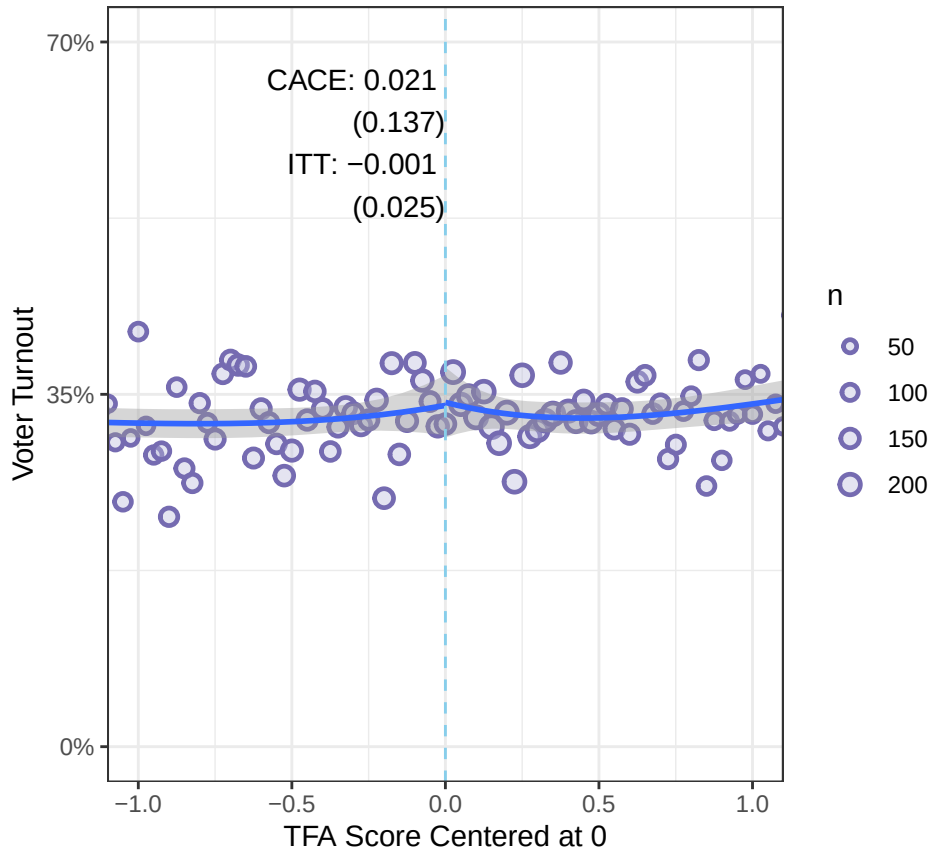

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.375 (0.094) \nConventional ITT: 0.076 (0.017)"
```



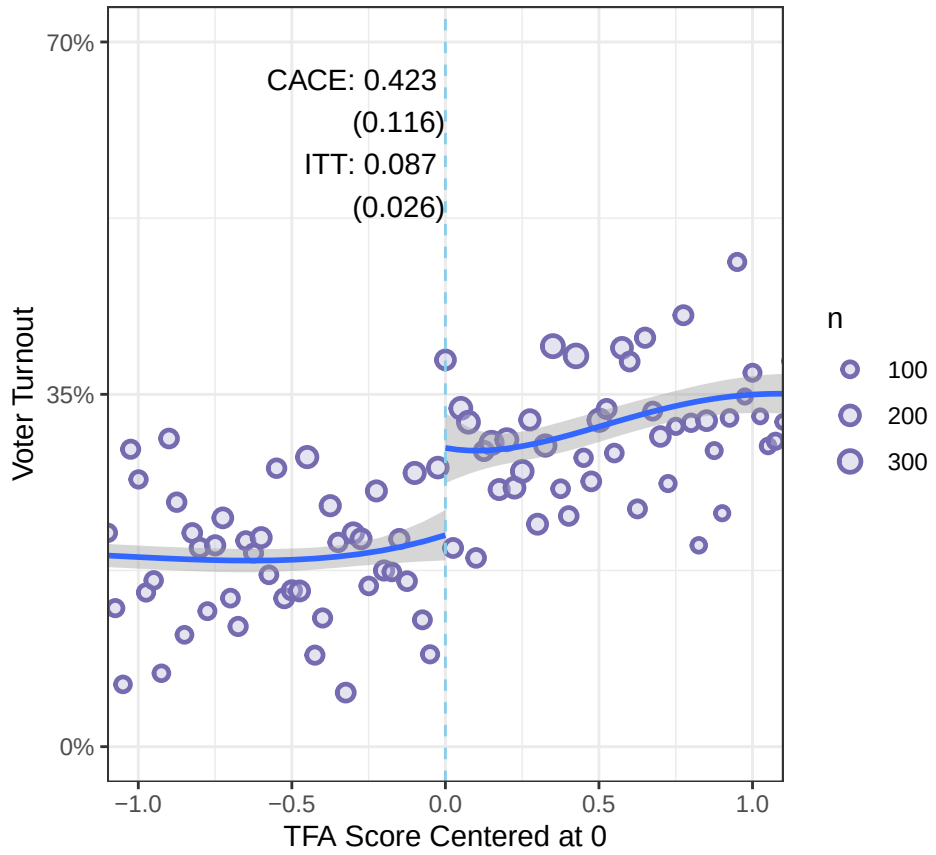

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.252 (0.125) \nConventional ITT: 0.048 (0.026)"
```



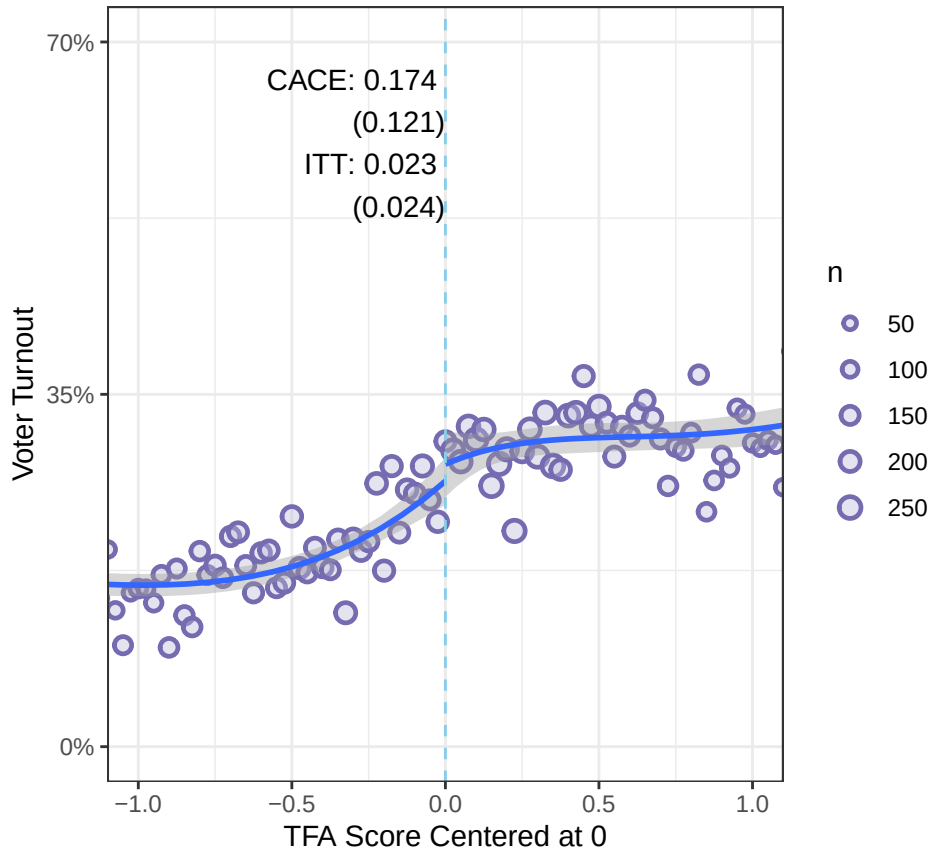

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.018 (0.121) \nConventional ITT: -0.003 (0.021)"
```




```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.375 (0.104) \nConventional ITT: 0.083 (0.021)"
```



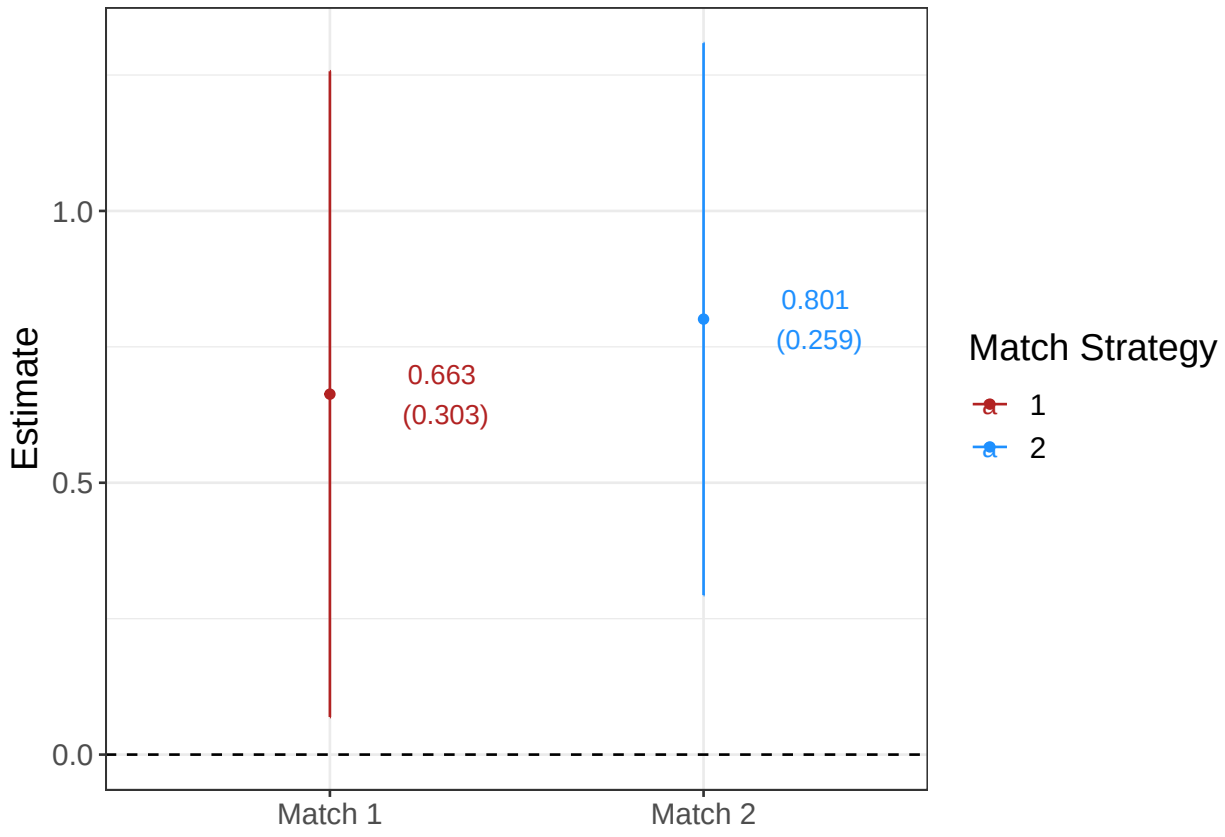

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
## [1] "Conventional CACE: 0.166 (0.106) \nConventional ITT: 0.029 (0.02)"
```



Completed Program (replaces matriculated)

This section presents results using an alternative measure of "compliance"in the fuzzy regression discontinuity setup–the application score instruments for whether an applicant completed the program, rather than whether the applicant matriculated in the program. These results are presented in section A9 of the appendix.

```
## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."

## [1] "Mass points detected in the running variable."
## [1] "Mass points detected in the running variable."
```



Stats for paper

This section calculates various statistics reported in the paper and the appendix. First, we identify which applicants completed the TFA program. We calculate the rate of completion among matriculants (reported in the paper's first footnote).

Next, we use data from the Cooperative Election Study to calculate the rate of turnout among young teachers in the general public. This analysis is reported in section B1 of the appendix.

We continue this analysis by loading data on the professions of TFA applicants, as reported in the survey.

Finally, we run regression models (also reported in Section B1 of the appendix) showing the relationship between teaching and turnout in TFA applicants and the general public.