Location, Location, Location: Precinct Placement and the Costs of Voting

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This article provides a new measure of voting costs by using Geographic Information Systems (GIS) tools to calculate the distance between the residence and polling place for registered voters in the city of Atlanta. Using this measure to predict turnout at the individual level, we find that small differences in distance from the polls can have a significant impact on voter turnout. We also find that moving a polling place can affect the decision to vote. In addition to providing a better understanding of the costs of voting, our findings have important implications regarding the location of polling places and the effects of altering precinct boundaries.

> We have assumed that voting is a costless act, but this assumption is self-contradictory because every act takes time. In fact, time is the principal cost of voting: time to register, to discover what parties are running, to deliberate, to go to the polls, and to mark the ballot. Since time is a scarce resource, voting is inherently costly. (Downs 1957, 265)

Of the many ways that citizens participate, voting is perhaps the most fundamental to democratic society. Not only is voting the most common type of participation, but voters are more representative of the wider citizenry than other types of participants (Verba, Schlozman, and Brady 1995). Moreover, because each citizen is allowed only one vote, all citizens, at least theoretically, have an equal voice. But despite the egalitarian nature of voting, voter turnout is related to education and wealth, and as a result, "low voter turnout means unequal and socioeconomically biased turnout" (Lijphart 1997, 2).

At the same time, voting is the form of political participation whose costs the government can most easily alter through institutional change. Imposition or abolition of poll taxes and literacy tests, changes in the ease of registration such as "motor voter," changes in the day of week or time of year of the election, length of time the polls remain open, and the placement of polling stations are among the institutional factors that can affect the costs of voting.

The 2000 presidential election in the United States highlighted the impact of seemingly minor administrative details. For example, the butterfly ballot confused

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thousands of voters (Wand et al. 2001), while unequal access to modern voting equipment and purged voter lists prevented many citizens, particularly minorities, from voting (Judis 2001; Pierre and Slevin 2001). Likewise, most people regard the placement of polling sites as a simple bureaucratic detail. However, we demonstrate in this article that changes in the location of a polling place or small differences in the distance one must travel in order to vote can both have significant impacts on a citizen's likelihood of voting.

The Costs of Voting

Political scientists have studied voter turnout and the decision to vote from many perspectives. Much of this research has focused on an individual level cost-benefit analysis where a person will vote when the following inequality is satisfied:

$$C < PB + D$$

A person will vote when the costs (C) are outweighed by the benefits (B) that accrue from the favored candidate winning discounted by the probability of having an impact on the outcome (P), when added to the "satisfaction" of performing one's civic duty (D) (Aldrich 1993; Downs 1957; Ferejohn and Fiorina 1974; Niemi 1976; Riker and Ordeshook 1968; Sanders 1980).

Empirical tests of this theory have focused more on the P, B, and D terms than on the C term. To a large degree, this emphasis is theoretically driven. As Aldrich (1993) discusses, scholars have established that information and decision-making costs are fairly low. Moreover, researchers have argued that the direct costs involved with the act of voting itself are also low. As Niemi writes, "many people regard voting as no more costly than many other kinds of intermittent activities they undertake" (1976, 116). Despite downplaying the role of costs, Niemi concedes that "if the B or PB term is indeed quite small, then a small increase in the cost of voting—such as driving a mile instead of a half-mile to the polls—would significantly reduce turnout" (1976, 117). Yet, Aldrich (1993) points out that the C term is omitted in some empirical models (such as Riker and Ordeshook 1968) or measured indirectly (and problematically) due to the difficulty of evaluating the costs of voting at the individual level with the available survey data. He does suggest, however, "if good measures of costs were available in surveys they would also show strong effects" (1993, 257).

Using survey data mostly from the National Election Studies (NES) and Current Population Surveys (CPS), scholars have learned quite a lot about the impact of certain individual-level characteristics on the decision to vote. For example, educated citizens vote at higher levels and voting increases with age, although there is a point at which age becomes an impediment to voting (Leighley and Nagler 1992; Rosenstone and Hansen 1993; Wolfinger and Rosenstone 1980). Most scholars also agree that income is positively related to voting (Leighley and Nagler 1992; Wolfinger and Rosenstone 1980; but see Filer, Kenny, and

Morton 1993). Other studies suggest that individuals can become habitual voters (Plutzer 2002), and that policy preferences (Mebane and Sekhon 2002), attitudes toward political candidates (Holbrook et al. 2001; Sanders 1999), and uncertainty about the character traits of candidates (Sanders 2001) impact voter turnout.

Despite the demonstrated utility of these survey data, such data also suffer from certain limitations. First, surveys rely on reported turnout instead of actual behavior. But vote validation studies find that the self-reported vote in the NES exceeds the actual vote by between 7.0 and 11.5% (Anderson and Silver 1986) and over reporting is not randomly distributed (Abramson and Claggett 1991; Silver, Anderson, and Abramson 1986). Although some scholars suggest that such misreporting has little effect on the final results (Sigelman 1982), others note that it may have implications for our understanding of key subgroups such as young voters (Hill and Hurley 1984) or exaggerate relationships between socioeconomic status and turnout (Anderson and Silver 1986). Second, while scholars suggest that costs associated with travel might impact a person's likelihood of voting (Downs 1957; Niemi 1976; Sanders 1980), privacy concerns protect the names and addresses of survey respondents. And without such information, researchers cannot measure individuals' travel costs. Sanders does the best job possible given these limitations, coding survey respondents as "rural" or "urban," with the assumption that, "getting to the polls is more difficult in rural areas where distances may be large" (1980, 859). But it is clear that a true assessment of the impact of geography on the costs of voting requires data with a more explicit geographic component. To date, only one study has made a direct examination of the impact of distance on voting. Gimpel and Schuknecht (2003) model this effect for the 2000 election using ecological data for precincts in three Maryland counties.

This project departs from past studies in two important ways. First, we use administrative data instead of survey data, giving us the actual behavior and geographic location of each individual. Thus, we are able to furnish a direct measure of cost previously absent in the literature. Second, like Gimpel and Schuknecht (2003), we take advantage of technological improvements in Geographic Information Systems (GIS) tools, though we calculate the distance between the residence and polling place for individual registered voters. This approach allows us to address a number of theoretical and substantively interesting questions. Is distance from a polling place a measurable cost of voting? Does the distance impact an individual's decision whether or not to vote? Do changes in the location of polling places and precinct boundaries influence the decision to vote?

Data and Methods

Our study analyzes turnout in the 2001 mayoral race in the city of Atlanta. Although we sacrifice some generalizability in doing so, we focus on an election in a single city to maximize internal validity. Nationwide studies on voting in presidential years are complicated by state-specific effects resulting from the

Electoral College system and the presence of other high-profile races. For example, candidates in the 2000 Presidential elections campaigned heavily and engaged in aggressive "get out the vote" efforts in Florida, while largely ignoring the neighboring state of Georgia. In addition, West Virginia witnessed a close gubernatorial contest in 2000, Michigan had a close senatorial race, and Missouri had both. As a result, the costs and benefits of voting are different across states, and we should expect each individual's voting calculus to reflect these differences. By examining a single city nonpresidential election, we are less susceptible to the types of variations that occur across states in presidential elections. With fewer elections taking place across a smaller geographic space, we provide better controls for factors that may impact turnout such as candidate expenditures (Patterson and Caldeira 1983), the closeness of the election (Cox and Munger 1989; Downs 1957; Foster 1984; Key 1949), and negative advertising (Ansolabehere et al. 1994). Although variations occur across precincts in our analysis, we believe our selection of a single city allows us to better isolate the impact of distance to the polling place, our variable of theoretical interest.

We recognize that the voting calculus will differ somewhat across election types and geographic settings. Values for *P*, *B*, and *D* will be different for a presidential race than for a mayoral race. Since the distance is a constant, there is no reason to expect the direct costs associated with traveling to the polls to vary by election type. Direct costs related to waiting in line would be higher but information costs would be lower in presidential races. Although we focus on an urban setting, we expect distance would matter in suburban and rural areas as well. To be sure, the perceived cost of traveling an extra mile should be lower for suburbanites accustomed to longer commutes or for rural voters who must drive long distances to buy groceries or see a movie. But the average distances such voters must travel are also greater because polling places are more spread out in sparsely populated areas. Indeed, Gimpel and Schuknecht (2003) found that while distance mattered in urban, rural, and suburban settings, it had different impacts in each due to differences in road congestion.

Atlanta's nonpartisan mayoral race had three major candidates, all of whom were African American: Shirley Franklin, Robb Pitts, and Gloria Bromell-Tinubu. Most observers gave only Franklin and Pitts a serious chance of winning, while Bromell-Tinubu played a spoiler role, threatening to send the election to a runoff (Bennett 2001). In the end, Franklin got 50.2% of the vote, avoiding a runoff by just 189 votes to become Atlanta's first black female mayor.

The primary data for this study come from the city of Atlanta voterfile, obtained from the Georgia Secretary of State.[1] In addition to a person's name and address, the voterfile contains information on race, gender, age, date of registration, and voting history. We geocoded each voter's address using Caliper's Maptitude 4.5 and a 2000 streets file, with a match rate of 98%. The precinct locations

[1] A table explaining the source of each variable in our model appears as Appendix A at http://www.journalofpolitics.org.

were geocoded with a match rate of 100%. We then calculated *roads distance*, the shortest path distance over city streets between each individual's home address and the polling place to which he or she was assigned using Caliper's TransCad 3.6. The resultant distance measure has a mean of .83 miles, a standard deviation of .57, and a median value of .69 miles. A kernel density plot of *roads distance* is found in Appendix B at http://www.journalofpolitics.org.

While the voterfile contains useful information unavailable in the NES or CPS, its use requires certain trade-offs. First, a voterfile contains information only on citizens who have actually registered to vote, forcing us to ignore the first part of what is actually a two-stage process (see Timpone 1998). Second, a voterfile does not contain data commonly found in the surveys such as income, educational attainment, policy preferences, candidate evaluations, efficacy, or sense of civic duty that might impact an individual's decision whether or not to vote.[2] But once a voter's home address has been geocoded, we can estimate many of these individual-level variables with information from the 2000 Census. We do not use the summary characteristics of the entire geographic unit as our estimate. Instead, we impute these values using voterfile data about that individual's race, gender, and age, as possible.[3] Unlike contextual effects, our estimates for these characteristics vary within geographic units. The practice of using census-based estimates, which has been in use by Public Health scholars for over a decade, has both supporters (Cherkin, Grothaus, and Wagner 1992; Krieger 1992; Krieger and Gordon 1999) and critics (Geronimus and Bound 1998, 1999; Geronimus, Bound, and Neidert 1996). We feel that our use of this technique is appropriate, given that we base our estimates on the smallest geographic unit available (see Krieger, Williams, and Moss 1997; Soobader et al. 2001) and rely on Census and election data that are temporally close (see Krieger 1992).[4]

Specifying the Impact of Distance

The dependent variable for our study is whether or not an individual voted. We use a logit model to test the relative impacts of these factors, with the Huber/White/sandwich estimators of robust standard errors (White 1980).[5]

[2] We should also note that Georgia voters do not register to vote by party. However, the election that we examine is also a nonpartisan race.

[3] The voterfile includes information on race, age, and gender. In SF3, the Census reports income data by race and age, educational attainment by gender and race, vehicle availability by race, and homeownership by race. Race is unavailable for a small percentage of voters (2.5%); the values for "all races" were used to impute data for these individuals.

[4] Diagnostics related to the inclusion of these imputed variables can be found in Appendix C at http://www.journalofpolitics.org.

[5] Another potential concern is that distance might be related to other variables in our model, which could in turn make it inappropriate for us to fix our other variables to their mean or mode when estimating the impact of distance. Because wealthier people within a city are less densely populated than poorer people, one could reasonably expect for distance to be positively associated with income. On the other hand, one also might reasonably fear that precincts might be drawn in order to disenfran-

We would like to stress that we do not expect distance to affect voters monotonically. Some people will walk to their polling place, some will drive, while still others may take public transportation.[6] We theorize that people will walk to the polls if the distance is sufficiently short whether they own cars or not. It is not worth getting into the car, parking, and walking from the parking lot if the polls are right next door or even just a few blocks away. But if the polls are located beyond walking distance, only people with access to cars will have the option of driving. Moreover, the cost of driving an extra block is lower than the cost of walking that same block, so we predict that voters will be more sensitive to differences in distance over short ranges than over longer ranges. Therefore, we model this expectation by using the log of distance in our equation.[7] Finally, because only some people have the option of driving, we include a control variable, *vehicle available*, which reflects the probability that at least one vehicle is available to the household and an interaction term between *vehicle available* and the *logged distance*.

Control Variables: Costs, Benefits, and Civic Duty

To isolate the influence of distance on an individual's decision to vote, we include control variables that capture elements of the costs, benefits, and civic duty components of the decision process.

Costs

The greater the costs of voting, the less likely a person is to vote. Wolfinger and Rosenstone contend that education "reduces the cost of voting by giving people the skills necessary for processing political information and for making political decisions" (1980, 36). We measure education as the likelihood that an individual is a *college graduate*. Experiences gained throughout life increase familiarity with the political process decreasing the costs of voting (Rosenstone and Hansen 1993), although physical limitations may appear later in life (Milbrath and Goel 1977). We include both linear and squared terms for *age* to account for the nonlinear relationship between age and turnout. Finally, a large number of voters in the 2001 mayoral race saw their precincts move as result of the redistricting that followed the 2000 census. We expect that such voters will

chise minorities or poorer voters by forcing them to travel long distances to vote. We present diagnostics in Appendix D (http://www.journalofpolitics.org) showing that the other independent variables in the model, including our income measure, are not very good predictors of distance.

[6] We do not examine poll accessibility to public transportation in our study. However, most Atlantans live within one mile of the polls and the normal "headway" for buses on MARTA, Atlanta's public transportation system, is 30 minutes. Therefore, we expect that few voters travel to the polls on public transportation.

[7] We confirmed the appropriateness of the log transformation by testing the stability of the parameter for distance over a series of models presented in Appendix E (http://www.journalofpolitics.org).

be less likely to vote due to information costs associated with locating the new polling station, and include a dummy variable, *moved polling place*, for these voters.

Benefits

People who stand to gain more from the election of a particular candidate will be more likely to vote. Most scholars argue that voters with greater incomes have more at stake (Downs 1957; Wolfinger and Rosenstone 1980), while some contend that income reflects the opportunity cost of voting (Filer, Kenny, and Morton 1993). We use median household income as our income measure and include a squared term to account for the possibility that the relationship between income and likelihood of voting is nonlinear. We also measure stake in the election with *homeowner*, the likelihood of an individual owning his or her home. Not only are homeowners the most likely to be affected by changes in the property tax structure,[8] they also have less ability to "vote with their feet" and move out of the city than do renters. Voters may perceive benefits based on the candidates in this election. Focusing specifically on the race of the mayor as a measure of political empowerment, Bobo and Gilliam argue that black "empowerment should influence participation because macro level aspects of a person's sociopolitical environment affect cost-benefit calculations" (1990, 379). To capture the potential benefits to blacks and women of electing Atlanta's first African-American female mayor, we include dummy variables for *black male*, *black female*, and *nonblack female*; nonblack males provide the baseline for comparison. Finally, four of the 12 City Council races had open seats. We include a dummy variable for voters who reside in these *open seat* districts, with the expectation that such voters will be more inclined to vote.[9]

Civic Duty

Because we use a voterfile instead of survey data, we cannot measure perceptions of civic duty as directly as do other scholars (Kanazawa 1998; Sanders 1980; Verba and Nie 1972). However, there is still information available in the voterfile that allows us to measure this concept. New residents may be less likely to vote because of fewer community connections and the burdens associated with adjusting to a new environment (Lane 1959; Wolfinger and Rosenstone 1980). This phenomenon may be particularly important in a city like Atlanta that has

[8] This is particularly true in those cities which, like Atlanta, lack a local income tax and whose city governments lack the authority to impose sales taxes.

[9] In the early stages of this project, we had hoped to further leverage our use of GIS by geocoding yard signs as a precinct-level measure of grassroots campaign activity. We were not able to obtain these data or any information that could be quantified at the council district or precinct levels. Diagnostics reported in Appendix F (http://www.journalofpolitics.org) test confirm that the lack of such data does not bias our model.

seen significant in-migration and gentrification. We model this effect with *years since registration*, the number of years that have elapsed since each voter first registered in the county. Following the same logic as for the age and income variables, we include a squared term for this variable. In addition, we theorize that many voters who registered in 2001 were mobilized by one of the campaigns and registered specifically to vote in this election. As such, voters may feel a greater duty to vote in this particular election; we include a dummy variable, *new voter*, for new registrants. Finally, some communities may have stronger traditions of political participation that impact turnout. Holding all other factors constant, a person is more likely to vote if he or she discusses politics with a neighbor or sees a neighbor wearing one of the "I'm a Georgia Voter" stickers that are handed out at the polls on Election Day. We control for this contextual effect with *turnout 2000*, the percent turnout in the 2000 election.

Findings

The first column in Table 1 ("All Voters") shows the results of our logit model of voter turnout. The model performs reasonably well, reducing the error in prediction of the dependent variable by 24.3%.

The control variables in our model generally behave as expected. In terms of costs, we find that age has a positive effect on turnout. Education is in the opposite direction expected, but it has a negligible impact on the dependent variable. But there was also a surprise: the dummy variable for whether or not a voter's precinct has moved has a sizable impact in the opposite of the predicted direction, an unexpected phenomenon that we investigate below. The stake in the election related to income, homeownership and benefits related to "political empowerment" all have a positive impact on turnout. Nonblack females, however, appear no more likely to vote than nonblack males. Voters in districts with open seats, longstanding voters, and voters mobilized to register for this race vote at greater rates. Finally, there appears to be a locality-based element of duty that transcends a person's demographic characteristics: voters from precincts with higher turnout in 2000 were more likely to vote in the 2001 mayoral race.

Turning to our variable of theoretical interest, we find that distance has a statistically significant impact on the voting decision. Figure 1 shows the predicted probablilties that result from our model when all variables are held at their mean or mode except for our vehicle availability and distance measures. To illustrate the range of the effect of distance, we plot our predicted probabilities at the lower and upper bounds of our continuous *vehicle available* variable. When no one owns a car (*vehicle available* = 0), the likelihood of voting drops from .664 at a distance of .01 miles to .418 at the median distance of .69 miles. When automobiles are universally available (*vehicle available* = 1), voters are much less sensitive to changes in distance: the likelihood of voting drops from .444 to .392 over the same distance range. Using the method for predicting changes described by Wolfinger and Rosenstone (1980) yields similar results: the likelihood of

TABLE 1

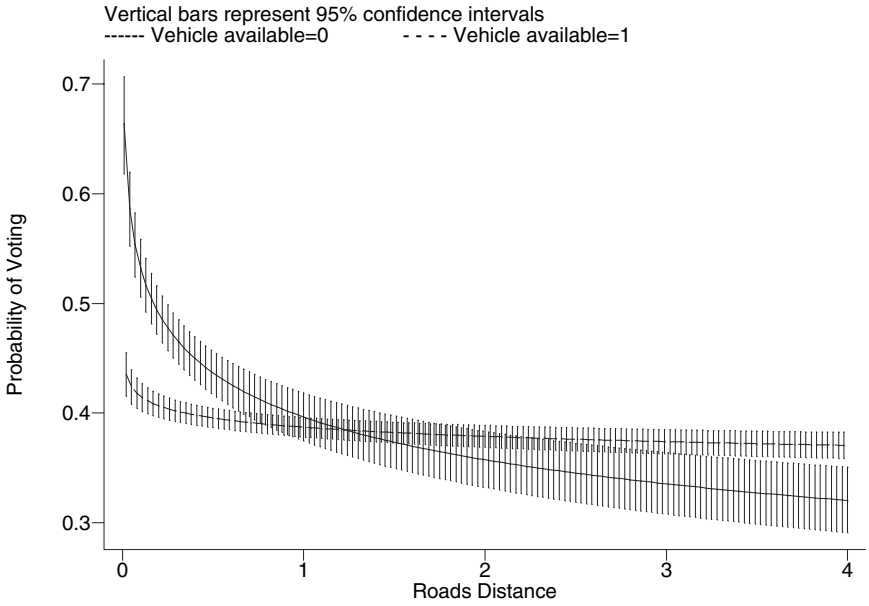
Determinants of Voting

	All Voters	Moved Polls
INDEPENDENT VARIABLES		
COSTS		
Logged distance	−.2390*	—
	(.0248)	
Change in distance, 2000–2001	—	−.0550*
		(.0277)
Vehicle available	−.0385	−.1755
	(.0600)	(.1644)
Vehicle available x Logged distance	.1881*	—
	(.0318)	
College graduate	−.0681*	−.0572
	(.0206)	(.0691)
Age	.0911*	.1050*
	(.0020)	(.0067)
Age, squared	−.0007*	−.0009*
	(.0000)	(.0001)
Moved polling place	.1712*	—
	(.0157)	
BENEFITS		
Income, $10,000	.0332*	.0296
	(.0061)	(.0219)
Income, $10,000, squared	−.0004	−.0027
	(.0003)	(.0016)
Homeowner	.4886*	1.2219*
	(.0264)	(.0707)
Black male	.0920*	−.0796
	(.0207)	(.0598)
Black female	.3442*	.2326*
	(.0203)	(.0592)
Non-black female	−.0064	−.0688
	(.0155)	(.0385)
Open seat	.0634*	.0748*
	(.0117)	(.0328)
DUTY		
Years since registration	.0924*	.0875*
	(.0014)	(.0041)
Years since registration, squared	−.0012*	−.0011*
	(.0000)	(.0001)
New voter	.2658*	—
	(.0231)	
Turnout, 2000	.0145*	.0082*
	(.0008)	(.0018)
Constant	−5.1036*	−4.8130*
	(.0666)	(.1996)
N	198,123	25,617
−2 log likelihood	−113,622.77	−1,434.35
Pseudo R^2	.141	.155

Notes: * $p < .05$; robust standard errors are in parentheses.

FIGURE 1

Predicted Probabilities of Voting



voting drops from .464 at .01 miles to .385 at .69 miles. These are sizable differences in the context of an election where the overall probability of voting was only .414.[10]

However, we are left with the puzzle of how to explain why voting might increase when the polling place moves. It turns out that one result of Atlanta's post-census reapportionment of city council districts was an increase of the number of precincts from 160 to 168. We decided to examine the impact of changes in distance on voters registered before 2001 whose precincts had moved. The second column of Table 1 ("Moved Polls") shows that existing voters are sensitive to changes in distance from their respective polling places. It appears that the gain in turnout that accrues from splitting precincts outweighs the loss due to any confusion over the location of the polling place (information costs) that also occurs. However, it is also possible that postcards sent 30 days before

[10] As an additional experiment, we re-estimate the election outcomes under two counterfactual conditions: (1) each polling place located in the geographic center of its precinct and (2) distance = .01 miles. To do this, we must assume that the probability of each person in a given precinct voting for a particular candidate is the same as the proportion of the vote for that candidate in that same precinct. We find that Shirley Franklin might have been thrown to a run-off election, had the precincts been configured differently: she garners 49.0% of the vote under the first scenario and 49.5% of the vote under the second.

the election to voters whose precinct has moved, as required by Georgia state law, have an offsetting effect by reminding citizens to vote.

Conclusions

The question of "who votes?" is fundamental to political science. We advance our understanding of this question by leveraging a new data source and an emergent technology. The voterfile, an underutilized data source, allows a more direct measure of political behavior and provides the geographic location of individual voters. Ever since Key's (1949) seminal work on the "friends and neighbors" vote in southern politics, political scientists have studied how geography impacts political outcomes. However, recent improvements in GIS tools and GIS-based transportation modeling allow us to make significant gains in our understanding of the spatial dimensions of politics (see Kohfeld and Sprague 2002; Sui and Hugill 2002; Ward 2002).

Because the *C* term is more important than many political scientists have previously believed, our findings raise important theoretical questions. We need a better investigation of the sources of costs, an understanding of how some costs may differ from others, and a theory of how costs may interact with the potential benefits of voting. It took a quarter of a century for the necessary technology to develop, but we are now able to respond to Niemi's challenge to develop new models that "retain some measure of the *C* term" (1976, 119). We see that voters in Atlanta are sensitive even to small distances, in line with Downs's argument that "the returns from voting are usually so low that tiny variations in cost may have tremendous effects on the distribution of political power" (1957, 266). While the impact of distance may vary by type of election and geographic setting, our findings indicate that properly specified models of turnout must account for such costs.

Finally, scholars have long expressed concern about low voter turnout in the United States, and we feel that the solution involves increased attention to the costs of voting. While it may be possible to increase the *D* term through citizen education, any improvement would occur slowly. Likewise, if the closeness of the 2000 presidential election raised the *P* term for citizens, it was not reflected in a turnout surge in the midterm elections of 2002. However, the *C* term is a factor that the government has the power to affect almost instantaneously, and we find that the size of precincts may be too large in some areas. Our study suggests that splitting precincts helps increase turnout even if voters incur information costs due to the change.

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