Online Appendix
Do Billboard Advertisements Increase Voter Turnout? A Large-Scale Field Experiment

5.1 Further details on imputed exposures

Individuals who reside within a given region will vary greatly in the frequency with which they pass by billboards and are thereby exposed to our treatment. Thus, estimating dosage simply by the number of nearby boards is a rather coarse measure. To improve the exposure measure when analyzing individual level data, we developed a simple algorithm which uses cell phone location data to give a more realistic, distance-based estimate of exposure. In doing so, we took great care to preserve the privacy of individually-identifiable data.

We employed cell phone data to obtain a more precise estimate of the level of "dosage" for a given individual based on their home location, as well as the expected dosage level across all possible assignments. Data were obtained without personally identifying information from The Center for New Data, which in turn obtained data from Veraset, a company that aggregates anonymized population movement data. They provided a dataset of over 137 billion location "pings" from mobile devices of several million distinct users. The Center for New Data has designed an algorithm that infers the location of each device's "home." For each board in our study, we pulled ping data for each device with an imputed home location within 5 miles of the board. We then tallied how many days over the course of our study that device pinged a location within 200 meters of the billboard. However, this dataset is incomplete and not match-able to the voter file. In addition, data agreements prevent us from directly including this potentially-identifiable location data in our published paper.

To accommodate these limitations, we used the cell phone data to calculate equations which would provide the best estimate for the number of days an individual would be expected to pass by a given board in our study, based only on their home's distance from the board. The ping frequency distribution relative to location is, for most boards, non-linear; the majority of individuals did not ping near the target board, and the number who do (and the frequency) drops off precipitously with location. To capture this, we estimated the following non-linear model:

$$y = \exp(a + b\,x) + u_i, \tag{11}$$

where y_i is measured exposure to the board, x_i is distance from the board, and a and b are parameters. We used the scikit-learn command curve_fit() for our estimates. We imposed an upper-bound of 3.4 and 0 for a and b respectively, which ensured that equations would not predict impossibly high values (over 30)

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for expected exposure at any positive distance. The estimated curves for four example boards are included below.

It should be noted that distance alone does not strongly predict individual exposure, given considerable variation in individual travel patterns. However, our estimates do convey valuable information about the relative reach of each board. For example, some boards are estimated to have positive and relatively constant reach over five miles, while others drop estimates to near zero after less than half a mile. Inspection of specific cases reveals that these estimates intuitively reflect the prominence of boards; boards near key arteries connecting suburbs to cities tend to have a broader reach over distances, and more remote boards tend to reach only nearby individuals. Thus, despite a sizable degree of imprecision in our exposure models at the individual level, this estimate nonetheless adds to the precision and realism of our analysis.

Imprecision in measuring an independent variable can lead to bias. Therefore, the reader may be concerned that our lack of information about residents' actual travel patterns may lead to bias. We cannot deny that modeling assumptions are required when characterizing the relationship between residential location and predicted exposure. But ultimately the imputations we use are functions of residential location and distances to billboards; cell phone data merely provides a way to scale exposure as a function of distance. Our imputed exposure model is conceptually similar to simply imposing a quadratic model. The table below demonstrates how a quadratic for distance affects outcomes.

Table 6: Individual Level Analysis by Radii, with Quadratic-modeled Distance

	Dependent variable:				
	Voted in 2020				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment (Binary)	0.011	0.001	−0.003	−0.006	−0.006
	(0.012)	(0.010)	(0.009)	(0.008)	(0.008)
Distance in Miles	0.185	0.098	0.038	0.023	0.013
	(0.125)	(0.031)	(0.010)	(0.007)	(0.004)
Distance Squared	−0.200	−0.057	−0.010	−0.004	−0.0001
	(0.181)	(0.024)	(0.004)	(0.002)	(0.001)
Voted 2018	0.329	0.325	0.320	0.315	0.304
	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Voted 2016	0.209	0.210	0.208	0.206	0.202
	(0.006)	(0.004)	(0.003)	(0.003)	(0.003)
Voted 2014	0.038	0.034	0.033	0.032	0.029
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Voted 2012	0.068	0.065	0.061	0.058	0.054
	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
Constant	0.278	0.297	0.320	0.334	0.352
	(0.023)	(0.013)	(0.011)	(0.010)	(0.009)
Observations	423,570	1,561,594	4,996,597	9,353,313	18,454,443
R^2	0.302	0.305	0.305	0.301	0.293
Adjusted R^2	0.302	0.305	0.305	0.301	0.293

Distance and distance squared both refer to an individual's home's distance from the nearest billboard

5.2 Dosage-agnostic model and results

Table 7: Marginal effect of binary treatment on turnout by block (0.5 miles)

Tranche	Block	# clusters	n treated	n control	% treated voted	% control voted	ITT	ITT DiD
1	1	77	$50,208$	$66,414$	0.599	0.594	0.005	0.020
	2	38	$65,336$	$53,916$	0.608	0.566	0.042	0.007
	3	8	$20,030$	$32,803$	0.644	0.602	0.041	-0.006
2	1	2	$1,361$	$7,988$	0.449	0.792	-0.343	0.042
3	1	10	$23,268$	$15,622$	0.715	0.665	0.050	0.012
4	1	5	$7,909$	$10,850$	0.533	0.563	-0.030	-0.019
	2	2	$3,334$	$10,171$	0.695	0.593	0.102	0.060
	3	6	$11,628$	$4,187$	0.660	0.650	0.010	0.083
	4	6	$15,250$	$23,295$	0.683	0.682	0.001	-0.012

Estimand	Weighted by	Pooled estimate	p-value (RI)
ITT	# Clusters	0.015	0.294
ITT	n	0.018	0.204
ITT DiD	# Clusters	0.015	0.239
ITT DiD	n	0.012	0.166

Table 8: Marginal effect of binary treatment on turnout by block (1 mile)

Tranche	Block	# clusters	n treated	n control	% treated voted	% control voted	ITT	ITT DiD
1	1	77	$218,215$	$256,222$	0.625	0.628	-0.003	0.009
	2	38	$240,591$	$173,031$	0.621	0.586	0.035	0.006
	3	8	$56,871$	$92,140$	0.647	0.620	0.026	-0.008
2	1	2	$3,359$	$34,588$	0.460	0.768	-0.308	0.088
3	1	10	$94,620$	$57,943$	0.722	0.685	0.037	0.003
4	1	5	$31,846$	$36,722$	0.571	0.576	-0.006	-0.012
	2	2	$12,799$	$38,750$	0.721	0.691	0.030	0.028
	3	6	$42,955$	$15,635$	0.664	0.667	-0.004	0.047
	4	6	$65,558$	$89,749$	0.679	0.738	-0.060	-0.008

Estimand	Weighted by	Pooled estimate	p-value (RI)
ITT	# Clusters	0.005	0.537
ITT	n	0.002	0.626
ITT DiD	# Clusters	0.008	0.335
ITT DiD	n	0.007	0.327

A simpler alternative to the coarse-grained model in in Section 2.5.1, which assumes subjects receive a treatment *dosage* depending on how many treated billboards are near their registered address, is a model that assumes that subjects have a binary treatment status depending only on the treatment status of the billboard nearest them. Define $D_i \in \{0, 1\}$ to be subject i's binary treatment status and $b_i \in \{1, \dots, m\}$ to

Table 9: Marginal effect of binary treatment on turnout by block (2 miles)

Tranche	Block	# clusters	n treated	n control	% treated voted	% control voted	ITT	ITT DiD
1	1	77	855,998	930,563	0.640	0.647	-0.006	0.005
	2	38	743,610	525,370	0.640	0.624	0.016	0.002
	3	8	118,742	202,326	0.666	0.659	0.007	0.0004
2	1	2	12,400	130,779	0.607	0.766	-0.159	-0.002
3	1	10	279,768	189,773	0.713	0.686	0.027	0.003
4	1	5	71,807	99,725	0.595	0.601	-0.007	-0.010
	2	2	35,656	105,910	0.712	0.735	-0.022	0.033
	3	6	125,560	54,411	0.681	0.695	-0.014	0.033
	4	6	236,783	277,416	0.706	0.767	-0.062	-0.011

Estimand	Weighted by	Pooled estimate	p-value (RI)
ITT	# Clusters	-0.002	0.799
ITT	n	-0.007	0.934
ITT DiD	# Clusters	0.004	0.476
ITT DiD	n	0.003	0.533

the billboard nearest to i's registered address. This model then assumes simply that

$$D_i = Z_{b_i} \tag{12}$$

where $Z_j \in \{0, 1\}$ is the randomized treatment status of billboard j.

As described in Section 2, billboards were block-randomized. We consider the following simple model for the intent-to-treat effect $\alpha_1^{(\mathrm{ITT})}$ of treating board b_i on i's turnout:

$$\mathbb{E}[Y_i] = \alpha_0 + \alpha_1^{(\mathrm{ITT})} Z_{b_i}. \tag{13}$$

We also consider a model for the difference-in-difference ITT, $\alpha_1^{(\mathrm{DiD})}$, where i's binary voting outcome in 2016 is subtracted from their 2020 outcome:

$$\mathbb{E}[Y_i - Y_i^{(2016)}] = \alpha_0 + \alpha_1^{(\mathrm{DiD})} Z_{b_i}. \tag{14}$$

The estimates of the ITT and ITT-DiD, $\hat{\alpha}_1^{(\mathrm{ITT})}$ and $\hat{\alpha}_1^{(\mathrm{DiD})}$, are specific to blocks and we consider two different ways of pooling estimates across blocks: 1) weighting by the number of billboard clusters within blocks and 2) weighting by the number of subjects in each block. The per-block estimates are reported in the top panel Table 7 and the pooled estimates are reported in the bottom panel, where we also report p-values associated with the pooled estimates obtained via randomization inference.

5.3 Omnibus Measure

Table 10: Marginal effect of imputed treatment dosage on individual-level voter turnout, overall and by whether subjects are registered in battleground states (Using a Pooled Model of Billboard Exposure), 5 mile radius

	Dependent variable:		
	Voted in 2020		
	Overall	Battleground	Non-battleground
	(1)	(2)	(3)
Treatment (Dosage)	−0.003	−0.011	0.004
	(0.006)	(0.007)	(0.008)
Exposure to all boards	−0.005	−0.007	−0.007
	(0.005)	(0.006)	(0.007)
Voted 2018	0.305	0.320	0.293
	(0.004)	(0.005)	(0.005)
Voted 2016	0.202	0.203	0.199
	(0.003)	(0.004)	(0.004)
Voted 2014	0.029	0.030	0.026
	(0.002)	(0.002)	(0.002)
Voted 2012	0.054	0.058	0.051
	(0.002)	(0.003)	(0.002)
Constant	0.386	0.361	0.410
	(0.009)	(0.010)	(0.013)
Observations	18,454,443	8,047,875	10,406,568
Clustered SEs	✓	✓	✓
R^2	0.291	0.298	0.284
Adjusted R^2	0.291	0.298	0.284

5.4 Quartiles of Geographic Cluster Size

Table 11: Individual Level Analysis by Quartile of Geographic Cluster Size, 5 mile radius

	Dependent variable:			
	Voted in 2020			
	Lowest Quartile	Sec Quartile	Third Quartile	Highest Quartile
	(1)	(2)	(3)	(4)
Treatment (Dosage)	−0.017	−0.012	−0.004	0.003
	(0.002)	(0.001)	(0.0003)	(0.0003)
Exposure to all boards	−0.001	−0.010	−0.008	−0.009
	(0.002)	(0.001)	(0.0003)	(0.0002)
Voted 2018	0.284	0.284	0.294	0.309
	(0.004)	(0.001)	(0.001)	(0.0003)
Voted 2016	0.205	0.204	0.197	0.203
	(0.005)	(0.001)	(0.001)	(0.0003)
Voted 2014	0.021	0.020	0.027	0.030
	(0.003)	(0.001)	(0.0005)	(0.0002)
Voted 2012	0.054	0.061	0.054	0.053
	(0.004)	(0.001)	(0.001)	(0.0003)
Constant	0.407	0.418	0.409	0.380
	(0.003)	(0.001)	(0.0005)	(0.0002)
RI p-value	0.824	0.907	0.938	0.84
Observations	75,586	754,435	3,253,268	14,371,154
Clustered SEs	✓	✓	✓	✓
R^2	0.284	0.286	0.279	0.295
Adjusted R^2	0.284	0.286	0.279	0.295

5.5 Geographic Subsets of Individual Level Analysis, by Levels of Exposure

The following tables alter our individual-level analysis in ways that shed light on the robustness of the results. The first table replicates the results in the main text but for different radii. The tables after that show the binary treatment effect for various geographic subsets, such as individuals living very close to boards, individuals only in battleground or non-battleground states, and states with voting only available on election day.

Table 12: Individual Level Analysis by Radii (Dosage Treatment)

	Dependent variable:				
	Voted in 2020				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment (Dosage)	0.009	0.006	0.002	−0.00003	−0.002
	(0.006)	(0.007)	(0.006)	(0.005)	(0.004)
Exposure to all boards	0.008	0.006	0.004	0.002	−0.005
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Voted 2018	0.329	0.324	0.320	0.316	0.305
	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Voted 2016	0.210	0.211	0.209	0.206	0.202
	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
Voted 2014	0.037	0.034	0.033	0.032	0.029
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Voted 2012	0.069	0.065	0.061	0.058	0.054
	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
Constant	0.307	0.327	0.345	0.358	0.386
	(0.010)	(0.009)	(0.009)	(0.008)	(0.008)
RI p-value	0.084	0.63	0.937	0.951	0.891
Observations	423,570	1,561,594	4,996,597	9,353,313	18,454,443
Clustered SEs	✓	✓	✓	✓	✓
R^2	0.303	0.305	0.305	0.301	0.291
Adjusted R^2	0.303	0.305	0.305	0.301	0.291

Treatment dosage: The variable Treatment (Dosage) is the predicted number of days that the individual was exposed to at least one treated board. For the radius of 0.5 miles, it has a mean of 0.49 with a standard deviation of 0.91. For the radius of 1 mile, it has a mean of 0.37 with a standard deviation of 0.69. For the radius of 2 miles, it has a mean of 0.28 with a standard deviation of 0.61. For the radius of 3 miles, it has a mean of 0.25 with a standard deviation of 0.59.
Standard errors were clustered by billboard cluster. No weights were included for the individual-level regressions.

Table 13: Individual Level Analysis by Radii (Binary Treatment)

	Dependent variable:				
	Voted in 2020				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment (Binary)	0.013	0.002	−0.003	−0.006	−0.006
	(0.011)	(0.010)	(0.009)	(0.008)	(0.008)
Exposure to all boards	0.010	0.009	0.005	0.002	−0.006
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Voted 2018	0.329	0.325	0.320	0.316	0.305
	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Voted 2016	0.210	0.211	0.209	0.206	0.202
	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
Voted 2014	0.037	0.034	0.033	0.032	0.029
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Voted 2012	0.069	0.065	0.061	0.058	0.054
	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
Constant	0.302	0.327	0.346	0.362	0.389
	(0.013)	(0.011)	(0.010)	(0.009)	(0.009)
RI p-value	0.154	0.627	0.836	0.894	0.944
Observations	423,570	1,561,594	4,996,597	9,353,313	18,454,443
Clustered SEs	✓	✓	✓	✓	✓
R^2	0.303	0.305	0.305	0.301	0.291
Adjusted R^2	0.303	0.305	0.305	0.301	0.291

Table 14: Individual Level Analysis by Levels of Expected Exposure (All voters within 5-mile radius)

	Dependent variable:			
	Voted in 2020			
	Lowest Quartile	Sec Quartile	Third Quartile	Highest Quartile
	(1)	(2)	(3)	(4)
Treatment (Binary)	0.002	0.002	−0.009	−0.001
	(0.017)	(0.014)	(0.011)	(0.007)
Exposure to all boards	−408.998	−408.998	0.008	−0.003
	(230.574)	(0.114)	(0.058)	(0.003)
Voted 2018	0.288	0.288	0.310	0.308
	(0.008)	(0.006)	(0.006)	(0.004)
Voted 2016	0.187	0.187	0.210	0.209
	(0.006)	(0.005)	(0.003)	(0.003)
Voted 2014	0.029	0.029	0.032	0.028
	(0.003)	(0.003)	(0.003)	(0.002)
Voted 2012	0.045	0.045	0.052	0.065
	(0.004)	(0.003)	(0.004)	(0.002)
Constant	0.423	0.423	0.373	0.371
	(0.016)	(0.013)	(0.022)	(0.010)
RI p-value	0.743	0.719	0.869	0.959
Observations	4,613,611	4,613,611	4,613,611	4,613,610
Clustered SEs	✓	✓	✓	✓
R^2	0.262	0.262	0.303	0.306
Adjusted R^2	0.262	0.262	0.303	0.306

Table 15: Individual Level Analysis by Levels of Expected Exposure (All voters within 1-mile radius)

	Dependent variable:			
	Voted in 2020			
	Lowest Quartile	Sec Quartile	Third Quartile	Highest Quartile
	(1)	(2)	(3)	(4)
Treatment (Binary)	−0.023	0.008	0.020	0.003
	(0.019)	(0.012)	(0.012)	(0.015)
Exposure to all boards	0.137	0.017	0.022	0.001
	(0.107)	(0.041)	(0.033)	(0.003)
Voted 2018	0.327	0.330	0.328	0.312
	(0.008)	(0.006)	(0.005)	(0.008)
Voted 2016	0.210	0.213	0.212	0.206
	(0.006)	(0.005)	(0.005)	(0.005)
Voted 2014	0.038	0.039	0.030	0.029
	(0.005)	(0.004)	(0.003)	(0.003)
Voted 2012	0.067	0.058	0.068	0.066
	(0.006)	(0.004)	(0.004)	(0.005)
Constant	0.333	0.313	0.301	0.359
	(0.022)	(0.019)	(0.027)	(0.017)
RI p-value	0.853	0.311	0.093	0.858
Observations	390,399	390,399	390,398	390,398
Clustered SEs	✓	✓	✓	✓
R^2	0.303	0.308	0.308	0.302
Adjusted R^2	0.303	0.308	0.307	0.302

Table 16: Individual Level Analysis by Levels of Exposure (All Voters in Battleground States)

	Dependent variable:			
	Voted in 2020			
	Lowest Quartile	Sec Quartile	Third Quartile	Highest Quartile
	(1)	(2)	(3)	(4)
Treatment (Binary)	−0.019	0.005	0.004	−0.016
	(0.023)	(0.014)	(0.020)	(0.011)
Exposure to all boards	−16,158.420	−0.005	0.051	−0.008
	(13,744.500)	(0.213)	(0.092)	(0.003)
Voted 2018	0.305	0.319	0.326	0.328
	(0.012)	(0.006)	(0.010)	(0.006)
Voted 2016	0.190	0.196	0.214	0.210
	(0.009)	(0.008)	(0.004)	(0.005)
Voted 2014	0.031	0.031	0.030	0.029
	(0.004)	(0.002)	(0.006)	(0.003)
Voted 2012	0.055	0.055	0.052	0.071
	(0.006)	(0.005)	(0.007)	(0.004)
Constant	0.395	0.363	0.328	0.352
	(0.021)	(0.016)	(0.029)	(0.014)
RI p-value	0.918	0.318	0.603	0.988
Observations	2,011,969	2,011,969	2,011,969	2,011,968
Clustered SEs	✓	✓	✓	✓
R^2	0.278	0.288	0.301	0.320
Adjusted R^2	0.278	0.288	0.301	0.320

Table 17: Individual Level Analysis by Levels of Exposure (All Voters in Non-battleground States)

	Dependent variable:			
	Voted in 2020			
	Lowest Quartile	Sec Quartile	Third Quartile	Highest Quartile
	(1)	(2)	(3)	(4)
Treatment (Binary)	−0.004	−0.003	−0.011	0.008
	(0.018)	(0.021)	(0.012)	(0.008)
Exposure to all boards	−92.128	0.015	−0.069	0.003
	(32.279)	(0.099)	(0.038)	(0.003)
Voted 2018	0.274	0.301	0.299	0.295
	(0.008)	(0.009)	(0.006)	(0.004)
Voted 2016	0.179	0.201	0.208	0.205
	(0.007)	(0.008)	(0.005)	(0.004)
Voted 2014	0.023	0.027	0.031	0.026
	(0.003)	(0.005)	(0.002)	(0.002)
Voted 2012	0.041	0.053	0.054	0.058
	(0.004)	(0.003)	(0.003)	(0.003)
Constant	0.466	0.397	0.415	0.385
	(0.016)	(0.020)	(0.019)	(0.012)
RI p-value	0.731	0.581	0.978	0.728
Observations	2,601,642	2,601,642	2,601,642	2,601,642
Clustered SEs	✓	✓	✓	✓
R^2	0.251	0.292	0.303	0.291
Adjusted R^2	0.251	0.292	0.303	0.291

Table 18: Individual Level Analysis (Election Day-only Voting States)

|	Dependent variable:				
	Voted in 2020				
	0.5 mile	1 mile	2 mile	3 mile	5 mile
	(1)	(2)	(3)	(4)	(5)
Treatment (Binary)	0.071	0.035	0.020	0.005	−0.010
	(0.035)	(0.033)	(0.023)	(0.020)	(0.019)
Exposure to all boards	0.009	0.026	0.028	0.024	0.011
	(0.010)	(0.022)	(0.012)	(0.009)	(0.008)
Voted 2018	0.335	0.322	0.331	0.325	0.313
	(0.037)	(0.025)	(0.015)	(0.011)	(0.010)
Voted 2016	0.197	0.203	0.205	0.209	0.207
	(0.014)	(0.017)	(0.010)	(0.008)	(0.008)
Voted 2014	0.034	0.037	0.039	0.038	0.036
	(0.009)	(0.005)	(0.004)	(0.003)	(0.003)
Voted 2012	0.061	0.056	0.059	0.056	0.050
	(0.008)	(0.007)	(0.005)	(0.004)	(0.004)
Constant	0.271	0.295	0.296	0.315	0.360
	(0.026)	(0.034)	(0.021)	(0.019)	(0.024)
RI p-value	0.328	0.33	0.113	0.37	0.862
Observations	17,823	74,636	255,245	450,471	825,651
Clustered SEs	✓	✓	✓	✓	✓
R^2	0.311	0.305	0.308	0.305	0.296
Adjusted R^2	0.311	0.305	0.308	0.305	0.296

5.6 Supplementary plots
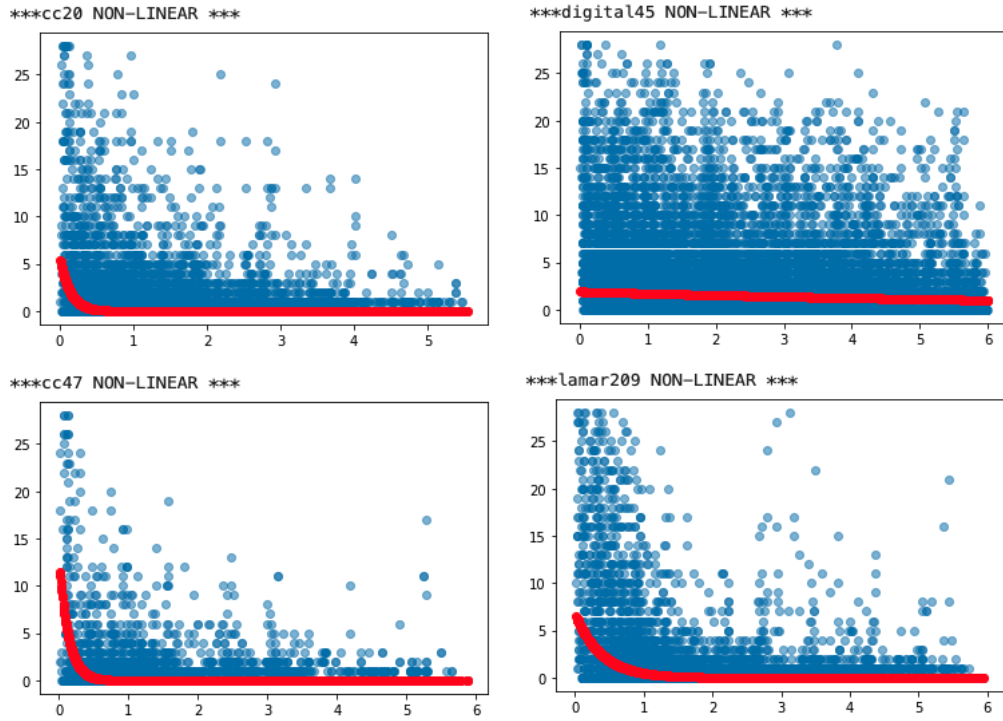
Figure 4: These plots give representative examples of cell phone exposure models, with number of exposures on the Y axis and distance from the board on the X axis. Each point represents an individual, and the line is the estimated exposure function for the given board. For all boards, estimated exposure is weakly decreasing with distance

5.7 Billboard Design

Figure 5: Turnout Nation Billboard
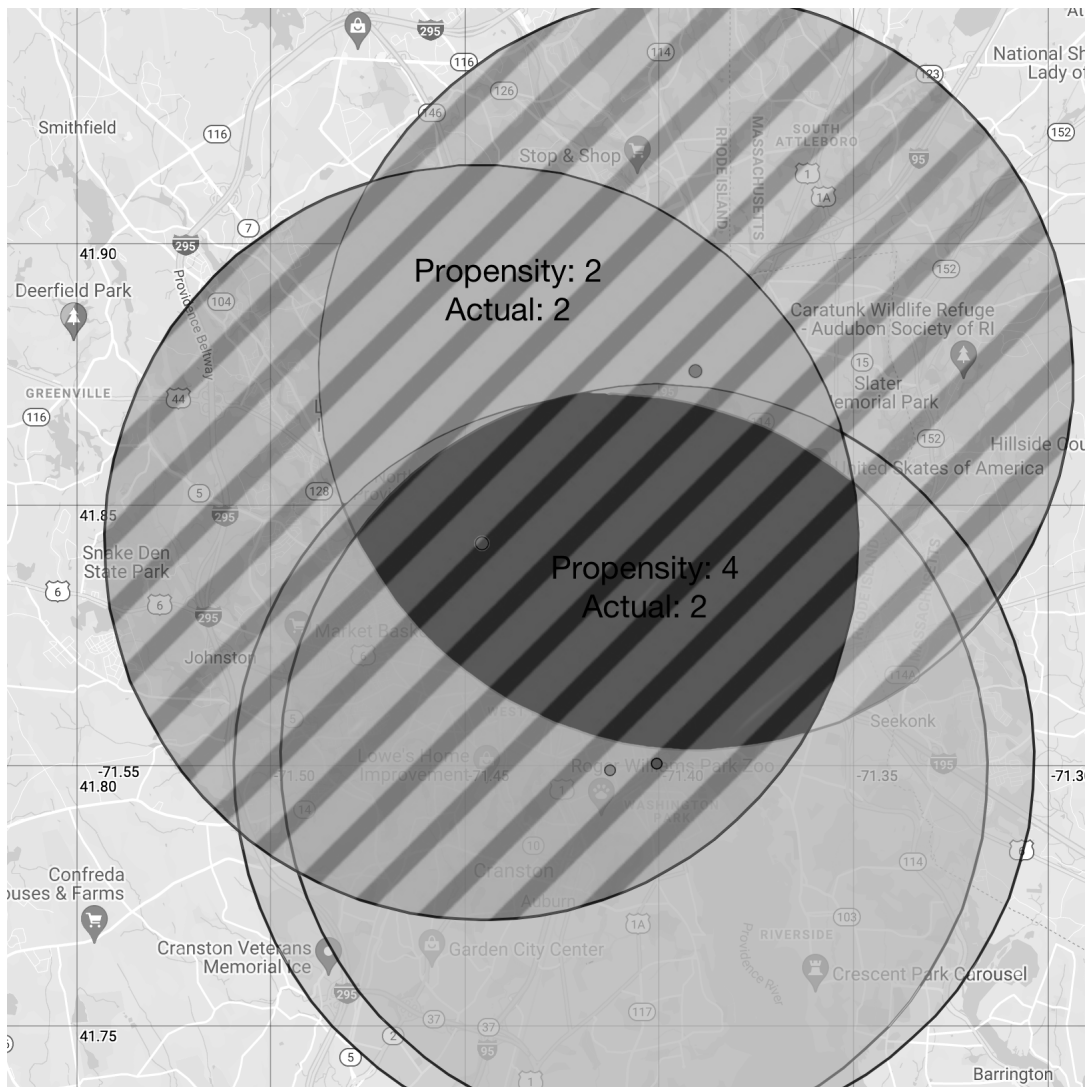
5.8   Visual Example of Dosage and Propensity

Figure 6: Example of 5-mile radii around treatment and control boards, with dosage propensity and actual dosage (treatment is striped)

5.9 Results for raw number of new registrants as outcome

This analysis considers the effect of treatment dosage on voter registration in 2020, as measured by the number of new registrants living in geographic areas surrounding our treatment and control billboards.

Table 19: Number of New Registrants Per Geographic Cluster

	Dependent variable:				
	Number of New Registrants in 2020				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment (Dosage)	−4.415	−7.620	−7.619	−8.096	−8.101
	(4.203)	(11.628)	(23.929)	(36.342)	(56.396)
2018 Aggregate Turnout	0.055	0.048	0.001	0.001	0.051
	(0.024)	(0.028)	(0.031)	(0.030)	(0.029)
2016 Aggregate Turnout	0.004	−0.026	0.021	0.025	0.031
	(0.025)	(0.031)	(0.033)	(0.033)	(0.036)
2014 Aggregate Turnout	−0.065	−0.045	−0.038	−0.050	−0.081
	(0.023)	(0.027)	(0.025)	(0.024)	(0.024)
2012 Aggregate Turnout	0.024	0.054	0.035	0.040	0.003
	(0.026)	(0.031)	(0.031)	(0.030)	(0.032)
Treatment Propensity = 0.5	−0.417	−6.026	71.608	82.337	294.969
	(25.489)	(147.081)	(303.229)	(405.532)	(1,056.691)
Treatment Propensity = 1	−2.988	−15.707	−3.223	−53.132	45.386
	(25.817)	(145.937)	(302.396)	(402.506)	(1,058.386)
Treatment Propensity = 1.5		−9.431	9.790	−38.255	12.928
		(147.411)	(305.838)	(404.444)	(1,064.415)
Treatment Propensity = 2			−10.421	−60.484	−42.681
			(319.869)	(424.707)	(1,077.918)
Constant	8.068	27.368	18.583	63.564	0.363
	(26.251)	(148.241)	(303.428)	(408.375)	(1,051.143)
RI p-value	0.8246	0.7371	0.6478	0.6013	0.563
Pct geoclusters exposure >1	0.05	0.121	0.203	0.227	0.244
Observations	301	354	448	528	624
R^2	0.311	0.267	0.295	0.319	0.323
Adjusted R^2	0.295	0.250	0.281	0.307	0.312

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

RI p-values: the p-values derived by randomization inference for each regression model are calculated based on a large number of possible block and cluster assignments of billboards to treatment.

Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.

Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster.

5.10 Results for geographic region-specific model conditioning on battleground state status

The following two tables replicate our aggregate level analysis, subsetting by battleground or non-battleground states.

Table 20: Turnout Rate Per Geographic Cluster (Battleground States)

	Dependent variable:				
	2020 Turnout Rate				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment (Dosage)	−0.004	0.002	0.004	0.005	0.005
	(0.007)	(0.005)	(0.003)	(0.003)	(0.002)
2018 Turnout Rate	0.631	0.502	0.401	0.381	0.388
	(0.078)	(0.064)	(0.051)	(0.048)	(0.043)
2016 Turnout Rate	0.633	0.884	1.029	1.058	1.128
	(0.094)	(0.075)	(0.061)	(0.056)	(0.055)
2014 Turnout Rate	0.308	0.334	0.435	0.413	0.315
	(0.118)	(0.091)	(0.066)	(0.059)	(0.052)
2012 Turnout Rate	−0.448	−0.578	−0.740	−0.735	−0.728
	(0.100)	(0.082)	(0.065)	(0.058)	(0.053)
Treatment Propensity = 0.5	0.013	−0.006	−0.011	0.017	0.031
	(0.019)	(0.036)	(0.135)	(0.027)	(0.014)
Treatment Propensity = 1		−0.017	−0.024	0.015	0.027
		(0.036)	(0.135)	(0.027)	(0.014)
Treatment Propensity = 1.5			−0.037	−0.002	0.018
			(0.136)	(0.028)	(0.015)
Treatment Propensity = 2			−0.035	−0.018	0.009
			(0.138)	(0.031)	(0.016)
Constant	0.121	0.117	0.142	0.108	0.080
	(0.031)	(0.042)	(0.136)	(0.030)	(0.019)
RI p-value	0.6612	0.389	0.2081	0.0815	0.0678
Pct geoclusters exposure >1	0.031	0.122	0.193	0.206	0.216
Observations	129	156	192	223	250
R^2	0.844	0.889	0.926	0.923	0.920
Adjusted R^2	0.836	0.884	0.922	0.920	0.917

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.
RI p-values: the p-values derived by randomization inference for each regression model are calculated based on a large number of possible block and cluster assignments of billboards to treatment.
Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.
Observations in each regression are restricted to geographic clusters with more than 100 registered voters.
All models weight for total number of registered voters in each geographic cluster.

Table 21: Turnout Rate Per Geographic Cluster (Non-battleground States)

	Dependent variable:				
	2020 Turnout Rate				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment (Dosage)	0.017	0.010	0.006	0.004	0.002
	(0.008)	(0.006)	(0.004)	(0.004)	(0.003)
2018 Turnout Rate	0.927	0.810	0.834	0.832	0.857
	(0.101)	(0.092)	(0.085)	(0.080)	(0.073)
2016 Turnout Rate	0.518	0.592	0.519	0.384	0.399
	(0.134)	(0.132)	(0.128)	(0.122)	(0.115)
2014 Turnout Rate	−0.104	−0.081	−0.058	−0.017	−0.009
	(0.084)	(0.073)	(0.066)	(0.061)	(0.056)
2012 Turnout Rate	−0.519	−0.512	−0.495	−0.442	−0.532
	(0.092)	(0.087)	(0.080)	(0.078)	(0.073)
Treatment Propensity = 0.5	0.059	0.025	0.038	0.031	0.045
	(0.064)	(0.292)	(0.208)	(0.040)	(0.271)
Treatment Propensity = 1	0.033	0.004	0.023	0.019	0.036
	(0.066)	(0.293)	(0.208)	(0.040)	(0.271)
Treatment Propensity = 1.5		−0.009	0.029	0.018	0.031
		(0.293)	(0.208)	(0.040)	(0.271)
Treatment Propensity = 2			0.002	0.004	0.022
			(0.210)	(0.043)	(0.271)
Constant	0.155	0.198	0.204	0.257	0.273
	(0.070)	(0.294)	(0.210)	(0.049)	(0.273)
RI p-value	0.0502	0.1135	0.1593	0.2453	0.366
Pct geoclusters exposure >1	0.064	0.121	0.211	0.243	0.262
Observations	172	198	256	305	374
R^2	0.774	0.777	0.733	0.672	0.649
Adjusted R^2	0.764	0.768	0.723	0.662	0.640

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

RI p-values: the p-values derived by randomization inference for each regression model are calculated based on a large number of possible block and cluster assignments of billboards to treatment.

Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.

Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster.

5.11 Results for geographic region-specific model conditioning on early vote state status

The following six tables and one figure condition our aggregate and individual analyses on the type of early voting available for various states. We consider whether early voting was available before we deployed our billboards, and if voting was or was not allowed before election day. There were 45 states with any kind of early voting in 2020, leaving only 5 states with no early voting. 18 states had early voting which started before our billboards went up, leaving 32 which started early voting after.

Table 22: Turnout Rate Per Geographic Cluster (States that Allowed Voting Before Boards Were Deployed)

	Dependent variable:				
	2020 Turnout Rate				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment Dosage	−0.015	−0.007	−0.003	−0.002	0.003
	(0.014)	(0.011)	(0.008)	(0.007)	(0.005)
2018 Turnout Rate	1.197	1.070	1.055	1.114	1.069
	(0.144)	(0.136)	(0.124)	(0.124)	(0.115)
2016 Turnout Rate	−0.132	0.239	0.389	0.219	0.425
	(0.184)	(0.179)	(0.167)	(0.176)	(0.183)
2014 Turnout Rate	0.199	0.149	0.110	0.130	0.054
	(0.149)	(0.129)	(0.110)	(0.100)	(0.092)
2012 Turnout Rate	−0.547	−0.735	−0.837	−0.766	−0.863
	(0.142)	(0.134)	(0.115)	(0.111)	(0.114)
Treatment Propensity = 0.5	0.065	0.063	0.065	0.039	0.046
	(0.061)	(0.138)	(0.124)	(0.055)	(0.027)
Treatment Propensity = 1		0.054	0.051	0.032	0.036
		(0.138)	(0.123)	(0.054)	(0.027)
Treatment Propensity = 1.5			0.047	0.029	0.024
			(0.125)	(0.055)	(0.027)
Constant	0.336	0.289	0.269	0.324	0.294
	(0.075)	(0.142)	(0.130)	(0.069)	(0.047)
Pct geoclusters exposure >1	0.021	0.119	0.23	0.271	0.314
Observations	94	109	139	155	175
R^2	0.723	0.749	0.745	0.718	0.720
Adjusted R^2	0.704	0.732	0.729	0.702	0.707

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

RI p-values: the p-values derived by randomization inference for each regression model are calculated based on a large number of possible block and cluster assignments of billboards to treatment.

Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.

Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.

Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster.

Table 23: Turnout Rate Per Geographic Cluster (States that Did Not Allow Voting Before Boards Were Deployed)

	Dependent variable:				
	2020 Turnout Rate				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment Dosage	0.006	0.005	0.004	0.005	0.006
	(0.005)	(0.003)	(0.002)	(0.002)	(0.001)
2018 Turnout Rate	0.662	0.547	0.499	0.469	0.471
	(0.056)	(0.046)	(0.041)	(0.038)	(0.033)
2016 Turnout Rate	0.884	0.950	0.988	1.000	1.008
	(0.080)	(0.064)	(0.055)	(0.049)	(0.042)
2014 Turnout Rate	−0.124	−0.070	−0.079	−0.082	−0.122
	(0.066)	(0.052)	(0.044)	(0.040)	(0.034)
2012 Turnout Rate	−0.354	−0.361	−0.356	−0.341	−0.297
	(0.060)	(0.051)	(0.043)	(0.040)	(0.035)
Treatment Propensity = 0.5	0.019	0.030	0.023	0.026	0.079
	(0.045)	(0.183)	(0.089)	(0.017)	(0.140)
Treatment Propensity = 1	−0.0002	0.014	0.011	0.020	0.074
	(0.045)	(0.183)	(0.089)	(0.017)	(0.141)
Treatment Propensity = 1.5		0.008	0.009	0.010	0.068
		(0.183)	(0.089)	(0.017)	(0.141)
Treatment Propensity = 2			0.006	0.008	0.055
			(0.090)	(0.019)	(0.141)
Constant	0.044	0.038	0.050	0.048	−0.017
	(0.049)	(0.184)	(0.090)	(0.022)	(0.141)
Pct geoclusters exposure >1	0.063	0.122	0.191	0.209	0.216
Observations	207	245	309	373	449
R^2	0.888	0.911	0.920	0.913	0.909
Adjusted R^2	0.884	0.908	0.917	0.911	0.907

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

RI p-values: the p-values derived by randomization inference for each regression model are calculated based on a large number of possible block and cluster assignments of billboards to treatment.

Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.

Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster.

0.5 miles

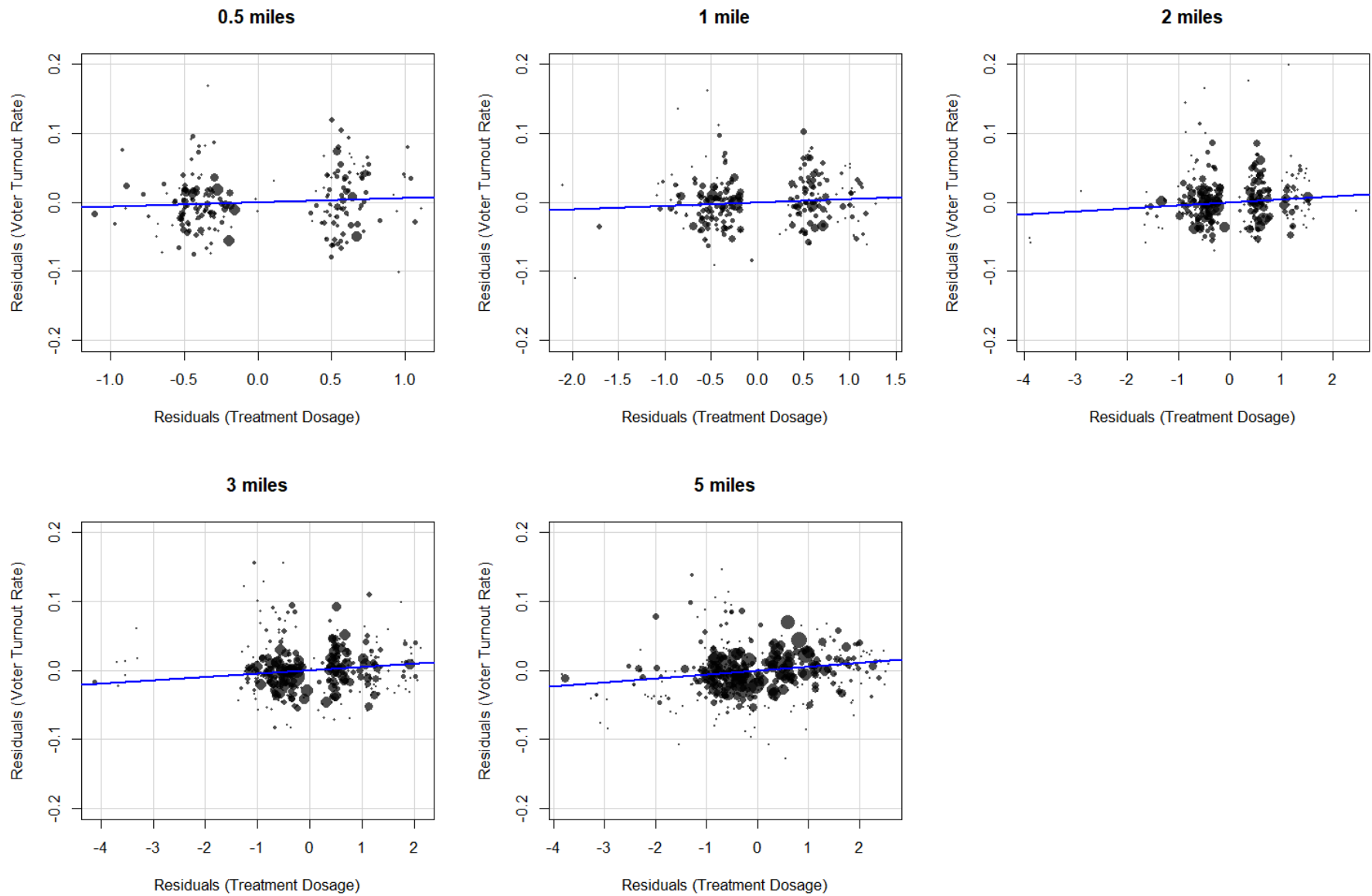**1 mile**

2 miles

3 miles

5 miles

Figure 7: States That Vote Only After Boards Were Up: Visualization of Marginal Effects of Dosage on Turnout Rates, by Radius

Table 24: Individual Level Analysis by Radii (By State Allowing Voting Before Boards Were Up)

	Dependent variable:	
	Voted in 2020	
	Before boards up	After boards up
	(1)	(2)
Treatment (Dosage)	0.009	−0.003
	(0.012)	(0.005)
Exposure to all boards	−0.013	−0.006
	(0.011)	(0.004)
Voted 2018	0.307	0.304
	(0.006)	(0.004)
Voted 2016	0.193	0.208
	(0.005)	(0.003)
Voted 2014	0.036	0.024
	(0.002)	(0.002)
Voted 2012	0.049	0.058
	(0.003)	(0.003)
Constant	0.386	0.386
	(0.015)	(0.010)
Observations	6,900,570	11,553,873
R^2	0.280	0.298
Adjusted R^2	0.280	0.298

Table 25: Turnout Rate Per Geographic Cluster (States that Allowed Voting Before Traditional Tuesday)

	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
			Dependent variable:		
			2020 Turnout Rate		
	(1)	(2)	(3)	(4)	(5)
Treatment Dosage	0.004	0.005	0.004	0.003	0.003
	(0.006)	(0.004)	(0.003)	(0.003)	(0.002)
2018 Turnout Rate	0.777	0.662	0.605	0.584	0.585
	(0.065)	(0.058)	(0.054)	(0.052)	(0.047)
2016 Turnout Rate	0.574	0.750	0.827	0.817	0.864
	(0.083)	(0.074)	(0.068)	(0.066)	(0.064)
2014 Turnout Rate	0.052	0.055	0.073	0.079	0.047
	(0.068)	(0.058)	(0.050)	(0.046)	(0.042)
2012 Turnout Rate	−0.400	−0.481	−0.541	−0.539	−0.567
	(0.067)	(0.061)	(0.054)	(0.052)	(0.050)
Treatment Propensity = 0.5	0.008	0.026	0.019	0.015	0.068
	(0.061)	(0.274)	(0.141)	(0.028)	(0.254)
Treatment Propensity = 1	−0.015	0.008	0.005	0.007	0.058
	(0.062)	(0.274)	(0.141)	(0.027)	(0.254)
Treatment Propensity = 1.5		0.006	0.004	0.002	0.050
		(0.275)	(0.141)	(0.028)	(0.254)
Treatment Propensity = 2			0.001	0.003	0.047
			(0.143)	(0.031)	(0.254)
Constant	0.141	0.118	0.136	0.153	0.104
	(0.065)	(0.275)	(0.142)	(0.032)	(0.254)
Observations	288	339	426	504	600
R^2	0.789	0.814	0.814	0.789	0.770
Adjusted R^2	0.783	0.809	0.810	0.785	0.766

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

RI p-values: the p-values derived by randomization inference for each regression model are calculated based on a large number of possible block and cluster assignments of billboards to treatment.

Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.

Observations in each regression are restricted to geographic clusters with more than 100 registered voters.

Table 26: Turnout Rate Per Geographic Cluster (States with Only Traditional Tuesday Voting)

	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
			Dependent variable:		
			2020 Turnout Rate		
	(1)	(2)	(3)	(4)	(5)
Treatment Dosage	0.010	−0.019	−0.014	−0.001	−0.018
	(0.015)	(0.013)	(0.008)	(0.007)	(0.003)
2018 Turnout Rate	0.325	0.415	1.108	0.899	0.499
	(0.254)	(0.231)	(0.154)	(0.255)	(0.125)
2016 Turnout Rate	1.537	1.136	0.320	0.148	1.375
	(0.410)	(0.374)	(0.276)	(0.377)	(0.185)
2014 Turnout Rate	−0.347	−0.012	0.135	−0.011	−0.320
	(0.180)	(0.164)	(0.097)	(0.124)	(0.066)
2012 Turnout Rate	−0.825	−0.526	−0.655	−0.120	−0.663
	(0.275)	(0.376)	(0.207)	(0.215)	(0.078)
Treatment Propensity = 0.5		−0.034	−0.053	0.015	−0.049
		(0.052)	(0.070)	(0.033)	(0.014)
Treatment Propensity = 1			−0.043	−0.004	−0.048
			(0.067)	(0.029)	(0.012)
Treatment Propensity = 1.5			−0.044	0.022	−0.031
			(0.068)	(0.028)	(0.011)
Treatment Propensity = 2					
Constant	0.110	0.112	0.272	0.182	0.104
	(0.072)	(0.082)	(0.071)	(0.051)	(0.023)
Observations	13	15	22	24	24
R^2	0.976	0.977	0.986	0.974	0.993
Adjusted R^2	0.959	0.959	0.977	0.960	0.990

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

RI p-values: the p-values derived by randomization inference for each regression model are calculated based on a large number of possible block and cluster assignments of billboards to treatment.

Pct geoclusters exposure >1: percentage of geographic clusters exposed to more than one billboard for a given radius.

Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster. All models weight for total number of registered voters in each geographic cluster.

Table 27: Individual Level Analysis (By State Allowing Traditional Tuesday Voting)

	Dependent variable:	
	Voted in 2020	
	Before Tuesday	On Tuesday
	(1)	(2)
Treatment (Dosage)	−0.004	0.037
	(0.004)	(0.017)
Exposure to all boards	−0.005	−0.025
	(0.003)	(0.019)
Voted 2018	0.305	0.311
	(0.004)	(0.010)
Voted 2016	0.202	0.206
	(0.003)	(0.007)
Voted 2014	0.029	0.036
	(0.002)	(0.003)
Voted 2012	0.054	0.049
	(0.002)	(0.004)
Constant	0.387	0.363
	(0.009)	(0.021)
Observations	17,628,792	825,651
R^2	0.291	0.296
Adjusted R^2	0.291	0.296

5.12 Digital boards

Table 28: Digital Boards: Marginal effect of treatment dosage on a geographic region's voter turnout rate, by radii

	Dependent variable:				
	2020 Turnout Rate				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment (Dosage)	0.011	0.009	0.004	0.002	0.002
	(0.009)	(0.006)	(0.004)	(0.003)	(0.002)
2018 Turnout Rate	0.446	0.397	0.414	0.434	0.435
	(0.096)	(0.081)	(0.064)	(0.058)	(0.051)
2016 Turnout Rate	1.218	1.144	1.100	1.045	1.098
	(0.141)	(0.120)	(0.097)	(0.090)	(0.082)
2014 Turnout Rate	0.122	0.137	0.066	0.031	−0.024
	(0.098)	(0.080)	(0.057)	(0.050)	(0.042)
2012 Turnout Rate	−0.879	−0.719	−0.629	−0.575	−0.549
	(0.118)	(0.099)	(0.077)	(0.074)	(0.069)
Treatment Propensity = 0.5	0.043	0.029	0.034	0.017	0.089
	(0.066)	(0.199)	(0.117)	(0.020)	(0.133)
Treatment Propensity = 1	0.035	0.011	0.023	0.009	0.072
	(0.067)	(0.199)	(0.117)	(0.020)	(0.133)
Treatment Propensity = 1.5		0.012	0.015	0.009	0.072
		(0.199)	(0.117)	(0.020)	(0.133)
Treatment Propensity = 2			0.015	−0.003	0.066
			(0.118)	(0.021)	(0.133)
Constant	0.122	0.117	0.112	0.136	0.048
	(0.070)	(0.200)	(0.119)	(0.027)	(0.134)
Observations	109	133	191	241	295
R^2	0.885	0.889	0.900	0.890	0.882
Adjusted R^2	0.877	0.882	0.895	0.885	0.878

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

The one-tailed *RI p-values* were derived by randomization inference for each regression model, calculated based on a large number of block and cluster assignments of billboards to treatment. Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster.
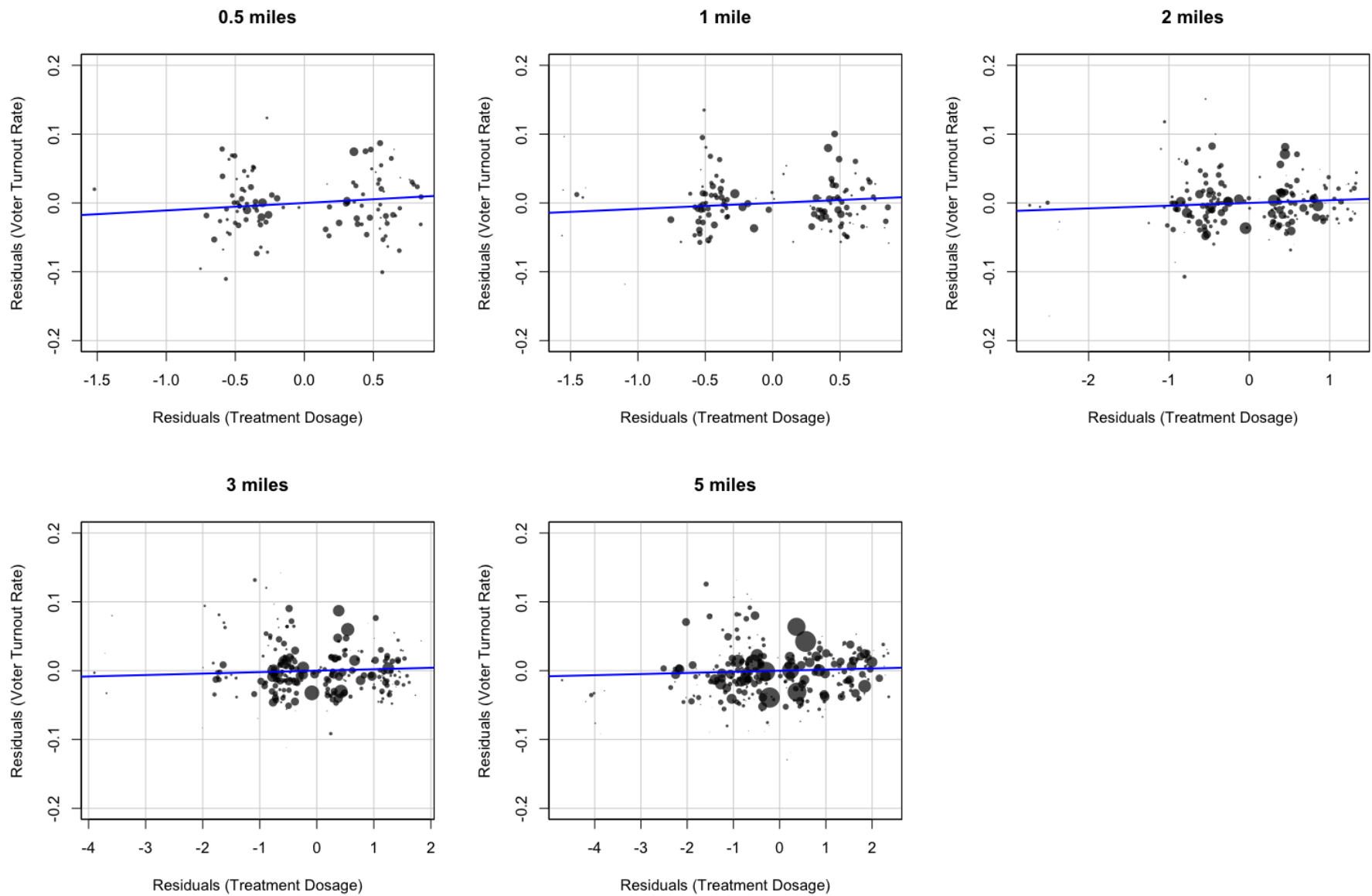
Figure 8: Digital Boards: Visualization of Marginal Effects of Dosage on Turnout Rates, by Radius

Table 29: Digital Boards: Turnout Rate Per Geographic Cluster (Battleground States)

			Dependent variable:		
			2020 Turnout Rate		
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment Dosage	−0.005	0.004	0.003	0.005	0.001
	(0.018)	(0.011)	(0.006)	(0.004)	(0.002)
2018 Turnout Rate	0.543	0.163	0.083	0.043	−0.013
	(0.230)	(0.163)	(0.105)	(0.090)	(0.076)
2016 Turnout Rate	1.312	1.584	1.703	1.867	2.068
	(0.306)	(0.231)	(0.164)	(0.139)	(0.115)
2014 Turnout Rate	−0.052	0.081	0.040	−0.186	−0.461
	(0.437)	(0.347)	(0.228)	(0.193)	(0.162)
2012 Turnout Rate	−0.927	−0.948	−0.929	−0.855	−0.734
	(0.314)	(0.238)	(0.155)	(0.143)	(0.142)
Treatment Propensity = 0.5	−0.030	−0.013	0.008	−0.013	−0.022
	(0.044)	(0.049)	(0.029)	(0.030)	(0.015)
Treatment Propensity = 1		−0.031	−0.0003	−0.003	−0.013
		(0.049)	(0.029)	(0.030)	(0.015)
Treatment Propensity = 1.5			−0.003	−0.013	−0.008
			(0.025)	(0.028)	(0.015)
Treatment Propensity = 2				−0.023	−0.001
				(0.026)	(0.012)
Constant	0.172	0.160	0.125	0.102	0.049
	(0.067)	(0.075)	(0.050)	(0.046)	(0.033)
Observations	39	52	73	88	92
R^2	0.845	0.892	0.929	0.936	0.952
Adjusted R^2	0.816	0.875	0.920	0.929	0.946

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

The one-tailed *RI p-values* were derived by randomization inference for each regression model, calculated based on a large number of block and cluster assignments of billboards to treatment. Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster.

Table 30: Digital Boards: Turnout Rate Per Geographic Cluster (Non-battleground States)

	Dependent variable:				
	2020 Turnout Rate				
	0.5 Miles	1 Mile	2 Miles	3 Miles	5 Miles
	(1)	(2)	(3)	(4)	(5)
Treatment Dosage	0.021	0.015	0.007	0.004	0.003
	(0.011)	(0.008)	(0.005)	(0.003)	(0.002)
2018 Turnout Rate	0.506	0.559	0.631	0.661	0.607
	(0.125)	(0.108)	(0.088)	(0.078)	(0.065)
2016 Turnout Rate	1.025	0.809	0.671	0.577	0.741
	(0.190)	(0.180)	(0.152)	(0.132)	(0.112)
2014 Turnout Rate	0.157	0.156	0.056	0.011	−0.033
	(0.102)	(0.087)	(0.063)	(0.054)	(0.046)
2012 Turnout Rate	−0.768	−0.575	−0.428	−0.340	−0.369
	(0.142)	(0.124)	(0.102)	(0.094)	(0.084)
Treatment Propensity = 0.5	0.071	0.066	0.050	0.032	0.073
	(0.067)	(0.208)	(0.125)	(0.024)	(0.137)
Treatment Propensity = 1	0.041	0.049	0.037	0.023	0.057
	(0.068)	(0.207)	(0.124)	(0.024)	(0.137)
Treatment Propensity = 1.5		0.029	0.028	0.024	0.057
		(0.207)	(0.124)	(0.024)	(0.137)
Treatment Propensity = 2			0.011	−0.002	0.048
			(0.128)	(0.027)	(0.137)
Constant	0.107	0.113	0.138	0.169	0.096
	(0.074)	(0.211)	(0.129)	(0.037)	(0.141)
Observations	70	81	118	153	203
R^2	0.887	0.863	0.879	0.868	0.846
Adjusted R^2	0.874	0.848	0.869	0.860	0.838

Treatment dosage: clusters may be exposed from 0 to 3 treated boards in the half-mile radius; 0 to 3 treated boards in the 1-mile radius; 0 to 4 treated boards in the 2-mile radius; 0 to 5 treated boards in the 3-mile radius; and 0 to 4 treated boards in the 5-mile radius.

The one-tailed *RI p-values* were derived by randomization inference for each regression model, calculated based on a large number of block and cluster assignments of billboards to treatment. Observations in each regression are restricted to geographic clusters with more than 100 registered voters. All models weight for total number of registered voters in each geographic cluster.

Table 31: Digital Boards: Individual Level Analysis

	Dependent variable:		
	Voted in 2020		
	Overall	Battleground	Non-battleground
	(1)	(2)	(3)
Exposure to treated boards	−0.003	−0.007	−0.001
	(0.0002)	(0.004)	(0.005)
Exposure to all boards	−0.015	−0.007	−0.011
	(0.0002)	(0.006)	(0.006)
Voted 2018	0.289	0.323	0.278
	(0.001)	(0.014)	(0.008)
Voted 2016	0.200	0.218	0.191
	(0.001)	(0.008)	(0.008)
Voted 2014	0.021	0.026	0.020
	(0.0004)	(0.004)	(0.003)
Voted 2012	0.058	0.073	0.052
	(0.0005)	(0.006)	(0.003)
Constant	0.429	0.351	0.449
	(0.0004)	(0.026)	(0.021)
Observations	4,502,227	1,062,865	3,439,362
R^2	0.293	0.333	0.275
Adjusted R^2	0.293	0.333	0.275

The variable *Exposure to all boards* is the predicted number of days that the individual was exposed to at least one board, either treated or control. It has a mean of 0.519 with a standard deviation of 0.927.

The variable *Exposure to treated boards* is the predicted number of days that the individual was exposed to at least one treated board. It has a mean of 1.046 with a standard deviation of 1.061.

These regressions include only individuals living within a maximum radius of five miles from any digital billboard. Standard errors were clustered by billboard cluster. No weights were included for the individual-level regressions.