

Getting Settled in Your New Home: The Costs of Moving on Voter Turnout

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Abstract

What is the dynamic impact of moving on turnout? Moving depresses turnout by imposing various costs on voters. However, movers eventually settle down, and such detrimental effects can disappear over time. I measure these dynamics using United States Postal Services (USPS) data and detailed voter panel data from Orange County, California. Using a generalized additive model, I show that previously registered voters who move close to the election are significantly less likely to vote (at most -16.2 percentage points), and it takes at least six months on average for turnout to recover. This dip and recovery is not observed for within-precinct moves, suggesting that costs of moving matter only when the voter's environment has sufficiently changed. Given this, can we accelerate the recovery of movers' turnout? I evaluate an election administration policy that resolves their re-registration burden. This policy proactively tracks movers, updates their registration records for them, and notifies them by mailings. Using a natural experiment, I find that it is extremely effective in boosting turnout (+5.9 percentage points). This success of a simple, pre-existing, and non-partisan safety net is promising, and I conclude by discussing policy implications.

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1 Introduction

Americans are very mobile—at least 10% of Americans move every year (United States Census Bureau, 2018*a,c*). This is an internal migration rate that is almost twice as high as other developed countries' rates. In 2018, with 10.1% of 'mover' rate, more than 30 million people changed residences in the United States. And while moving in itself is a non-political life event, it has a large impact on people's political participation, particularly by lowering their turnout (Squire, Wolfinger and Glass, 1987; Highton, 2000).

Many different types of costs obstruct movers' turnout. A voter whose residence changed has to re-register to vote with her new address and figure out where her new polling place is, which poses an administrative burden. She has to learn the names and the issue positions of her new political representatives if she crosses political district lines. In addition, she may no longer have friends and neighbors in her new community, which can break the social and contextual cues that motivate her to turn out.

On the other hand, a voter is rarely a mover for a long time. She eventually settles into her new home, transitions into a 'stayer,' and overcomes the detrimental shock of moving on political participation. Eventually, she will have more time to re-register, to learn about the new political districts, and to build social ties. Given this, what is the *dynamic* impact of moving on turnout? If there is a significantly negative effect of moving, can we offset the lowered turnout of movers by a policy intervention? I answer these questions using detailed voter panel data from California's Orange County between 2016 and 2018 elections, appended with data from the United States Postal Services (USPS).

The existing studies have been capped by resource constraints, by either relying on settings where some type of costs are entirely alleviated by the institutional setting, or by using surveys with a small sample size and rough, self-reported measurements related to moving. This unique administrative dataset on the American electorate—large, accurate, and comprehensive—helps fill the gap in the literature by overcoming measurement constraints present in survey-based research.

Using a generalized additive model, I show that previously registered voters who move close to the election are significantly less likely to vote. Compared to a voter who has lived for a full two years at her new residence, the propensity to vote is at most 16.2 percentage points lower. The detrimental effect is largely transitory, but I find that it takes at least six months on average for turnout to recover. The nonlinear dip and recovery pattern is not seen for 'small' moves, where information cost of voting is nonexistent or

very low. This suggests that costs of moving matter only when the voter’s environment has sufficiently changed.

Time does help a voter recover from moving. Yet, is there a way to quickly offset the lowered turnout other than simply waiting—i.e., speed the convergence? I evaluate an election administration policy designed to retain movers by lifting their burden of having re-register to vote. I exploit a natural experiment in which by a chance practice of election administration policy, only some movers were proactively tracked, had their voter registration updated for them, and were notified of the automated change by an official mailing. I find those who received this mailing turned out 5.9 percentage points more. This is a highly effective get out the vote (GOTV) measure. Moreover, this is a simple, non-partisan, and pre-existing policy based on the National Voter Registration Act of 1993, which is very promising for a scale-up. I discuss the policy implications, and suggest that restrictions placed on this policy should be lifted if election administrators want to increase turnout of voters who move close to the Election Day.

2 Literature

2.1 Who Are the Movers?

As aforementioned, at least 10% of Americans move annually. This is a decreased proportion compared to decades ago, for example around when Squire, Wolfinger and Glass (1987) was written at nearly 30%, but still a formidable percentage. Table 1 shows geographic mobility for the last five years, estimated from the Current Population Survey (CPS), 2013-2018. It also provides more details into where movers are headed to. Two-thirds of internal migration within the United States are same-county moves. One-fifth of moves are same-state, cross-county moves, and about 15% of Americans cross state borders.

It should first be recognized that movers are nonrandom, self-selected group. What does it mean for a voter to have changed residences?¹ They are likely to be younger and renters (Squire, Wolfinger and Glass, 1987; McDonald, 2008). Some also document that

¹I use residential mobility instead of geographic mobility to refer to any changes in residence, regardless of distance. According to Gillespie (2016), geographic mobility refers to “long-distance household migration across some administrative or geopolitical boundary,” whereas residential mobility refers to “short-distance household mobility.” Highton (2000) uses residential mobility vs. community mobility similarly to distinguish changes in residences from changes in communities.

	2017-2018	2016-2017	2015-2016	2014-2015	2013-2014
As proportion of population,					
— Movers	10.1	11.0	11.2	11.6	11.5
— Non-movers	89.9	89.0	88.8	88.4	88.5
As proportion of within-country movers,					
— Same-county movers	63.7	64.2	63.8	66.1	67.8
— Same state, different county movers	20.8	19.8	22.2	19.2	18.7
— Different state movers	15.5	15.9	14.1	14.7	13.5

Table 1: Annual Geographical Mobility Rates, By Type of Movement: 2013-2018

they are more likely to be non-white (McDonald, 2008) and higher educated (Squire, Wolfinger and Glass, 1987). But what makes them move?

Reason for Moving	2017-2018	2016-2017	2015-2016	2014-2015	2013-2014
1 Wanted new or better home/apartment	16.4	16.0	17.4	15.3	15.8
2 To establish own household	12.6	11.5	12.2	11.0	11.1
3 Other family reason	11.1	11.3	10.5	14.3	13.4
4 New job or job transfer	10.3	9.9	10.8	10.6	9.7
5 Wanted cheaper housing	7.9	8.3	8.2	7.5	9.4
6 Wanted to own home, not rent	7.3	7.3	5.9	5.3	5.6
7 Other housing reason	6.7	7.6	6.7	14.4	12.8
8 To be closer to work/easier commute	5.6	5.5	6.0	4.9	6.2
9 Other reasons	5.0	5.0	4.4	1.5	1.0
10 Change in marital status	4.4	5.1	4.8	5.8	4.9
11 To attend or leave college	2.8	3.0	3.2	0.3	0.5
12 Wanted better neighborhood/less crime	2.6	2.8	3.1	2.9	3.0
13 Health reasons	1.8	1.9	1.8	0.3	0.4
14 To look for work or lost job	1.5	1.3	1.5	1.6	2.1
15 Retired	1.1	0.8	0.7	1.1	0.7
16 Other job-related reason	1.1	0.9	1.2	2.3	2.0
17 Foreclosure/eviction	0.7	1.1	0.9	0.7	1.3
18 Change of climate	0.7	0.5	0.8	0.2	0.1
19 Natural disaster	0.5	0.3	0.1	—	0.0

Table 2: Reasons for Moving, 2013-2018, The Census Bureau, Aligned in Descending Order Using 2017-2018 Responses

Table 2 displays the reasons cited for moving in percentages from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (United States Census Bureau, 2018b), 2013-2018. In 2017 to 2018, 40.9% of moves were housing-related,² 28.1%

²These are wanted own home, not rent, wanted new or better home/apartment, wanted better neighborhood/less crime, wanted cheaper housing, foreclosure/eviction, and other housing reason.

were family-related,³ and 18.5% job-related.⁴ The first and foremost reason seems to be that the mover wanted a new or better home (16.4%).

As can be seen, factors behind moving are diverse and not dominated by one particular reason. Age is clearly a key higher-level variable, as many events in a person's life cycle such as marriage or job seem to trigger residential mobility. Indeed, the Census Bureau has consistently reported that people in their mid to late twenties have the highest mobility rate, at 65.5% during a five-year interval (Ihrke and Faber, 2012).⁵ While I recognize that movers are a self-selected group, the interest of this paper is analyzing turnout changes within movers. Hence, the upcoming analysis is entirely conditional on being a mover within the last two years.

2.2 The Costs of Turnout

The analysis of turnout for movers is part of the larger literature of what influences individual turnout, a key indicator and foundation of legitimate democracy. Previous research has shown that there are a variety of reasons why movers will face additional burdens when turning out to vote. Residential mobility can activate one or more of these barriers, as can other factors. While many different costs of voting exist, three types of costs are relevant: convenience costs, information costs, and social costs.

The key idea behind *convenience costs* is that turnout can improve or deteriorate with barriers between the voter and the polling place (or a vote-by-mail ballot), and because voter registration is not automatic in the U.S.,⁶ the major discussion has been focused on institutional barriers to registration (Rosenstone and Wolfinger, 1978; Wolfinger, Highton and Mullin, 2005; Ansolabehere and Konisky, 2006; Nickerson, 2014; Street et al., 2015).

³These are change in marital status, to establish own household, and other family reason. Other family reason is the third-largest factor in moving, but an ambiguous category. To supplement this loss in information, the Census Bureau has conducted an analysis of a write-in expansion (Ihrke, 2016). They determined that the common write-in responses for this particular category were such as moved with family member(s), pregnant/had a baby/adoption, assist or take care of family member(s), death of a family member, and move closer to family.

⁴These are new job or job transfer, to look for work or lost job, to be closer to work/easier commute, retired, and other job-related reason.

⁵In sociology, the life-cycle theory of household mobility argues that individuals relocate because they are dissatisfied with their current housing when there is a change in family size and household composition (Rossi, 1980; Gillespie, 2016). Highton and Wolfinger (2001) on the other hand concluded that early adult roles have inconsistent and sometimes negative association with turnout, while age significantly boosts turnout, independent of assuming social roles.

⁶The only exception is the state of Oregon, which first implemented automatic voter registration (AVR) in 2015.

For movers, the costs are the burden of re-registering to vote to reflect their recentmost address. Squire, Wolfinger and Glass (1987) show that the longer people live in their homes, the more likely that they will turn out, attributing it to having more time to newly register. Highton (2000) shows that changing residences accounts more for a drop in turnout than changing communities, suggesting that re-registration costs are high.

Information costs constitute the cost of (1) having to learn about the choices available on the ballot for the new political jurisdiction, and (2) having to learn where, if changed, a new polling place is. By the same vein, voters roll off for unfamiliar choices (Wattenberg, McAllister and Salvanto, 2000) or when they are redistricted/reprecincted (Hayes and McKee, 2009; Brady and McNulty, 2011; Amos, Smith and Claire, 2017). Hansen (2016) finds that crossing municipality borders did not lower turnout, but along with Squire, Wolfinger and Glass (1987), finds that educated voters are less affected by moving.

Social costs usually indicates a decrease in social rewards from voting, i.e., a decreasing D term. Because turnout is perceived as a desirable behavior, it results in intrinsic satisfaction from social networks (Rosenstone and Hansen, 1993). A higher degree of social “embeddedness” will give higher turnout, while its disruption result in a lower turnout, such as recent loss of a spouse (Hobbs, Christakis and Fowler, 2014). Moving can also cut social ties and lower turnout: Aldrich, Montgomery and Wood (2011) discuss the disruption of voter’s habit formation by moving; Gay (2012) shows that mobility experiments had a negative impact on poor voters’ turnout whose social relations were severed; Hansen (2016) argues that when there are no convenience costs, absence of evidence for information costs translates into evidence of social costs on turnout.

All in all, moving hampers turnout in a variety of ways. But how does the voter *adapt* to the damage incurred by moving over time, i.e., depending on residential stability, or how long she has lived in her new residence? Previous literature has been mostly built on surveys, which were unfortunately resource-constrained. Movers are but a small part of the already strained survey sample, and it is plausible that movers are less likely to be contacted for or answer surveys. Highton and Wolfinger (2001) pooled six presidential elections’ worth respondents for a sufficiently large sample size within the National Election Studies (NES) for a total of 9,435 respondents. The CPS’s sample size is much larger, but it faces the same problem, and its technical documentation briefly touches upon the bias and sample variation from the exclusion of movers.⁷ Moreover, the CPS

⁷In 16-4, *Quality Indicators of Nonsample Errors*, the authors write as follows:

Panel nonresponse. (M)overs are not followed, but the new household members are interviewed ... Out-movers were more likely to be unemployed but more likely to respond

breaks down residential stability into five uneven categories.⁸ The only paper that uses administrative data is Hansen (2016), but here residential stability is again presented in uneven, arbitrary categories of 0-30 days, 31-90 days, and 90 days and beyond.

The detailed voter data that I use improves upon these measurement constraints. I have sufficient sample size to fully use the residential stability information without discretizing them into coarser categories. What is more, it is accurate and not reliant upon self-reported moving and turnout information, the latter of which especially can be subject to social desirability bias. To cap it all, the data contains fine-grain information on their old and new residences and political districts, which I can geocode and use to identify different environments in which adaptations can occur heterogeneously.

In particular, I build upon the less-studied aspect of information costs of moving, and show that turnout depends on not only how long you have lived there, but also how much your environment changed by moving. I show that dynamic adaptation occurs differently by what information barriers the movers is facing.

Finally, this paper provides a first-ever evaluation of an election administration policy aimed to retain movers, rooted in the National Voter Registration Act of 1993 (NVRA). The policy idea is in fact first suggested in Squire, Wolfinger and Glass (1987) in discussing how to increase turnout and also briefly discussed in Wolfinger and Highton (1995) and Highton and Wolfinger (1998). However, again due to resource constraints, the authors were not able to estimate the partial effect of the policy.

3 Data and Context

This Section describes the data acquisition and the sample in detail. The data is provided by official election administrators, and it is a combination of official voter registration records and the change-of-address requests filed at the United States Postal Services (USPS), a rare change to look in-depth at movers' political participation. In my final sample, out of roughly 1.5 million registered voters, I have 102,425 movers in the data. For details on data wrangling and descriptive statistics, see Appendix B and C.

compared with in-movers.

⁸CPS distinguishes the length by (1) less than 1 month, (2) 1-6 months, (3) 7-11 months, (4) 1-2 years, (4) 3-4 years, (5) 5 years or longer.

3.1 Official Voter Database from Orange County, California

Data Acquisition. The data is provided by the Orange County Registrar of Voters (OCROV) in California. The acquisition is part of a long-term, larger project built on strong cooperation and trust with election administrators of Orange County, who are the leading public servants in terms of innovative administration practices. Including the 2016 general election snapshot, I have received 156 daily “snapshots” of the voter data from April 26, 2018 to December 31, 2018, which cover 89% of business days within the period. This is an unprecedented level of granular details provided for academic studies, and provides high accuracy in capturing the dynamic aspect of the voter file.

Given the daily snapshots, I applying entity resolution between them to reverse-engineer transaction logs to the data. More simply, this allows me to look into what records are added, dropped, or changed, on a daily level. By closely observing how the data changes day to day, I am able to extract not only who moves, but when they re-register and through what means. These details contain insight into what the voter is doing, and what policies are affecting the re-registration or voting decisions. No other existing compilation of voter data provides such information, and none certainly have been augmented with the NCOA dataset. For more details on the data, refer to Kim, Schneider and Alvarez (forthcoming).⁹

Asides from being able to determine mover status, the voter data carries many useful covariates. It carries full street-level addresses of old and new residences which can be geocoded into specific latitude/longitudes and accompanying political districts. It also has date of birth, original place of birth, partisan affiliation, precinct assignment, political district assignments such as congressional districts, first and most recent voter registration date, and the reasons for the last update of the registration. Most of all, it has accurate records of voting history that is not inflated by social desirability bias as in surveys. I also augment the data with imputed gender and race.¹⁰

Classifying Movers. Movers are defined as those who have moved after 2016 general Election Day and before the 2018 general Election Day, up to October 31, 2018—that is,

⁹Caltech IRB number is 18-0802.

¹⁰While there is a ‘gender’ entry in the Orange County dataset, most of the entries are missing. R package `gender` (Mullen, 2018; Blevins and Mullen, 2015) of rOpenSci project helps infer gender by first names and the Social Security Administration’s yearly dataset. If there is an entered gender or a prefix (e.g. ‘Mr.’), it overrides the inferred gender. For race/ethnicity, `wru` uses surname and geolocation to infer race (Khanna, Imai and Jin, 2017; Imai and Khanna, 2016) using Bayesian updating. The inference is primarily performed on the census block level.

those who have moved within two years of Election Day, as in Squire, Wolfinger and Glass (1987). My sample is limited to in-county movers, which enables full visibility of their voting history for the dependent variable, which is the 2018 general election turnout. Note that in-county movers form the lion's share of movers at more than 63% as seen in Table 1, giving sufficient number of cases to analyze movers' political behavior.

I classify movers from stayers by closely monitoring the changes in the residential addresses of voters. This may seem initially odd because not all movers will voluntarily report their new address to the Registrar. Indeed, while a voter can voluntarily re-register to vote with their new address, or visit the Department of Motor Vehicles and update their registration information there, not all voters will do either of these things. The OCROV writes in its website as follows:

Unfortunately most people that move notify their banks, car lenders, family and friends - even magazine subscriptions before they change their voter registration. You can help us to keep our voter lists up-to-date by taking a few minutes to notify us of changes in your life.

In Orange County, it is possible to detect movers just by observing the Registrar's changing data due to a particular election administration practice called the National Change of Address (NCOA) processing. While originally designed as voter list maintenance activity, the processing allows the Registrar to detect movers in advance, even when they do not voluntarily inform the election administrators. Section 3.2 illustrates this.

3.2 National Change-of-Address (NCOA) Data

The NVRA, while mainly about offering more opportunities to register to vote, also requires the states to maintain accurate, up-to-date database. To achieve this goal, states can use the permanent change-of-address requests submitted to the United States Postal Service (USPS). Individuals submit such requests to the USPS because then the agency will forward mail from their old residence to the new one. USPS maintains the last 48 months' requests, called the National Change-of-Address (NCOA) data, which approximates 160 million change-of-address (COA) records with accurate old and new residences, as well as when the individual moved and requested the data.

While not strictly required to use the NCOA dataset, California's Election Code requires the Secretary of State to match the statewide voter file to the NCOA data (called NCOA processing). If existing voters have changed addresses, the Secretary will then transfer

the data to relevant counties. For protection of voters' privacy, the change-of-address request dates are coarsened to the month of the move instead of the exact date, and the data is disseminated on a monthly basis. Within the Orange County data in question, there were two major NCOA processings, respectively on July 26th and December 20th.

If the address change is within the same county, the voter file is *automatically* updated with a forwardable address confirmation mailing sent to the voter. If this update should be reverted because there was an error or the move is temporary, the voter can inform the Registrar using a prepaid postage or a phone call. For the full wording of the various legal statutes and California's NVRA guidelines, see Appendix A.

Altogether, by examining the changing data, it is possible to detect between 2016-2018 elections (1) all voters who have voluntarily disclosed their change of address to the Registrar before any NCOA processings, and (2) all voters who did not but filed a change of address with the USPS, thereby being detected through NCOA processing and ultimately had their address updated within the Registrar's database.¹¹ I classify them altogether as movers between 2016-2018 elections. Again, this is a valuable addition by the NCOA dataset.

Validated Movers. The NCOA data enables the classification of movers, as the Registrar performed NCOA processing up to movers of November 2018. The only undetected movers would be those who did not voluntarily inform the Registrar, the DMV, nor the USPS, and did not vote in either the primary or general election with the updated address. While this is theoretically possible, I limit my sample of movers to those *who requested a change of address with the USPS*, independent of informing the Registrar.

This is a validation measure which ensures that the measured mobility is not a correction of incorrect data entries/typos. Suppose that a voter has lived at 110 N. California Boulevard, and the address changes to 1100 N. California Boulevard in the voter data. Or suppose that I see a voter's record change from 200 S. Main Street to 200 N. Main Street. Is this a real change in physical residences, or a modification in data with no entailing real-world change? By itself it is difficult to discern. However, even if the old and new addresses look similar, if I see that in the USPS data that the voter has requested a change of address, I can be assured that there is a true change in residences.

¹¹In Orange County, another source of third party address changes is the consumer credit reporting agency, which a county can use to verify a voter's residence per CA Elec Code § 2227 (2017). However, as we detail above, we do not use this class of movers, which form a very small percentage.

In addition, I am able to get an accurate measure of when a voter has moved, which is something not available in the voter database. For instance, if a voter voluntarily reports a new address to the Registrar in October 2018 but does not have any record in the NCOA database, it is incorrect to impute her moving date to October 2018 because it would be confounded by the fact that closer to the election, voters will remember to re-register more. As this paper's interest is in the dynamic effect of moving, ascertaining the timing of the move is vital.

While these two points are strong pros in limiting the sample of movers to those who officially requested the change of address, one point should be noted. There is no study to my knowledge about who chooses to request the change of address, as opposed to those who do not. The data itself is certainly popular—for example, the Census Bureau has used the NCOA data to supplement the tracking of migrations (Hogan, 2008). The youngest electorate, e.g. teenagers, may be underrepresented, as they are likely to have little mail in their name. Not many more educated guesses are possible.¹²

The OCROV used a USPS-licensed vendor to provide me with the augmented data. Some 2 out of 3 movers that I had classified could be matched to the NCOA dataset, with the same set of old and new addresses as can be found in the voter file. In the end I have around 100,000 voters.

4 Dynamic Impact of Moving

In this Section, I describe how I estimate how voters adapt to moving—i.e., the impact of moving over time. In particular, I show how the impact varies by different hurdles of moving, defined by different informational environments.

4.1 Methods

The dependent variable used in this paper is the turnout for 2018 general election. Residential stability, or months lived at the new residence, is the key explanatory variable. This is a continuous variable ranging from 1 to 24 months lived in the new residence before the 2018 General Election. Figure 1 shows the distribution of number of movers

¹²Comparison within the available voter file is not a valid comparison, since the baseline population will be then those who voluntarily reports to the Registrar or those who vote without the change of address requests.

by each value. For example, those who have lived four months at their new home by November Election Day are essentially movers in July 2018. There is a seasonality as summer is the most popular time for moving, and January the least popular month.

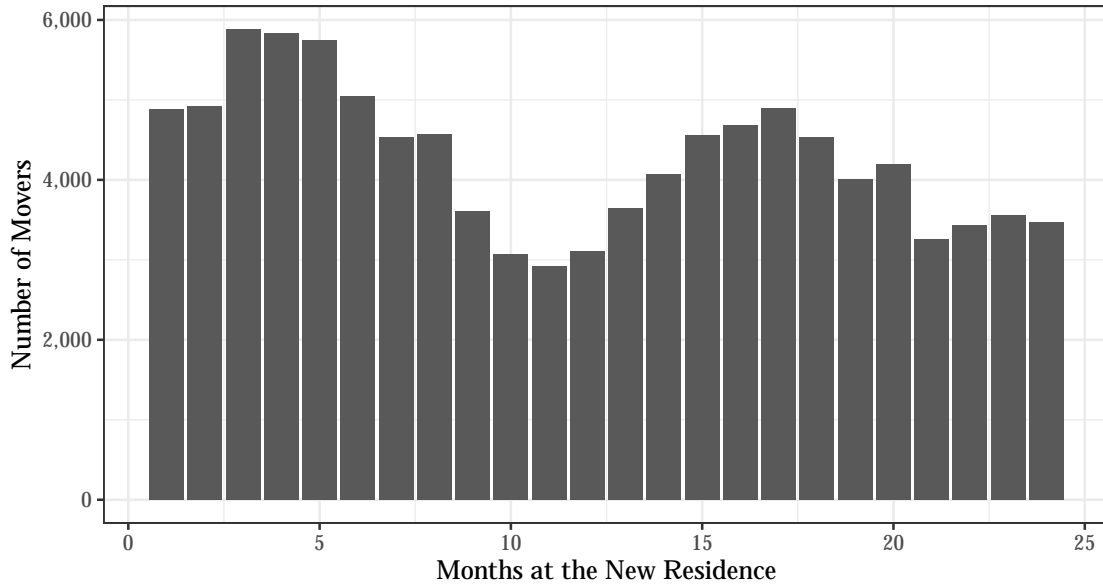


Figure 1: Distribution of Months at the New Residence

Ideally within a controlled environment, a researcher could randomize (1) the timing of voter’s moves given a particular election date and (2) the various costs that she may potentially face. As this is not possible, the data is observational. An experimental research design is also difficult, since ignorability of treatment assignment is likely to be violated with voters who have moved in various points in time. However, the cross-sectional analyses presented in this Section, which show the conditional prediction of turnout given the values of the independent variables, still provide insight into a problem that practically does not have an experimental design. In addition, it is likely that voters do not self-select into choosing their timing of residential move based on the decision of whether to turn out to vote in a future election. Hence in this paper, I assume that the cross-sectional variation between the 24 months are conditional on the observables. For example, the seasonality of move is age-dependent, hence I control for age.

In the following Subsections, I show how turnout is depressed by moving by semiparametric regressions. More specifically, I use generalized additive models (GAM) which can flexibly fit continuous variables. The functional form associated with costs that change over time is not known, and there is no reason a priori to assume that that the relationship will be linear. GAMs help see beyond the default linearity assumption

while keeping the interpretability of an additive model. In addition, while parametric handling of nonlinearity such as log transformations or polynomial regressions will impose a global function, GAMs are local and more flexible (Beck and Jackman, 1998). The results indeed show that the relationship between residential stability and turnout is strongly nonlinear and need a local specification.

GAMs are fitted by R package `mgcv` using thin plate regression splines (TPRS) and fitted by restricted maximum likelihood (REML) method. The smoothness is automatically selected using a penalized spline approach and are checked with standard diagnostics to see if the basis dimensions for smooths are adequate (Wood, 2017). Thin plate regression splines have one basis function per data point, but the basis functions are reduced by eigendecomposition, hence fitting on a reduced problem (Wood, 2003).

Because I show how costs of moving depends on different environments, I further use factor-by-curves, which is an extension of simple GAMs, by allowing the smoothed continuous variable to ‘interact’ with a specified factor. In other words, the smoothing curves are fitted separately for each level of the factor, subject to a centering constraint. For more reference on generalized additive models, see Hastie (1992), Beck and Jackman (1998), Keele (2008), Wood (2011), and Wood (2017). All continuous variables are smoothed. The main independent variable is the months lived at the new residence, which is an interval variable, taking discrete values from 1 to 24. Given this, the usage of GAM provides a unique specification into the relationship between residential stability and turnout, something that has rarely been exercised in the literature.

4.2 Differentiating Information Costs

Not all moves are created equal—a move across the street is not equal to a move thirty miles away from your original home. As explored in the literature, these situations pose different costs of moving. While it is impossible to fully net out convenience and social costs, it is possible to differentiate the information environments that voters are facing. For factor-by-curves, I use the following categorical proxies for information costs:

1. The voter moved within the same street address (e.g. only change units within the same apartment complex), labeled *Same Address* (3.3%);
2. The voter moved within the same precinct and with the same polling place, labeled *Same Precinct* (5.7%);

3. The voter crossed precinct boundaries but within the same state-level or local political districts,¹³ and with the same polling place, labeled *Same Subdisriacts* (8.3%);
4. The voter crossed some local or state-level districts or her polling place changed, but within the same congressional district, labeled *Same Congressional District* (46.3%);
5. The voter crossed congressional district lines: *Different Congressional District* (36.5%).

The variable captures five different situations a mover can face, with progressively larger burdens. Note that convenience cost should theoretically apply to all movers, and the social costs are not independent with information costs. For example, if social costs are roughly proxied by distance moved, if a voter moves within the same apartment, there are certainly no information or social costs involved, because the distance moved is zero. If a voter moves a mile or more, it is highly likely that she crosses precinct boundaries. If she moves sufficiently far away, she is also likely to cross local, state, and federal district boundaries. Therefore I simply term this the difference in ‘environment,’ or (generic) costs of moving.

The logistic GAM with factor-by-curves used in this paper is as follows, for $i = 1, \dots, n$:

$$\Pr(y_i = 1 | x_i, \mathbf{X}_i^1, \mathbf{X}_i^2, z_i) = \left(1 + \left(\exp \left(\beta_0 + f(x) \mathbf{I}_z + \gamma \mathbf{I}_z + \sum_{j=1}^J \beta_j X_{i,j}^1 + \sum_{k=1}^K g_k(X_{i,k}^2) \right) \right)^{-1} \right)^{-1} \quad (1)$$

y_i is the turnout of 2018 general election, x is the residential stability (months lived at the new residence), and the z is the information cost category. \mathbf{X}_1 is the set of variables that are linearly added without smoothing, such as dummies for race/ethnicity or gender. \mathbf{X}_2 is the set of variables that are additive but smoothed, such as age, and g_j for $j = 1, \dots, J$ are nonparametric smooths fitted for each of these variables. γ is separately included with the indicator variables for information cost categories, because the estimation of smooths are subject to a centered constraint. Note that the model is essentially specifying that the residential stability information should not be pooled for different environments, while for other variables such as age, voters are exchangeable across environments.

The following covariates are controlled for: number of times moved in a 24-month period, straight Euclidean distance from voter’s home to the designated polling place (Gimpel and Schuknecht, 2003; Dyck and Gimpel, 2005; McNulty, Dowling and Ariotti, 2009), permanent absentee voting status (Gronke, Galanes-Rosenbaum and Miller, 2007),

¹³These include state senate districts, state assembly districts,

age, inferred gender¹⁴ and race, partisan affiliation, 2016 general turnout, census block group-level median household income of old and new residences, whether the voter was born abroad (e.g. a naturalized citizen), and the congressional district of the new residence. The congressional district was added to address the fact that there were some hotly contested House races in the 2018 general election, as opposed to other districts where landslides were predicted.

4.3 Results

4.3.1 Heterogeneity by Costs of Moving

Figure 2 shows the relationship between residential stability and turnout by each information cost category, holding other covariates fixed.¹⁵ What is immediately striking is that there is a strong nonlinear trend for movers with medium to high information costs ($p < 0.001$). There is a severe repression of turnout for movers close to the election if they at least crossed precinct lines. By the projected propensity to vote, an average voter (regardless of information environment) who has lived fully two years at her new residence will vote 67.6% of the time. An average voter who has lived only two months will vote 51.4%, resulting in maximum difference of 16.2 percentage points. Turnout steadily climbs before it reaches a plateau with slight variance, displaying similar patterns for the last three panels.

For movers with sufficient change in their informational environment, it takes at least six months or more to climb to the turnout of level of stayers (about 70%). The slight uptick of turnout for movers of October 2018 is puzzling, but it is likely because some of them were eligible to vote in their original precinct and polling place. By California election statutes, movers within 14 days of the Election Day can choose to vote either at their old and new residence's polling place.¹⁶

On the other hand, movers who have moved within the same street address ($p = 0.0924$)

¹⁴3.8% of voters have an ambiguous gender that cannot be inferred from the first name. In these cases, these are treated as unknown and as a baseline group, instead of dropping them from the sample.

¹⁵The dependent variable's values displayed in conditional plots usually use the median value for continuous variables and mode values for categorical variables, as each covariate has to have a fixed value. The predictions are not necessarily aligned with the average predicted value of the dependent variable. For more on visualizing the relationship between a single independent variable and the dependent variable, see (Breheny and Burchett, 2013). For the full set of values used for the displayed figures, see Appendix C.3.

¹⁶I do not interpret the bumps after turnout reaches a plateau—these are less likely to be 'interesting local features' (Beck and Jackman, 1998), and a researcher must refrain from inventing theories.

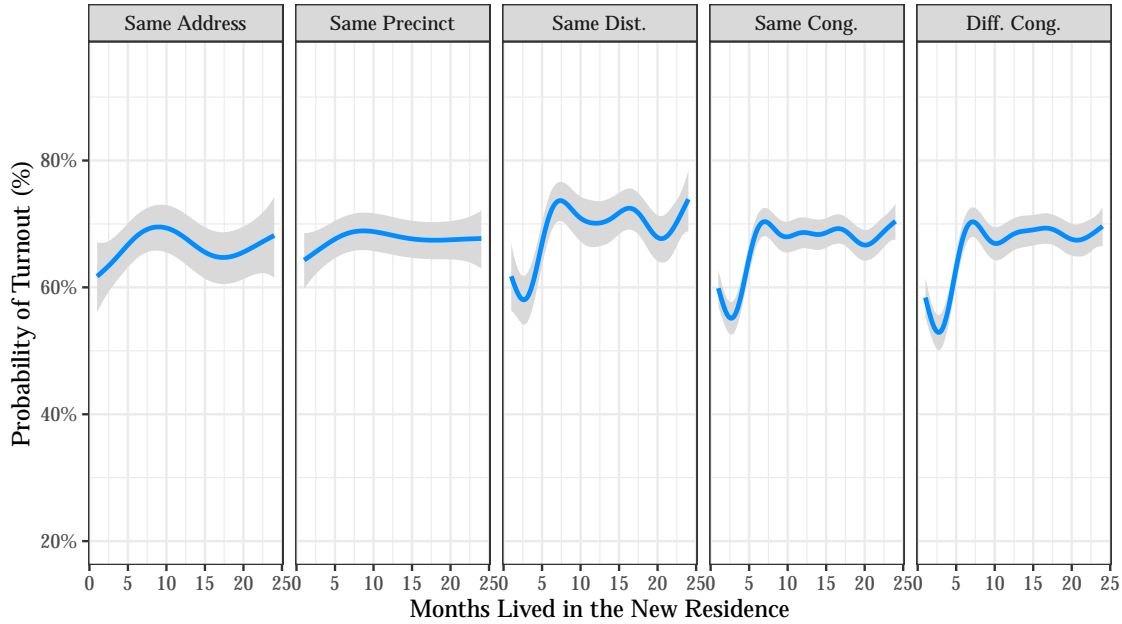


Figure 2: Fitted Smooths for Residential Stability by Information Cost

or within the same precinct ($p = 0.3004$) do not show strong associations between their time at the new residence and turnout. Given that the sample size for same-address movers is 3,000 or more voters, and the sample size for same-precinct movers at least 5,000, it seems to be the case that for those with low to no information cost, there is no strong evidence for turnout change over time. Crossing precinct lines or more seem to be a necessary condition to observe the repression and recovery.

4.3.2 Placebo Tests

For a robustness check, I perform placebo tests—that is, the same analysis on data where there was no ‘intervention,’ which should theoretically yield null results. An intuitive placebo test to check for sample self-selection is to use not the turnout of 2018 general election but previous elections. Because residential changes took place after the 2016 general election, theoretically, the imposed costs should not affect turnout for previous elections. Table 3 shows the results of the main regression and its placebo checks using primary and general elections of 2016, 2014, and 2012. The table contains both the parametric coefficients and the smooth terms, and covariates are excluded for brevity—the full table can be found in Appendix D.

The first noticeable results from placebo tests is the sample-selection issue of information

	<i>Imperfect Placebo</i>		<i>Placebo Tests</i>				
	General 2018	General 2016	Primary 2016	General 2014	Primary 2014	General 2012	Primary 2012
A. Smooth terms (effective degrees of freedom / residual degrees of freedom)							
Res. Stability × Same Address	3.353 4.153	1.148* 1.145	2.698 3.358	2.655 3.305	1.030 1.059	1.003 1.006	1.002 1.004
Res. Stability × Same Precinct	2.684 3.341	1.145 1.276	3.391 4.206	1.931 2.418	1.004 1.007	1.003 1.007	1.933 2.421
Res. Stability × Same Subdist.	7.205*** 8.232	1.034 1.067	2.305 2.878	1.015 1.030	2.007 1.792	3.971 4.899	3.473** 4.305
Res. Stability × Same Cong.	8.446*** 8.913	3.810*** 4.709	3.910* 4.830	1.013 1.027	1.792* 2.241	2.296 2.868	1.002 1.004
Res. Stability × Diff. Cong.	8.428*** 8.908	3.177*** 3.945	1.235 1.433	2.552 3.183	1.015 1.029	1.003* 1.007	1.002 1.003
Distance Moved	1.139* 1.139	1.009* 1.017	2.828 3.580	2.270 2.887	1.006 1.011	1.005 1.011	1.002 1.006
Age	7.991*** 8.655	7.378*** 8.227	7.314*** 8.200	7.035*** 7.998	7.603*** 8.473	7.655*** 8.365	8.115*** 8.752
Distance to Poll	4.947* 6.035	1.037 1.074	2.287 2.910	1.021 1.041	2.102* 2.676	1.011 1.021	1.814 2.303
Old Residence's Neighborhood Income	8.623*** 8.955	8.140*** 8.786	5.252** 6.318	8.377*** 8.882	8.060*** 8.754	3.017*** 3.808	7.732*** 8.573
New Residence's Neighborhood Income	8.357*** 8.881	7.866*** 8.655	1.009* 1.019	6.994** 8.037	3.103** 3.891	2.371* 3.029	1.003 1.006
B. Parametric coefficients (estimate / standard error)							
Same Precinct	0.053 (0.050)	0.043 (0.058)	0.003 (0.053)	0.303*** (0.064)	0.163 (0.084)	0.134 (0.069)	0.094 (0.080)
Same Subdist.	0.113* (0.048)	0.156** (0.054)	0.063 (0.050)	0.395*** (0.060)	0.170* (0.079)	0.257*** (0.064)	0.064 (0.075)
Same Cong.	-0.004 (0.042)	0.133** (0.047)	0.019 (0.046)	0.312*** (0.056)	0.152* (0.071)	0.201*** (0.056)	0.086 (0.068)
Diff. Cong.	-0.026 (0.045)	0.104* (0.050)	-0.018 (0.050)	0.325*** (0.059)	0.158* (0.074)	0.183** (0.060)	0.031 (0.071)
Controls	Y	Y	Y	Y	Y	Y	Y
Observations	100,389	96,195	83,977	71,411	69,104	65,388	59,914
Adjusted R ²	0.159	0.052	0.090	0.134	0.165	0.067	0.164
Log Likelihood	-57,722.160	-45,323.170	-53,401.650	-41,960.780	-26,208.670	-34,083.580	-27,761.590
UBRE	57,859.880	45,412.880	53,480.550	42,045.840	26,277.130	34,150.990	27,832.550

Note:

*p<0.05; **p<0.01; ***p<0.001

Table 3: Generalized Additive Model Results, Full Sample

cost categories. From Figure 2, comparative to movers within the same subdistricts, it appears that the mean of predicted turnout is lower for those with higher information costs. However, the placebo tests show that voters seem to be self-selecting into these different environments. A voter who moves within the same apartment complex can be a different voter than those who cross congressional district lines.

But having partialled out the difference in means by a centering constraint, do fitted smooths also pass placebo tests? Although not perfectly for every cost and past election combination, the results seem reasonable for elections *before* 2016 general election. For the 2016 general, there is a strong nonlinear relationship documented for movers with high information costs, on a smaller scale (effective degrees of freedom ≈ 3) and in the opposite direction, if linearly fitted.

Why is this the case? The likely answer is that the 2016 general election is not a great placebo for this model, because costs may also incur *right before* the voter moves. Note that a voter who has lived in her new residence for twenty-four months before the 2018 election is essentially a voter who has moved in the thicket of the 2016 general election month. Take distraction costs. A voter may be more distracted *before* she moves, rather than *after*, because it would take at least a few months to search make a housing decision and to search for appropriate housing. In addition, a voter who will soon move has no objective benefit to reap from a community that she will soon leave. In that case, the information costs of learning about local issues can outweigh the benefits of voting (Dowding, John and Rubenson, 2012). Figure 3 shows the descriptive proportion of turnout for respectively 2016 and 2018 elections by residential stability. The placebo tests excluding 2016 general election tests generally seem to pass.

4.4 Disentangling Distance Moved

Although the distance moved is adjusted for in the result above, there could be a multicollinearity problem. Is it distance that is actually driving the repression and recovery of turnout for voters with high information costs?

I test whether there is still a dynamic relationship when there is little to no distance moved. To do this, I define a sufficiently small neighborhood by distance, and run the same generalized additive model with movers who have moved to a nearby house. Specifically, I use a walkable neighborhood of 0.5 mile distance, which is the mean walking value for those who have reported at least one walking trip daily (Yang and Diez-

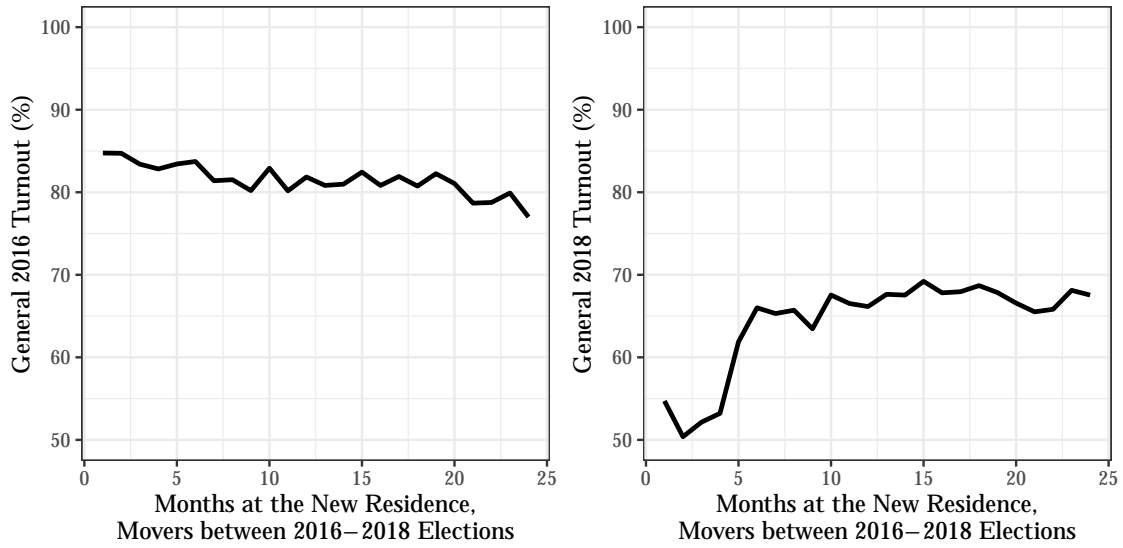


Figure 3: Turnout of Movers, 2016 and 2018 General Elections

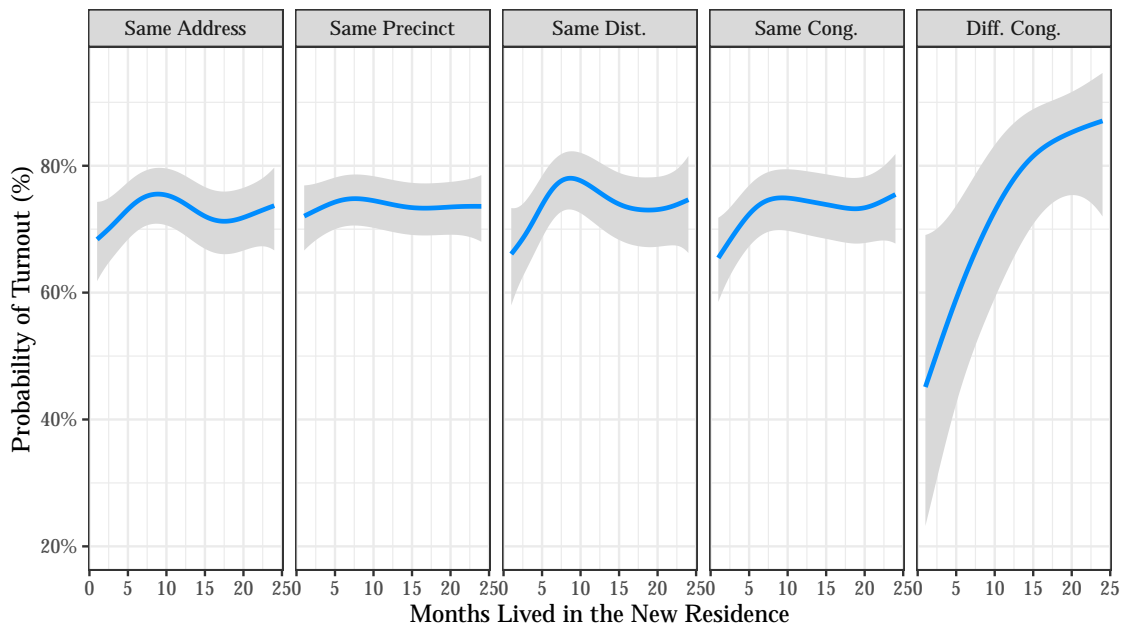


Figure 4: Fitted Smooths for Residential Stability by Information Cost, Movers within Half-Mile

	<i>Imperfect Placebo</i>		<i>Placebo Tests</i>				
	General 2018	General 2016	Primary 2016	General 2014	Primary 2014	General 2012	Primary 2012
A. Smooth terms (effective degrees of freedom / residual degrees of freedom)							
Res. Stability × Same Address	3.310 4.102	1.708* 1.004	2.771 3.448	2.732 3.400	1.148 1.281	1.002 1.003	1.000 1.001
Res. Stability × Same Precinct	2.559 3.189	1.004 1.008	3.169 3.937	1.930 2.416	3.181 3.954	1.541 1.904	3.155 3.924
Res. Stability × Same Subdist.	3.613* 4.472	1.113* 1.218	2.019 2.522	4.075 6.027	1.001*** 1.001	1.001 1.002	3.368** 4.177
Res. Stability × Same Cong.	3.003* 3.730	1.001 1.003	1.438 1.756	1.001 1.002	1.001 1.002	1.504 1.853	1.001 1.001
Res. Stability × Diff. Cong.	1.564** 1.939	1.003 1.006	1.002 1.005	1.002 1.004	1.808 2.274	1.003 1.005	1.084 1.163
Age	6.009*** 7.102	4.398*** 5.392	4.492*** 5.510	1.085*** 1.166	4.788*** 5.856	6.285*** 7.297	3.961*** 4.907
Distance to Poll	1.016 1.031	1.003 1.005	1.004 1.008	1.003 1.005	1.001 1.003	1.000 1.001	1.001 1.002
Old Residence's Neighborhood Income	5.223* 6.297	6.960** 7.998	3.146 3.944	3.645 4.534	1.002 1.003	1.000* 1.001	1.957 2.484
B. Parametric coefficients (estimate / standard error)							
Same Precinct	0.057 (0.058)	0.053 (0.068)	-0.026 (0.061)	0.262*** (0.073)	0.120 (0.098)	0.118 (0.080)	0.031 (0.094)
Same Subdist.	0.053 (0.077)	0.184* (0.089)	0.109 (0.079)	0.253** (0.093)	-0.093 (0.130)	0.238* (0.104)	-0.089 (0.122)
Same Cong.	0.009 (0.080)	0.305** (0.093)	-0.006 (0.083)	0.266** (0.097)	-0.024 (0.134)	0.312** (0.109)	-0.041 (0.127)
Diff. Cong.	0.001 (0.232)	-0.217 (0.241)	-0.172 (0.239)	-0.254 (0.296)	-1.032 (0.569)	0.086 (0.286)	0.333 (0.326)
Distance Moved	-0.020 (0.171)	-0.106 (0.200)	0.185 (0.175)	0.407* (0.201)	0.591* (0.277)	-0.139 (0.230)	0.505 (0.264)
Controls	Y	Y	Y	Y	Y	Y	Y
Observations	13,150	12,470	10,680	8,877	8,529	8,008	7,307
Adjusted R ²	0.157	0.051	0.090	0.137	0.173	0.068	0.186
Log Likelihood	-7,578.712	-5,909.561	-6,823.539	-5,199.565	-3,164.015	-4,214.901	-3,331.615
UBRE	7,619.864	5,942.088	6,855.060	5,224.926	3,178.778	4,238.004	3,348.890

Note:

*p<0.05; **p<0.01; ***p<0.001

Table 4: Generalized Additive Model Results, Subsample of Movers within Half Mile

Roux, 2012). Assuming that a street block equals one-ninth of a mile, this equates to walking about four blocks. While other thresholds are possible, I use walking distance because (1) car ownership is not observed, and (2) larger travel distance by vehicles can vary in their costs by time of the day and the available infrastructure surrounding a household.

The sample of movers who have moved less than half a mile is about 13.1% (13,150 voters). Given that now the distance is smaller, the sample is smaller, and that the distance moved has effective degrees of freedom¹⁷ that does not exceed 2 in Table 3, the distance moved is now treated as parametric (linear). I also exclude the neighborhood's median household income for the new household. This is because while in the full sample, the Pearson correlation coefficient was about 0.53, now in the 'small' move sample the correlation coefficient is 0.98.

Figure 4 shows the fitted smooths by each information cost category. Again, while the smooths do not seem to have strong relationship for movers within the same apartment ($p = 0.089$) or within the same precinct ($p = 0.568$), those with higher information costs have clearer dynamic trends ($p < 0.05$). That is, if the voter crosses precinct lines or more, *even within the same county*, a recovery of turnout is documented. This shows that independent of distance moved, the detrimental effects of turnout apply heterogeneously by informational environments. Changing the cutoff from half-mile to values such as one mile or three miles produce the same results.

Therefore, the conclusion holds that sufficient changes in information seem to be a necessary condition to observe a repression and recovery pattern, regardless of distance moved. One plausible explanation is how voters subjectively perceive voting costs to be. For a 'small' enough move, such as within the apartment or within the precinct, costs of moving may not matter so much, causing the voter to pay little attention to acclimating to the change.

For instance, for a within-apartment mover, a voter may be able to pick up her vote-by-mail ballot from a common mail room without necessarily having to re-register to have it forwarded. Or perhaps she could go to the same polling place, state her address up to the street-level and not the unit, and still be able to vote. Similarly within the precinct, the voter may simply be able to visit her polling place and state that she moved but is still within the precinct boundaries, or retrieve her ballot easily from her old home.¹⁸

¹⁷This is also called equivalent degrees of freedom (Beck and Jackman, 1998).

¹⁸Ballots are not forwarded even with the change-of-address requests at the USPS.

Also note that in Figure 2 the nonlinear pattern in movers who cross precincts, local and state-level districts, and congressional districts all show a very similar pattern. It seems to be that once the voter faces an environment in which some search cost must occur, how fast the voter adapts does not seem to be dependent much on varying degrees of information cost. All in all, the results show how it might not be entirely accurate to impose a global and additive functional form to different types of costs of moving.

5 Mitigating Re-registration Costs: Policy Evaluation

In Section 4 I have shown that turnout is significantly low for voters who move close to the election, especially if the movers are facing a ‘big’ enough move in terms of changed informational environment. Unfortunately, in terms of policy interventions, it is not usually possible to manipulate the voters’ change in environment, as election administrators have no voice in where the voters move to, what friends of neighbors they make, and so on. If voters stay six months or more they seem to reasonably catch up, but of course, election administrators cannot manipulate how long a voter has lived at the new residence on Election Day.

Is there any way to reliably help movers turn out, other than simply waiting? Very few papers have investigated how to boost the turnout of movers. McDonald (2008) shows that portable statewide registration, which permits in-state movers to be registered and to be able to vote on Election Day, increases turnout by 2.4 percentage points. How about movers within-state, or even within the county? Here I evaluate an election administration policy first suggested in Squire, Wolfinger and Glass (1987) and subsequently implemented through the NVRA, when evaluated, was found to greatly improve movers’ turnout.

5.1 Background

The National Voter Registration Act of 1993 decrees that states can use the United States Postal Service’s National Change-of-address (NCOA) records to determine whether the voter still lives in the address or have moved. California actively uses this data to maintain its voter rolls up-to-date (California Secretary of State, 2019). In particular, when a residential move is detected via NCOA processing, election administrators have to send a *physical mail* to the voter to notify that their new address will be used for voting pur-

poses, by CA Elec Code § 2225 (2017). This notification must be, substantially, in the following form (see Appendix A for full statutes):

“We have received notification that you have moved to a new residence address in California. You will be registered to vote at your new address unless you notify our office within 15 days that the address to which this card was mailed is not a change of your permanent residence. You must notify our office by either returning the attached postage-paid postcard, or by calling toll free. If this is not a permanent residence, and if you do not notify us within 15 days, you may be required to provide proof of your residence address in order to vote at future elections.”

Dear Voter:

According to information we have received, the address where you live OR where you receive mail has changed to the address printed on the attached card.

If your new address is in Orange County, we will update your registration and future election materials will be sent to your address. If you no longer reside in Orange County, your voter registration has been placed in the inactive file. You must reregister in the county in which you now reside. To receive an affidavit call 1(800)345-VOTE.

Within 15 days, return the Business Reply portion of this card notifying us that your change of address is correct or is not a change of permanent residence.

If the information on this card is incorrect and you fail to notify our office, you may not receive your voting materials for future elections and your registration may be permanently canceled.

*If you need assistance in Chinese, Korean, Spanish or Vietnamese, please call (714) 567-7600.

REGISTRAR OF VOTERS
PO BOX 11298
SANTA ANA, CA 92711-1298
Phone No. (714) 567-7600



NON-PROFIT ORG.
U.S. POSTAGE
PAID
Santa Ana, Ca
Permit No. 77

Presorted

FORWARDING SERVICE REQUESTED



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 963 SANTA ANA, CA

POSTAGE WILL BE PAID BY ADDRESSEE

REGISTRAR OF VOTERS
PO BOX 11298
SANTA ANA CA 92711-9839



Dear Voter:

WE HAVE BEEN NOTIFIED THAT YOU HAVE MOVED.

Check and sign the correct box below.

Send back the completed card within 15 days.

<input type="checkbox"/>	I live in Orange County and the address(es) above are correct.
Signature: _____ Date: _____	
<input type="checkbox"/>	I don't live in Orange County. Remove my name from the voter file.
Signature: _____ Date: _____	
<input type="checkbox"/>	The information above is incorrect.
I live at: _____ My mail is delivered to: _____	
Signature: _____ Date: _____	

NCOA

Figure 5: NCOA Mailing of Orange County, California, Front and Back

This policy, henceforth *NCOA mailing policy*, serves two purposes. First, it rids the movers of their convenience costs of re-registering to vote. Second, it reminds them about the upcoming election, acting as a ‘nudge.’ Figure 5 shows the mailing sent out

to the movers in Orange County, in its original form. Most importantly, if the voter actively does not deny moving to a new residence or notify the Registrar of a new mailing address, the voter file will reflect the new address. This is true even if the voter does not return the mailing checked with “I live in Orange County and the address(es) are correct,” acknowledging the movement. Therefore, if there is no counteraction, the USPS information is treated as a true move. If the voter is a permanent absentee voter, the mail ballots will be sent to the new address. If the voter has crossed precinct boundaries, the new polling place’s roster will have her name printed, and not the old one.

This is an extraordinarily proactive measure by the Registrar, and can potentially boost turnout. However, no measures of policy evaluation has been made so far. How effective is this policy in stimulating movers to turn out? And how can we estimate it?

5.2 Natural Experiment

A natural experiment is available as follows. As explained in Subsection 3.1, no list maintenance is performed 90 days before the Election Day. In Orange County, the last NCOA processing was performed on July 26th, 2018, up to the movers who moved before June 15, 2018, as the Secretary of State’s office obtains and disseminates NCOA data in the middle of the month. This discontinuity creates an interesting quasi-experimental opportunity for policy evaluation, as those who have moved in the *later half of June* and beyond did not get the NCOA mailings, as opposed to those who moved in the *early half of June*. This is a quasi- regression discontinuity design with NCOA mailing as an intervention. Although I cannot determine the exact date of the residential move, NCOA mailing treatment, which I can parse from the voter file changes, reveals that the voter did not move later than the cutoff.

The full sample for policy evaluation here is the set of June movers who filed a change of address. Note that the treatment group is the set of movers from June 1 to June 14 who *have not voluntarily updated their registration records until late July*. If the voter has already reported having changed residences to the Registrar so that the voter roll is already up-to-date, the mailing is not sent out. Therefore all others, including those who moved in early June and possibly disclosed it to the Registrar before July, are put to a control group.¹⁹ If anything, this will estimate a lower bound of the effect of the policy, as those who voluntarily inform the Registrar are more likely to vote.

¹⁹Note that if the disclosure is voluntary, I cannot extract whether the voter has moved in early or late June.

5.3 Results

The estimation of the policy effect is straightforward. The independent variable of interest is the NCOA treatment, which is binary, and I use the same set of covariates used in Section 4. Because the logistics regression result and the entailing average marginal effect is almost identical to the effect estimated by a linear probability model, I present the output from a linear probability model in Table 5 for a more direct interpretation. For alternative specifications, see Appendix E.2.

The first column is the main regression with 2018 general turnout as the dependent variable. Using eligible voters in previous three general and primary elections, I also perform placebo tests, which all pass for the treatment. On average, the treated group are more likely to have voted in the 2018 general by 5.9 percentage points (95% confidence interval: [0.0345, 0.0839]).

	<i>Imperfect Placebo</i>		<i>Placebo Tests</i>				
	General 2018	General 2016	Primary 2016	General 2014	Primary 2014	General 2012	Primary 2012
NCOA Treatment	0.059*** (0.013)	-0.006 (0.011)	0.001 (0.015)	-0.004 (0.015)	-0.011 (0.012)	0.001 (0.015)	-0.010 (0.015)
Same Address	-0.008 (0.040)	-0.051 (0.036)	-0.038 (0.049)	-0.046 (0.050)	0.026 (0.039)	-0.117** (0.049)	-0.041 (0.047)
Same Precinct	0.014 (0.036)	-0.063* (0.033)	-0.032 (0.042)	-0.070 (0.044)	0.008 (0.034)	-0.079* (0.043)	-0.052 (0.041)
Same Cong.	-0.040* (0.024)	-0.018 (0.022)	-0.015 (0.029)	-0.019 (0.029)	0.004 (0.023)	-0.039 (0.029)	-0.055** (0.028)
Diff. Cong.	-0.051* (0.027)	-0.043* (0.024)	-0.022 (0.032)	-0.016 (0.033)	-0.013 (0.026)	-0.047 (0.032)	-0.076** (0.031)
Distance Moved	-0.002* (0.001)	0.001 (0.001)	0.001 (0.002)	-0.002 (0.002)	0.0001 (0.001)	0.001 (0.002)	-0.0005 (0.002)
Controls	Y	Y	Y	Y	Y	Y	Y
Observations	5,539	5,035	4,341	3,680	3,553	3,366	3,082
Adjusted R ²	0.126	0.043	0.081	0.135	0.136	0.057	0.136
Res. Std. Error	0.455 (df=5510)	0.392 (df=5007)	0.474 (df=4313)	0.448 (df=3652)	0.342 (df=3525)	0.419 (df=3338)	0.391 (df=3054)
F statistic	29.427*** (df=28; 5510)	9.334*** (df=27; 5007)	15.164*** (df=27; 4313)	22.291*** (df=27; 3652)	21.695*** (df=27; 3525)	8.587*** (df=27; 3338)	18.902*** (df=27; 3054)

Note:

*p<0.05; **p<0.01; ***p<0.001

Table 5: Effect of NCOA Policy Treatment, Linear Probability Model

Effect Size. The estimated treatment effect is very large. In fact, if we could boost turnout of movers uniformly at 5.9%, much of the turnout depression by moving would disappear. To put this in context, take the results of the landmark study in persuasive get-out-the-vote mailings in Gerber, Green and Larimer (2008). The effect of showing households their own voting records and urging them to vote resulted in 4.9 percentage points increase of turnout, and showing them both their own and the neighborhood voting records resulted in 8.1 percentage points increase. Oftentimes, many get-out-the-

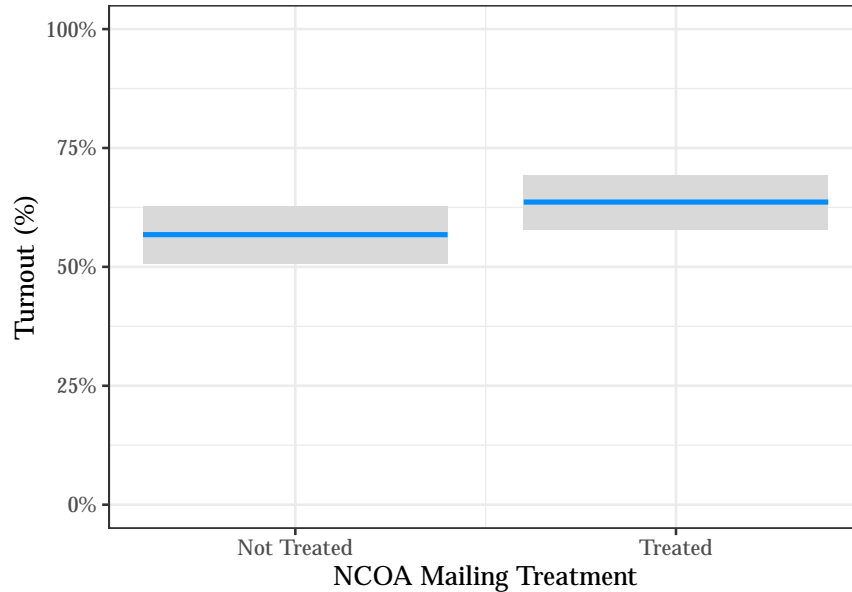


Figure 6: Effect of NCOA Mailing Treatment (Conditional Plot)

vote devices are insignificant or have effect size lower than 5 percentage points (Schelker and Schneiter, 2017).

So why is the effect so large, comparative to the previous findings of the get-out-the-vote literature? There can be a few caveats. First, the width of the “window” of observations used for the regression discontinuity is two weeks. Two extra weeks may have helped voters overcome the detrimental effect of moving, thereby inflating the effect size.

Second, this was an official, pre-paid postage mailing from the election administrators, and not a get-out-the-vote mailing from third-party civic organizations. This may have made the difference. For example, Mann and Bryant (2019) show that even a simple postcard from official election administrators can encourage voter registration and turnout (2 percentage points increase), without any legal or administrative process changes—a ‘nudge.’ Malhotra et al. (2012) also show that while third-party organization’s emails made no difference in turnout, emails from official sources increased turnout.

Third, Orange County in 2018 was a highly contentious area in which the entire county turned ‘blue,’ whereas it has been deemed a ‘conservative bastion’ for very long. Some districts, which had a Republican representative for thirty-five years, now elected a Democratic House representative. Hence the voters may have been simply more responsive to any type of stimulus related to the general election. However, also note that congressional districts of new residences are controlled for.

Lastly, the estimation is not for an average treatment effect (ATE) on all movers but the average treatment effect on the treated (ATT). Specifically, the treatment is on relatively *peripheral* voters who happened to move in the early weeks of June. The treated voters did not inform the Registrar in about two months of moving, which indicates that they are less interested in voting compared to those who do inform the Registrar. Also, treated group who moved within the first five days of June are likely not to have voted in the primary of 2018, which took place on June 5, 2018. If they voted with their new address, the database would have been updated, so that no treatment would have been necessary in July. In fact, if placebo tested with the dependent variable of 2018 primary, the treatment gives statistical negative effects on turnout. And peripheral voters are understood to be more responsive to stimulus than those who are already well-motivated to vote (Highton and Wolfinger, 1998).

However, there seems no denying that the NCOA mailing policy is effective, whatever the size may be. As can be seen with the placebo tests for 2016, 2014, and 2012 elections, the treated group is not so extremely peripheral to the degree that they have also voted less in previous cycles. In addition, as aforementioned, the effect is underestimated by including voluntary disclosers in the control group. So it may well be the case that the estimated size is valid.

Overcoming Costs of Moving. In Section 4, I have concluded that dynamic effects of costs exist only when the voter's environment has sufficiently changed. Does the NCOA mailing policy still boost the turnout of those with little to no change in environment?

Consistent with the results in Section 4, I find that the NCOA mailings do not have a turnout boosting effect on voters with 'small' moves. Table 6 shows that for movers within the same precinct or for movers within a half-mile of their original residence, the NCOA mailing has no effect. Again, this may indicate that while theoretically convenience/distraction costs should apply to all movers homogeneously, it only begins to be effective when the mover has moved sufficiently far away or crossed precinct lines while moving.

5.4 Policy Implications

In terms of election administration, the efficiency of an already existing NVRA policy is promising. It is designed for both higher turnout and for better voter list maintenance,

General 2018 Turnout				
	Low Info Cost	Distance Moved Less Than 0.5 Mile	Distance Moved Less Than 1 Mile	Distance Moved Less Than 3 Miles
NCOA Treatment	0.044 (0.043)	0.050 (0.034)	0.060** (0.027)	0.076*** (0.018)
Same Address		0.035 (0.054)	0.015 (0.046)	-0.001 (0.043)
Same Precinct	0.053 (0.051)	0.083 (0.054)	0.064 (0.044)	0.031 (0.038)
Distance Moved	0.050 (0.111)			-0.009 (0.012)
Same Cong.		0.012 (0.056)	0.015 (0.039)	-0.020 (0.027)
Diff. Cong.		-0.149 (0.206)	-0.103 (0.093)	-0.052 (0.041)
Controls	Y	Y	Y	Y
Observations	464	724	1,143	2,548
R ²	0.176	0.179	0.145	0.137
Adjusted R ²	0.131	0.149	0.124	0.128
Res. Std. Error	0.441 (df = 439)	0.441 (df = 697)	0.446 (df = 1115)	0.450 (df = 2519)
F Statistic	3.898*** (df = 24; 439)	5.851*** (df = 26; 697)	6.989*** (df = 27; 1115)	14.323*** (df = 28; 2519)

Note: *p<0.05; **p<0.01; ***p<0.001

Table 6: Effect of NCOA Policy Treatment in Small Moves

it is relatively simple, and it is non-partisan—both in nature and in effect, as when estimated, no further mobilization of movers would have swayed any major election results, not even a state senator or general assembly.²⁰ Therefore from a policy perspective, it is encouraging confirmation that the Registrar has “safety nets” that help movers adjust and participate in the political process.

However, the actual implementation of the policy can be difficult. List maintenance cannot take place 90 days before a federal election. Given a primary and a general election, this already equates to six months in the election year where NCOA mailings cannot be performed. If there is a special election or two, the moratorium period extends further. This means that the Registrar has to rely on a small window of time between those moratoriums to perform full NCOA processings and mailings.

When the usage of vote-by-mail is prevalent, or the election is conducted by all-mailing, this may pose a problem. This indicates that voters who move close to the election are relatively disenfranchised, policy-wide. The 90-days restriction is understandable in that it will lessen the load of election administrators too close to the election. If however the election administrators have sufficient resources, loosening the 90-days restriction can improve turnout of movers. (Highton and Wolfinger, 1998) in particular expressed

²⁰For Orange County 2018 general election results, see <https://www.ocvote.com/fileadmin/live/gen2018/results.htm#c-1913>.

concern about the 90-days policy as follows:

(A 90-day closing date) would be the first week in August for the general election ... Twelve percent of all adult citizens moved in the six months before November 1992, nearly three-quarters of everyone who moved during the entire year. Moving in the summer fits best with the school year, a rhythm that guides not only parents of school-age children but also significant groups such as teachers and university students. Purging and reregistration through the NCOA option misses all these people.

If the summer movers equate to younger and more transient electorate, easing the 90-days policy will benefit them in particular, who are already a low-turnout group.

Outside California, if NCOA processings are mandated, this could greatly help voters. According to the National Conference of State Legislatures (NASS), at least thirty-six states authorize the usage of NCOA data to check whether voters' address changed (National Association of Secretaries of State, 2017). What happens *after* the voter data and NCOA data is matched is slightly unclear. Pursuant to 42 U.S.C. § 1973gg-6(c), if moves detected are within-jurisdiction moves, the election official is required to update the voter's registration and then send the notice.

How this is exercised is a little less straightforward—in-county movers' addresses are automatically updated only in Arizona, Arkansas, Colorado, California, Iowa, Kansas, Kentucky, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Virginia, Washington, and West Virginia.²¹ In fact according to NASS, in California, Florida, and Illinois, this applies to all in-state and not just in-county movers, which is an extraordinary feat. For some states such as Delaware, Indiana, Louisiana, Maine, Mississippi, Missouri, Montana, Nebraska, Nevada, New Mexico, Ohio, Oklahoma, South Dakota, or Texas, no mentions exist of automatic updates *prior* to contact—some are contingent upon the voter actually returning the mailing notice, and some are silent on details.

What a simple contact without re-registration would do is not entirely clear. Do NCOA processings work mainly because they solve re-registration burden, or mainly because they are reminders about the election from official sources? The answer is out of reach for this paper. However, it is nonetheless clear that other states should follow up on the usage of NCOA data, if they wish to best clean the voter data as well as maintain movers' turnout.

²¹In Connecticut and Wisconsin, only movers within the municipality are contacted. In Michigan similarly, only voters within the city or township.

6 Discussion

In this paper, I first asked what the dynamic impact of moving on turnout is. I show how voters who move close to the election are significantly less likely to vote, the difference being at most 16.2 percentage points. It took movers at least six months to recover to a level of turnout similar to stayers, and the turnout was relatively steady for those who lived longer than six months at their new residence. This repression-and-recovery trend is not seen for ‘small’ moves in which there were no or very little information costs, such as within-apartment movers. The time trend was only apparent for voters who at least cross precinct boundaries while moving, even when limited to movers within half-mile. Sufficient changes in information costs seem to be a necessary condition in activating dynamic costs of moving.

While election administrators cannot dictate when or where the voter moves to, I show that a simple, pre-existing, and non-partisan policy is effective in retaining movers and boosting their turnout. With this policy, election administrators can use the change-of-address data from the USPS to proactively track movers, automatically update the voter registration database’s address for them, and notify them of this action. This resolves the convenience cost of voters, i.e., the re-registration burden from movers, and also reminds them about the upcoming election. Using a natural experiment that stems from legal requirements and how the policy was practiced, I evaluate the effect of the policy. I found that the propensity to vote was 5.9 percentage points larger for those who received the ‘NCOA mailings.’ I also discussed some related policy suggestions.

The importance of analyzing movers’ political behavior is even more important due to the changes in election administration practices. Many states are now moving towards all-mail elections. Vote-by-mail (VBM) has been argued to increase turnout, especially for the peripheral voters in low-stimulus elections (Karp and Banducci, 2000; Southwell and Burchett, 2000; Gerber, Huber and Hill, 2013). As of 2018, twenty-two states have provisions allowing all-mail elections under some circumstances. Among them, three (Oregon, Washington, and Colorado) conduct *all* elections by all-mail, and California and Hawaii are also gradually making a transition. When the entire electorate receives their ballots by physical mail, it is more vital than ever to analyze and remove barriers that movers may face when voting.

The detailed administrative data made this analysis possible, although limited to a single county. While I only use in-county movers, the costs of moving will only increase for out-county and out-state movers. Portable registration does not apply across county borders.

In these cases, the lowered turnout is likely to be stretched across a longer period of time. These voters with geographic, community mobility will take much longer to adjust than six months—indeed, two years, the observation period of this study, may be insufficient for a full recovery. It may take more than three years, five years, or even close to a decade, a time frame as analyzed in Highton (2000). However, as a majority of movers are within-county, it is still important to recognize how in-county movers may face difficulties in voting, especially if they have moved close to the Election Day. In addition, multistate partnerships such as Electronic Registration Information Center (ERIC)'s data sharing may benefit from taking a leaf out of in-county NCOA processings.

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Appendix A Legislation Related to Voter Registration

A.1 The National Voter Registration Act of 1993

The National Voter Registration Act of 1993 (NVRA), also known as the “motor voter law,” is about increasing the opportunities of voter registration through various means. Its various Sections decree that the States¹ offer citizens the chance to register to vote through motor vehicle agencies, by mail-in applications, and by public assistance and disability offices.

Section 8, *Administration of Voter Registration*, requires States to maintain accurate and up-to-date data. Specifically, the it mandates that the States conduct “a general voter registration list maintenance program that makes a reasonable effort to remove ineligible persons from the voter rolls by reason of the person’s death, or a change in the residence of the registrant outside of the jurisdiction, in accordance with procedures set forth in the NVRA” (The United States Department of Justice, Civil Rights Division, 2017).

A.2 The National Change of Address Program (NCOA).

For the second requirement, the NVRA offers one example. The States can use the permanent change-of-address records submitted to the United States Postal Service (USPS) by voters. A United States resident can fill out a change of address form on the Official USPS Change of Address website or physically at a local post office, to have her mail forwarded to the new residence or a PO Box. While from a voter’s point of view this serves primarily not to lose any mail while moving for a price of 1.05 USD,² the accumulated data contains movers’ old and new addresses, including the date they requested the service to start.

This data can be used by the States to check their voter data and to discern voters who have moved. By distinguishing those who have moved away from the jurisdiction, the election officials can remove the names of some voters. The only legal requirement is that this removal is performed 90 days prior to the date of the federal election. To see the actual screenshots of change-of-address applications and how it prompts voter registration data update, see Appendix A. Note that the usage of the NCOA data is not mandatory.³ The

¹The States here indicate 44 States and the District of Columbia, with Idaho, Minnesota, New Hampshire, North Dakota, Wisconsin, and Wyoming as exceptions.

²This is for ID verification.

³Highton and Wolfinger (1998) wrote as follows (page 92):

The NVRA provides one alternative to this daunting list-cleaning procedure: States may identify movers with the Postal Service’s computer file of address-change information, known as the National Change of Address (NCOA) program. About 40 million permanent change-of-address notices are filed each year with the Postal Service. The NCOA file is updated daily and each change is kept for three years. This information can be bought from two dozen licensed vendors who distribute customized NCOA data sets. The NVRA requires that people purged by NCOA who move inside the same county (about 60% of all movers) be automatically reregistered at their new address.

NCOA processing is just one example of a potential list maintenance activity that can be performed by the States. A majority of the states do implement the NCOA processing (National Association of Secretaries of State, 2017), California being one prominent state that mandates NCOA processing by its own election laws.

A.3 California Elections Code.

In California, counties can opt in to integrate NCOA processing into their list maintenance, as an alternative to a residency confirmation postcard (CA Elec Code § 2222 (2017); 52 U.S.C. § 20507(c)(1)(A)). This is classified as third party address changes, as opposed to first party address changes. Because there is a statewide voter registration system in California, it is the Secretary of State that is in charge of obtaining and disseminating the NCOA data (California Secretary of State, 2019).

Persuant to California Code of Regulations § 20108.50 National Change of Address Processing., the Secretary of State must NCOA process the statewide voter list, and send any records of registrants that seem to have changed their address to the relevant county officials.

A.4 The Justice Department's Summary

The following is the 36th question posted in [the Justice Department's questions and answers over the NVRA](#) (The United States Department of Justice, Civil Rights Division, 2017). It details the role that NCOA processing plays in voter list maintenance.

36. Do States have to use the NCOA process to initiate the notice process?

No. States do not have to use the NCOA process. Under the NVRA, States must have a general program that makes a reasonable effort to identify and remove the names of voters who have become ineligible to vote by means of a change of address. The program has to be uniform, non-discriminatory, in compliance with the Voting Rights Act and must be completed 90 days before a federal election. States otherwise have discretion under the NVRA and HAVA in how they design their general program, and States

For example, some general programs involve a State undertaking a uniform mailing of a voter registration card, sample ballot, or other election mailing to all voters in a jurisdiction, and then using information obtained from returned non-deliverable mail as the basis for correcting voter registration records (for apparent moves within a jurisdiction) or for initiating the notice process (for apparent moves outside a jurisdiction or non-deliverable mail with no forwarding address noted).

Another example involves general programs where States initiate the notice process based on information showing that a voter has not voted in elections nor made contact with a registrar over some period of time. This is not prohibited

by the NVRA and its bar on removing voters from the list solely for failure to vote, since it relies on the NVRA notice process, and thus utilizes both a notice and a waiting period of two federal general elections.

The following is the 38th question from the same source, detailing how the within-county movers can vote.

38. Are there any protections in the NVRA for those eligible registered voters who have changed address to another location within a registrar's jurisdiction, or are otherwise on an inactive voter list, but have not notified the registrar prior to the date of a federal election?

Yes. The NVRA contains fail-safe provisions to enable such persons who show up to vote on a federal election day to update their registration and to vote in that election even though they have not notified the registrar of the address change:

1. An eligible registered voter who has moved to an address in an area covered by the same polling place as his or her previous address is permitted to vote at that same polling place upon oral or written affirmation by the registrant of the change of address at the polling place;
2. An eligible registered voter who has moved to an address in an area covered by a different polling place from the polling place for his or her previous address, but within the same registrar's jurisdiction and the same congressional district, at the option of the registrant:
 - (a) shall be permitted to correct the voting records and vote at the old polling place upon oral or written affirmation by the registrant of the new address before an election official at that polling place; or
 - (b) shall be permitted to correct the voting records and vote at a designated central location within the same registrar's jurisdiction, upon written affirmation by the registrant of the new address on a standard form provided by the registrar; or
 - (c) shall be permitted to correct the voting records for purposes of future elections at the new polling place, and shall be permitted vote in the current election at that polling place if allowed under State law, upon confirmation by the registrant of the new address by such means as are required by law.

A central voting location need not be made available by the registrar if State law allows the person to vote at either the old or new polling place in the current election upon oral or written affirmation of the address change.

The failsafe provisions of Section 8 draw a distinction between the registrant's need for "affirmation" or "confirmation" of a new address, depending upon the circumstances in which the failsafe voting occurs.

A.5 California Elections Code Section 2225

The following is the full text of CA Elec Code § 2225 (2017).

(a) Based on change-of-address data received from the United States Postal Service or its licensees, the county elections official shall send a forwardable notice, including a postage-paid and preaddressed return form, to enable the voter to verify or correct address information.

Notification received through NCOA or Operation Mail that a voter has moved and has given no forwarding address shall not require the mailing of a forwardable notice to that voter.

(b) If postal service change-of-address data indicates that the voter has moved to a new residence address in California, the forwardable notice shall be in substantially the following form:

“We have received notification that you have moved to a new residence address in California. You will be registered to vote at your new address unless you notify our office within 15 days that the address to which this card was mailed is not a change of your permanent residence. You must notify our office by either returning the attached postage-paid postcard, or by calling toll free. If this is not a permanent residence, and if you do not notify us within 15 days, you may be required to provide proof of your residence address in order to vote at future elections.”

(c) If postal service change-of-address data received from a nonforwardable mailing indicates that a voter has moved and left no forwarding address, a forwardable notice shall be sent in substantially the following form:

“We are attempting to verify postal notification that the voter to whom this card is addressed has moved and left no forwarding address. If the person receiving this card is the addressed voter, please confirm your continued residence or provide current residence information on the attached postage-paid postcard within 15 days. If you do not return this card and continue to reside in California, you may be required to provide proof of your residence address in order to vote at future elections and, if you do not offer to vote at any election in the period between the date of this notice and the second federal general election following this notice, your voter registration will be cancelled and you will have to reregister in order to vote.”

(d) The use of a toll-free number to confirm the old residence address is optional. Any change to the voter address must be received in writing.

(Amended by Stats. 2015, Ch. 728, Sec. 68. (AB 1020) Effective January 1, 2016. Operative September 26, 2016, when the Secretary of State issued the certification prescribed by Stats. 2015, Ch. 728, Sec. 88.)

A.6 California Code of Regulations, Title 2: Administration

The following is § 20108.50. National Change of Address Processing in Division 7. Secretary of State, Chapter 2. Statewide Voter Registration Database.

Except during the 90 days prior to a Federal election, the Secretary of State shall conduct monthly voter registration list maintenance using a change of address service or services based on the United States Postal Service National Change of Address (NCOA) database to identify address changes for registered voters. For records showing a change of address, the Secretary of State shall automatically transmit a change of address notice to the elections official in the county from or within which a voter has moved. Within five (5) business days of receipt of a change of address notice from the Secretary of State the elections official shall process the change of address notice pursuant to California Elections Code Section 2225 and Section 2226 and submit any changes in the registration record to Calvoter in accordance with Section 20108.15 and Section 20108.40.

A.7 United States Postal Services NCOALink

Privacy Act Statement. The following is the privacy act statement that accompanies the web-based USPS change of address as of June 30, 2018. The emphasis is added by the author.

Your information will be used to provide you with mail forwarding and change of address services. Collection is authorized by 39 U.S.C. 401, 403, and 404. Providing the information is voluntary, but if not provided we will not be able to process your request. **We do not disclose your information to third parties without your consent, except to facilitate the transaction, to act on your behalf or request, or as legally required. This includes the following limited circumstances:** to a congressional office on your behalf; to financial entities regarding financial transaction issues; to a U.S. Postal Service (USPS) auditor; to entities, including law enforcement, as required by law or in legal proceedings; to contractors and other entities aiding us to fulfill the service (service providers); to federal, state, local or foreign government agencies regarding personnel matters or for the performance of its duties; for the service of legal process; **for voter registration purposes**; for jury service duties; to a disaster relief organization if the address has been impacted by a disaster or manmade hazard; to individuals or companies already in possession of your name and old mailing address, as an address correction service. Information will also be provided to licensed service providers of the USPS to perform mailing list correction service of lists containing your name and old address. A list of these licensed service providers can be obtained at the following URL: <https://postalpro.usps.com/mailing-and-shipping-services/NCOALink>. For more information regarding our privacy policies visit www.usps.com/privacypolicy.

Appendix B Data Wrangling

B.1 Re-processing the Database with NCOA.

While the classification of movers can be performed by just monitoring the changes to the voter data, I have re-processed the database with NCOA with the help of Orange County election officials.⁴ This is to detect the moving dates of the first class of voters, who disclosed their new address prior to having detected via NCOA. This final step augments the USPS data to the voter file, and determine movers' their residential stability, i.e., the months spent at the new residence.

B.2 Data Filtering

A couple caveats should be noted. I have excluded voters whose age was observed to be more than a 100. This decision accounts for the fact that for some voters, the date of birth is either entered wrongly (e.g. January 1, 1900), or the dead voters have not been fully accounted for.

Appendix C Descriptive Statistics

Here I present some descriptive statistics of data, as well as the values used in the main text's conditional plots.

C.1 Movers vs. Stayers

Table 1 shows some comparisons between movers between 2016-2018 elections and stayers in the final sample.

⁴The NCOA processing is formally named the NCOALink Product. According to the Postal Service, the NCOALink Product is only provided to a selection of companies licensed by the Service. The OCROV processed the data through a vendor of their choice at my request.

Variables	Movers	Stayers
% of General 2018 Turnout	63.6	70.1
% of Female, If Classified	51.8	50.6
Median Age	42	50
% of Republicans	33.2	31.4
% of Democrats	33.4	33.4
% of Voters Born Abroad	24.1	28.0
% of General 2016 Turnout, if Eligible	80.3	81.9

Table 1: Movers vs. Stayers, Sample Data

C.2 Who Requests Change of Address?

Table 2 shows comparisons between those who request change of address and those who do not, given the initial classification of movers. Note that this comparison is not a universal comparison.

Variables	Change-of-Address Requesters	Non-Requesters
% of General 2018 Turnout	63.6	70.1
% of Female, If Classified	51.8	50.6
Median Age	42	50
% of Republicans	33.2	31.4
% of Democrats	33.4	33.4
% of Voters Born Abroad	24.1	28.0
% of General 2016 Turnout, if Eligible	80.3	81.9

Table 2: Movers with Change-of-Address Requests and Those Without, Sample Data

C.3 Values for Conditional Plots

The followings are the values used to generate the conditional plots in the main text. These are in most cases the median value of each variable, with a few exceptions.

- Turnout 2016: numeric predictor; set to the value(s): 1 (i.e., voted in general 2016).
- Times Moved: numeric predictor; set to the value(s): 1.
- PAV (Permanent Absentee Voter): factor; set to the value(s): 1.
- Gender: factor; set to the value(s): Female.
- Race: factor; set to the value(s): White.

- Party Affiliation: factor; set to the value(s): Independent/Third-Party.
- Born Abroad: numeric predictor; set to the value(s): 0 (i.e., a natural-born citizen).
- Congressional District of New Residence (dummies for each congressional district): factor; set to the value(s): 45th Congressional District.
- Distance Moved (miles): numeric predictor; set to the value(s): 3.32.
- Age: numeric predictor; set to the value(s): 30.
- Distance to Polls (miles): numeric predictor; set to the value(s): 0.28.
- Old Residence’s Neighborhood Income (Census Block Group’s Median Household Income (1,000 USD)): numeric predictor; set to the value(s): 50.
- New Residence’s Neighborhood Income (Census Block Group’s Median Household Income (1,000 USD)): numeric predictor; set to the value(s): 50.

Again, note that conditional plots do not show the average predicted value of the dependent variable over all variations of controls.

Appendix D Regression Results in Main Text, Full Table

This Section shows the summary of the generalized additive models and the linear probability models in their full form, including all the coefficients from control variables.

	<i>Imperfect Placebo</i>			<i>Placebo Tests</i>			
	General 2018	General 2016	Primary 2016	General 2014	Primary 2014	General 2012	Primary 2012
A. Smooth terms (effective degrees of freedom / residual degrees of freedom)							
Res. Stability × Same Address	3.353 4.153	1.148* 1.145	2.698 3.358	2.655 3.305	1.030 1.059	1.003 1.006	1.002 1.004
Res. Stability × Same Precinct	2.684 3.341	1.145 1.276	3.391 4.206	1.931 2.418	1.004 1.007	1.003 1.007	1.933 2.421
Res. Stability × Same Subdist.	7.205*** 8.232	1.034 1.067	2.305 2.878	1.015 1.030	2.007 1.792	3.971 4.899	3.473** 4.305
Res. Stability × Same Cong.	8.446*** 8.913	3.810*** 4.709	3.910* 4.830	1.013 1.027	1.792* 2.241	2.296 2.868	1.002 1.004
Res. Stability × Diff. Cong.	8.428*** 8.908	3.177*** 3.945	1.235 1.433	2.552 3.183	1.015 1.029	1.003* 1.007	1.002 1.003
Distance Moved	1.139* 1.139	1.009* 1.017	2.828 3.580	2.270 2.887	1.006 1.011	1.005 1.011	1.002 1.006
Age	7.991*** 8.655	7.378*** 8.227	7.314*** 8.200	7.035*** 7.998	7.603*** 8.473	7.655*** 8.365	8.115*** 8.752
Distance to Poll	4.947* 6.035	1.037 1.074	2.287 2.910	1.021 1.041	2.102* 2.676	1.011 1.021	1.814 2.303
Old Residence's Neighborhood Income	8.623*** 8.955	8.140*** 8.786	5.252** 6.318	8.377*** 8.882	8.060*** 8.754	3.017*** 3.808	7.732*** 8.573
New Residence's Neighborhood Income	8.357*** 8.881	7.866*** 8.655	1.009* 1.019	6.994** 8.037	3.103** 3.891	2.371* 3.029	1.003 1.006
B. Parametric coefficients (estimate / standard error)							
Same Precinct	0.053 (0.050)	0.043 (0.058)	0.003 (0.053)	0.303*** (0.064)	0.163 (0.084)	0.134 (0.069)	0.094 (0.080)
Same Subdist.	0.113* (0.048)	0.156** (0.054)	0.063 (0.050)	0.395*** (0.060)	0.170* (0.079)	0.257*** (0.064)	0.064 (0.075)
Same Cong.	-0.004 (0.042)	0.133** (0.047)	0.019 (0.046)	0.312*** (0.056)	0.152* (0.071)	0.201*** (0.056)	0.086 (0.068)
Diff. Cong.	-0.026 (0.045)	0.104* (0.050)	-0.018 (0.050)	0.325*** (0.059)	0.158* (0.074)	0.183** (0.060)	0.031 (0.071)
2016 Turnout	1.467*** (0.017)						
Times Moved	-0.229*** (0.025)	-0.442*** (0.027)	-0.254*** (0.026)	-0.302*** (0.031)	-0.282*** (0.045)	-0.117*** (0.032)	-0.238*** (0.042)
PAV	0.291*** (0.015)	0.358*** (0.017)	0.376*** (0.016)	0.390*** (0.018)	0.831*** (0.026)	0.064** (0.020)	0.681*** (0.024)
Female	0.172*** (0.038)	0.230*** (0.042)	0.105* (0.041)	0.136** (0.049)	0.042 (0.066)	0.136** (0.052)	0.166* (0.067)
Male	0.215*** (0.038)	0.114** (0.042)	0.113** (0.041)	0.305*** (0.049)	0.235*** (0.066)	0.096* (0.052)	0.273*** (0.067)
Black	0.187* (0.073)	0.253** (0.083)	0.142* (0.079)	-0.096 (0.093)	-0.271* (0.133)	0.316** (0.102)	-0.354** (0.132)
Hispanic	-0.106*** (0.028)	0.190*** (0.031)	0.108*** (0.030)	-0.315*** (0.036)	-0.570*** (0.051)	0.093* (0.037)	-0.462*** (0.049)
Others (Race)	0.125*** (0.030)	0.232*** (0.033)	0.113*** (0.032)	-0.162*** (0.038)	-0.331*** (0.050)	0.158*** (0.040)	-0.171*** (0.049)
White	0.176*** (0.025)	0.418*** (0.027)	0.227*** (0.027)	0.059* (0.031)	-0.130** (0.040)	0.334*** (0.033)	0.041 (0.040)
Independent/Third-Party	-0.135*** (0.018)	-0.354*** (0.021)	-0.416*** (0.019)	-0.491*** (0.021)	-0.507*** (0.030)	-0.523*** (0.024)	-0.616*** (0.028)
Democrat	0.316*** (0.019)	0.144*** (0.022)	0.601*** (0.018)	-0.193*** (0.020)	-0.176*** (0.027)	-0.145*** (0.024)	-0.327*** (0.025)
Born Abroad	-0.263*** (0.018)	-0.251*** (0.021)	-0.196*** (0.020)	-0.203*** (0.024)	-0.192*** (0.033)	-0.275*** (0.027)	-0.265*** (0.032)
39th Cong. District	0.115 (0.155)	0.200 (0.170)	0.279 (0.171)	-0.019 (0.186)	0.202 (0.268)	0.134 (0.196)	0.236 (0.247)
45th Cong. District	0.231 (0.155)	0.278* (0.169)	0.325* (0.170)	0.012 (0.186)	0.248 (0.267)	0.169 (0.195)	0.151 (0.246)
46th Cong. District	-0.022 (0.156)	0.178 (0.170)	0.334* (0.171)	-0.025 (0.187)	0.169 (0.269)	0.079 (0.197)	0.169 (0.248)
47th Cong. District	0.015 (0.156)	0.147 (0.171)	0.243 (0.172)	-0.105 (0.188)	0.208 (0.270)	0.071 (0.198)	0.128 (0.249)
48th Cong. District	0.230 (0.154)	0.267 (0.169)	0.257 (0.170)	-0.021 (0.185)	0.182 (0.267)	0.154 (0.195)	0.055 (0.246)
49th Cong. District	0.289* (0.157)	0.390** (0.172)	0.254 (0.171)	-0.006 (0.188)	0.220 (0.269)	0.262 (0.198)	0.081 (0.248)
Constant	-0.907*** (0.167)	1.031*** (0.183)	-0.901*** (0.184)	-0.777*** (0.204)	-2.195*** (0.289)	0.880*** (0.214)	-1.597*** (0.269)
Observations	100,389	96,195	83,977	71,411	69,104	65,388	59,914
Adjusted R ²	0.159	0.052	0.090	0.134	0.165	0.067	0.164
Log Likelihood	-57,722.160	-45,323.170	-53,401.650	-41,960.780	-26,208.670	-34,083.580	-27,761.590
UBRE	57,859.880	45,412.880	53,480.550	42,045.840	26,277.130	34,150.990	27,832.550

Note:

*p<0.05; **p<0.01; ***p<0.001

Table 3: Generalized Additive Model Results, Full Sample

	<i>Imperfect Placebo</i>		<i>Placebo Tests</i>				
	General 2018	General 2016	Primary 2016	General 2014	Primary 2014	General 2012	Primary 2012
A. Smooth terms (effective degrees of freedom / residual degrees of freedom)							
Res. Stability × Same Address	3.310 4.102	1.708* 1.004	2.771 3.448	2.732 3.400	1.148 1.281	1.002 1.003	1.000 1.001
Res. Stability × Same Precinct	2.559 3.189	1.004 1.008	3.169 3.937	1.930 2.416	3.181 3.954	1.541 1.904	3.155 3.924
Res. Stability × Same Subdist.	3.613* 4.472	1.113* 1.218	2.019 2.522	4.075 6.027	1.001*** 1.001	1.001 1.002	3.368** 4.177
Res. Stability × Same Cong.	3.003* 3.730	1.001 1.003	1.438 1.756	1.001 1.002	1.001 1.002	1.504 1.853	1.001 1.001
Res. Stability × Diff. Cong.	1.564** 1.939	1.003 1.006	1.002 1.005	1.002 1.004	1.808 2.274	1.003 1.005	1.084 1.163
Age	6.009*** 7.102	4.398*** 5.392	4.492*** 5.510	1.085*** 1.166	4.788*** 5.856	6.285*** 7.297	3.961*** 4.907
Distance to Poll	1.016 1.031	1.003 1.005	1.004 1.008	1.003 1.005	1.001 1.003	1.000 1.001	1.001 1.002
Old Residence's Neighborhood Income	5.223* 6.297	6.960** 7.998	3.146 3.944	3.645 4.534	1.002 1.003	1.000* 1.001	1.957 2.484
B. Parametric coefficients (estimate / standard error)							
Same Precinct	0.057 (0.058)	0.053 (0.068)	-0.026 (0.061)	0.262*** (0.073)	0.120 (0.098)	0.118 (0.080)	0.031 (0.094)
Same Subdist.	0.053 (0.077)	0.184* (0.089)	0.109 (0.079)	0.253** (0.093)	-0.093 (0.130)	0.238* (0.104)	-0.089 (0.122)
Same Cong.	0.009 (0.080)	0.305** (0.093)	-0.006 (0.083)	0.266** (0.097)	-0.024 (0.134)	0.312** (0.109)	-0.041 (0.127)
Diff. Cong.	0.001 (0.232)	-0.217 (0.241)	-0.172 (0.239)	-0.254 (0.296)	-1.032 (0.569)	0.086 (0.286)	0.333 (0.326)
Distance Moved	-0.020 (0.171)	-0.106 (0.200)	0.185 (0.175)	0.407* (0.201)	0.591* (0.277)	-0.139 (0.230)	0.505 (0.264)
Turnout 2016	1.484*** (0.046)						
Moved Times	-0.222*** (0.066)	-0.612*** (0.072)	-0.276*** (0.070)	-0.287*** (0.085)	-0.307** (0.119)	-0.166 (0.088)	-0.226* (0.111)
PAV	0.163*** (0.042)	0.346*** (0.048)	0.251*** (0.044)	0.335*** (0.051)	0.850*** (0.078)	0.087 (0.056)	0.806*** (0.070)
Female	0.189 (0.102)	0.090 (0.116)	0.264* (0.115)	0.294* (0.141)	-0.195 (0.179)	0.317* (0.140)	0.331 (0.198)
Male	0.238* (0.102)	0.031 (0.116)	0.251* (0.116)	0.463** (0.141)	0.062 (0.179)	0.251 (0.140)	0.510* (0.198)
Black	0.206 (0.209)	0.083 (0.237)	0.075 (0.233)	-0.095 (0.284)	0.008 (0.373)	0.742* (0.321)	-0.828 (0.465)
Hispanic	0.083 (0.079)	0.112 (0.087)	0.122 (0.087)	-0.203 (0.105)	-0.623*** (0.148)	-0.053 (0.109)	-0.597*** (0.146)
Others (Race)	0.305*** (0.084)	0.194* (0.094)	0.159 (0.093)	-0.101 (0.110)	-0.336* (0.145)	0.166 (0.119)	-0.134 (0.143)
White	0.332*** (0.072)	0.330*** (0.082)	0.245** (0.080)	0.043 (0.094)	-0.163 (0.122)	0.260* (0.102)	0.020 (0.122)
Independent/Third-Party	-0.226*** (0.051)	-0.361*** (0.059)	-0.398*** (0.054)	-0.471*** (0.061)	-0.392*** (0.085)	-0.472*** (0.069)	-0.472*** (0.080)
Democrat	0.270*** (0.052)	0.164** (0.062)	0.587*** (0.051)	-0.166** (0.058)	-0.217** (0.078)	-0.122 (0.070)	-0.260*** (0.074)
foreign_born	-0.223*** (0.049)	-0.309*** (0.057)	-0.251*** (0.056)	-0.324*** (0.068)	-0.284** (0.093)	-0.207** (0.076)	-0.366*** (0.091)
39th Cong. District	0.364 (0.395)	0.730 (0.403)	0.636 (0.475)	-0.791 (0.508)	-0.559 (0.612)	-0.777 (0.777)	-1.640** (0.569)
45th Cong. District	0.644 (0.393)	0.807* (0.401)	0.542 (0.473)	-0.733 (0.505)	-0.581 (0.608)	-0.691 (0.775)	-1.877*** (0.566)
46th Cong. District	0.157 (0.397)	0.698 (0.405)	0.634 (0.477)	-0.746 (0.510)	-0.581 (0.614)	-0.876 (0.778)	-1.704** (0.572)
47th Cong. District	0.210 (0.400)	0.614 (0.408)	0.735 (0.480)	-0.839 (0.513)	-0.717 (0.620)	-0.828 (0.781)	-1.944*** (0.578)
48th Cong. District	0.654 (0.393)	0.900* (0.400)	0.568 (0.473)	-0.708 (0.505)	-0.704 (0.608)	-0.744 (0.775)	-1.926*** (0.565)
49th Cong. District	0.610 (0.400)	1.062** (0.412)	0.461 (0.478)	-0.793 (0.511)	-0.776 (0.617)	-0.502 (0.781)	-2.182*** (0.575)
Constant	-1.313** (0.419)	0.877* (0.430)	-1.250* (0.498)	-0.141 (0.538)	-1.092 (0.655)	1.730* (0.797)	0.085 (0.619)
Observations	13,150	12,470	10,680	8,877	8,529	8,008	7,307
Adjusted R ²	0.157	0.051	0.090	0.137	0.173	0.068	0.186
Log Likelihood	-7,578.712	-5,909.561	-6,823.539	-5,199.565	-3,164.015	-4,214.901	-3,331.615
UBRE	7,619.864	5,942.088	6,855.060	5,224.926	3,178.778	4,238.004	3,348.890

Note:

*p<0.05; **p<0.01; ***p<0.001

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Table 4: Generalized Additive Model Results, Subsample of Movers within Half Mile

	<i>Imperfect Placebo</i>		<i>Placebo Tests</i>				
	General 2018	General 2016	Primary 2016	General 2014	Primary 2014	General 2012	Primary 2012
NCOA Treatment	0.059*** (0.013)	-0.006 (0.011)	0.001 (0.015)	-0.004 (0.015)	-0.011 (0.012)	0.001 (0.015)	-0.010 (0.015)
Same Address	-0.008 (0.040)	-0.051 (0.036)	-0.038 (0.049)	-0.046 (0.050)	0.026 (0.039)	-0.117** (0.049)	-0.041 (0.047)
Same Precinct	0.014 (0.036)	-0.063* (0.033)	-0.032 (0.042)	-0.070 (0.044)	0.008 (0.034)	-0.079* (0.043)	-0.052 (0.041)
Same Cong.	-0.040* (0.024)	-0.018 (0.022)	-0.015 (0.029)	-0.019 (0.029)	0.004 (0.023)	-0.039 (0.029)	-0.055** (0.028)
Diff. Cong.	-0.051* (0.027)	-0.043* (0.024)	-0.022 (0.032)	-0.016 (0.033)	-0.013 (0.026)	-0.047 (0.032)	-0.076** (0.031)
Distance Moved	-0.002* (0.001)	0.001 (0.001)	0.001 (0.002)	-0.002 (0.002)	0.0001 (0.001)	0.001 (0.002)	-0.0005 (0.002)
2016 Turnout	0.275*** (0.014)						
Times Moved	-0.057*** (0.015)	-0.072*** (0.013)	-0.070*** (0.017)	-0.071*** (0.017)	-0.037*** (0.014)	-0.018 (0.017)	-0.042** (0.017)
Distance to Poll	0.013 (0.017)	-0.012 (0.016)	-0.030 (0.020)	0.007 (0.021)	-0.004 (0.016)	-0.006 (0.020)	-0.005 (0.020)
PAV†	0.054*** (0.013)	0.051*** (0.012)	0.078*** (0.015)	0.090*** (0.016)	0.098*** (0.012)	0.026* (0.015)	0.124*** (0.015)
Age	0.002*** (0.0004)	0.003*** (0.0004)	0.005*** (0.0005)	0.009*** (0.001)	0.007*** (0.0004)	0.005*** (0.0005)	0.008*** (0.0005)
Female‡	0.017 (0.034)	-0.006 (0.032)	-0.020 (0.042)	0.028 (0.043)	-0.020 (0.034)	0.038 (0.044)	0.015 (0.044)
Male‡	0.062* (0.034)	-0.026 (0.032)	0.0001 (0.042)	0.093** (0.043)	0.028 (0.034)	0.050 (0.044)	0.055 (0.044)
White	0.040* (0.022)	0.094*** (0.020)	0.045* (0.027)	0.010 (0.028)	0.007 (0.022)	0.051* (0.027)	-0.009 (0.027)
Black	0.245*** (0.064)	0.113* (0.060)	0.192** (0.084)	0.111 (0.086)	0.015 (0.068)	0.141 (0.088)	0.163* (0.086)
Hispanic	-0.030 (0.026)	0.063*** (0.023)	0.041 (0.031)	-0.066** (0.032)	-0.035 (0.025)	0.037 (0.032)	-0.061* (0.032)
Others (Race)‡‡	-0.005 (0.026)	0.073*** (0.024)	0.029 (0.031)	-0.034 (0.033)	0.020 (0.025)	0.020 (0.032)	-0.019 (0.032)
Independent/Third-Party	-0.016 (0.015)	-0.055*** (0.014)	-0.081*** (0.018)	-0.102*** (0.019)	-0.038*** (0.014)	-0.088*** (0.018)	-0.068*** (0.018)
Democrat	0.104*** (0.016)	0.021 (0.014)	0.142*** (0.018)	-0.036* (0.019)	-0.0004 (0.015)	-0.021 (0.018)	-0.042** (0.018)
Old Residence's	0.001*** (0.0003)	0.0003 (0.0003)	-0.001* (0.0003)	-0.001* (0.0003)	-0.0001 (0.0003)	0.0003 (0.0003)	-0.0002 (0.0003)
New Residence's	0.001* (0.0003)	0.0005* (0.0003)	0.0003 (0.0004)	0.00003 (0.0004)	-0.0002 (0.0003)	0.001 (0.0004)	-0.00003 (0.0003)
Neighborhood Income	0.001* (0.0003)	0.0005* (0.0003)	0.0003 (0.0004)	0.00003 (0.0004)	-0.0002 (0.0003)	0.001 (0.0004)	-0.00003 (0.0003)
Born Abroad	-0.044*** (0.015)	-0.019 (0.014)	-0.055*** (0.020)	-0.047** (0.021)	-0.055*** (0.017)	-0.044** (0.021)	-0.080*** (0.021)
39th Cong. District	0.113 (0.139)	0.229* (0.120)	0.116 (0.153)	-0.145 (0.145)	-0.005 (0.117)	0.292** (0.143)	-0.173 (0.142)
45th Cong. District	0.156 (0.138)	0.252** (0.120)	0.141 (0.152)	-0.148 (0.144)	-0.012 (0.116)	0.305** (0.142)	-0.156 (0.141)
46th Cong. District	0.108 (0.139)	0.234* (0.120)	0.132 (0.153)	-0.152 (0.145)	-0.008 (0.117)	0.253* (0.143)	-0.155 (0.142)
47th Cong. District	0.125 (0.141)	0.208* (0.122)	0.164 (0.155)	-0.153 (0.147)	-0.006 (0.118)	0.325** (0.145)	-0.111 (0.144)
48th Cong. District	0.157 (0.139)	0.239** (0.120)	0.142 (0.152)	-0.156 (0.144)	-0.007 (0.116)	0.273* (0.142)	-0.176 (0.141)
49th Cong. District	0.150 (0.140)	0.246** (0.121)	0.056 (0.153)	-0.147 (0.146)	-0.026 (0.117)	0.305** (0.144)	-0.213 (0.142)
Constant	0.011 (0.151)	0.410*** (0.132)	0.100 (0.167)	0.195 (0.161)	-0.146 (0.129)	0.142 (0.159)	0.099 (0.157)
Observations	5,539	5,035	4,341	3,680	3,553	3,366	3,082
Adjusted R ²	0.126	0.043	0.081	0.135	0.136	0.057	0.136
Res. Std. Error	0.455 (df=5510)	0.392 (df=5007)	0.474 (df=4313)	0.448 (df=3652)	0.342 (df=3525)	0.419 (df=3338)	0.391 (df=3054)
F statistic	29.427*** (df=28; 5510)	9.334*** (df=27; 5007)	15.164*** (df=27; 4313)	22.291*** (df=27; 3652)	21.695*** (df=27; 3525)	8.587*** (df=27; 3338)	18.902*** (df=27; 3054)

Note:

*p<0.05; **p<0.01; ***p<0.001

†: Permanent absentee voter.

‡: Voters with no clear gender classification are included as a baseline.

‡‡: Asian Americans are baseline race/ethnicity.

Table 5: Effect of NCOA Policy Treatment, Linear Probability Model

General 2018 Turnout				
	Low Info Cost	Distance Moved Less Than 0.5 Mile	Distance Moved Less Than 1 Mile	Distance Moved Less Than 3 Miles
NCOA Treatment	0.044 (0.043)	0.050 (0.034)	0.060** (0.027)	0.076*** (0.018)
Same Address		0.035 (0.054)	0.015 (0.046)	-0.001 (0.043)
Same Precinct	0.053 (0.051)	0.083 (0.054)	0.064 (0.044)	0.031 (0.038)
Distance Moved	0.050 (0.111)			-0.009 (0.012)
Same Cong.		0.012 (0.056)	0.015 (0.039)	-0.020 (0.027)
Diff. Cong.		-0.149 (0.206)	0.103 (0.093)	-0.052 (0.041)
2016 Turnout	0.299*** (0.047)	0.313*** (0.038)	0.286*** (0.031)	0.272*** (0.021)
Times Moved	0.024 (0.056)	-0.027 (0.038)	-0.028 (0.031)	-0.041* (0.022)
Distance to Poll	-0.074 (0.063)	-0.002 (0.049)	-0.040 (0.040)	0.004 (0.026)
PAV	0.045 (0.045)	0.006 (0.035)	0.021 (0.028)	0.068*** (0.019)
Age	0.004*** (0.001)	0.002** (0.001)	0.002*** (0.001)	0.002*** (0.001)
Female	0.024 (0.113)	-0.093 (0.090)	0.017 (0.077)	0.015 (0.048)
Male	0.097 (0.114)	-0.037 (0.091)	0.051 (0.077)	0.057 (0.048)
Black	0.488** (0.194)	0.481*** (0.158)	0.397*** (0.140)	0.333*** (0.101)
Hispanic	0.053 (0.098)	0.082 (0.077)	0.003 (0.059)	-0.050 (0.037)
Others (Race)	0.065 (0.101)	0.130 (0.080)	0.084 (0.060)	-0.034 (0.037)
White	0.048 (0.093)	0.142** (0.072)	0.061 (0.054)	0.024 (0.032)
Independent/Third-Party	-0.022 (0.056)	-0.085** (0.043)	-0.044 (0.034)	-0.033 (0.023)
Democrat	0.136** (0.055)	0.102** (0.043)	0.103*** (0.035)	0.078*** (0.023)
Old Residence's	0.022 (0.022)	-0.002 (0.004)	0.0002 (0.002)	0.0001 (0.001)
Neighborhood Income	-0.019 (0.022)	0.003 (0.004)	0.002 (0.002)	0.001* (0.001)
New Residence's	-0.019 (0.022)	0.003 (0.004)	0.002 (0.002)	0.001* (0.001)
Neighborhood Income	-0.013 (0.052)	0.009 (0.041)	-0.013 (0.033)	-0.036 (0.022)
Born Abroad			0.042 (0.346)	0.224 (0.148)
39th Cong. District			0.037 (0.345)	0.238 (0.147)
45th Cong. District	-0.047 (0.074)	-0.011 (0.059)	-0.028 (0.346)	0.154 (0.148)
46th Cong. District	-0.057 (0.086)	-0.006 (0.071)	0.067 (0.350)	0.210 (0.151)
47th Cong. District	0.111 (0.116)	0.115 (0.090)	0.090 (0.345)	0.245* (0.147)
48th Cong. District	0.066 (0.074)	0.079 (0.058)	-0.062 (0.348)	0.187 (0.150)
49th Cong. District	-0.111 (0.107)	-0.055 (0.086)	0.012 (0.348)	-0.060 (0.150)
Constant	-0.158 (0.206)	0.033 (0.167)	0.012 (0.369)	-0.060 (0.169)
Observations	464	724	1,143	2,548
R ²	0.176	0.179	0.145	0.137
Adjusted R ²	0.131	0.149	0.124	0.128
Res. Std. Error	0.441 (df = 439)	0.441 (df = 697)	0.446 (df = 1115)	0.450 (df = 2519)
F Statistic	3.898*** (df = 24; 439)	5.851*** (df = 26; 697)	6.989*** (df = 27; 1115)	14.323*** (df = 28; 2519)

Note:

*p<0.05; **p<0.01; ***p<0.001

‡: Permanent absentee voter.

‡: Voters with no clear gender classification are included as a baseline.

‡‡: Asian Americans are baseline race/ethnicity.

Table 6: Effect of NCOA Policy Treatment by Information/Social Costs

Appendix E Alternative Regression Specifications

E.1 Dynamic Costs: Logistic Regressions

E.2 Policy Evaluation: Logistic Regressions

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