Walkability and Voter Turnout*

Stone Neilon† Anand Edward Sokhey‡

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Abstract

Do features of the built environment influence rates of political participation? In this paper we consider the relationship between walkability—i.e.,the ease of walking to amenities in an area—and turnout in the contemporary United States. Focusing on census block groups in the country's 25 most populated Metropolitan Statistical Areas (MSAs), we leverage the Environmental Protection Agency's (EPA) walkability indices and aggregate voting data from the 2016, 2018, and 2020 election cycles. We find that areas with higher walkability have higher official turnout; this association obtains across primary and general election contests, in the presence of controls for a variety of socioeconomic factors, and under different modeling choices. In subsequent analyses we bring in novel data on the difficulty of voting in states to consider whether the apparent benefits of walkability can be better understood through traditional notions of "cost-based" versus socially-grounded theories of mass behavior. Our results suggest that both explanations have purchase, though on balance we think the evidence points more towards social factors. We discuss the implications of our findings as they relate to both political geography and longstanding theories of democratic functioning.

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†Ph.D. Student, Department of Political Science, University of Colorado at Boulder. E: `stone.neilon@colorado.edu`

‡Professor of Political Science, Department of Political Science, University of Colorado at Boulder. E: `anand.sokhey@colorado.edu`

1 Introduction

Robust citizen participation plays a central role in prominent studies of democratic functioning (e.g., Almond and Verba, 1963). And, while there are varied ways for individuals to engage with the political realm (donation, volunteerism, protestation, expression, etc.), the act of voting has tended to receive the lion's share of attention as it has long been considered a key indicator of democratic health (e.g., Powell, 1982; Powell Jr, 1986; Jackman, 1987).

At the country-level, scholars have looked to institutional and socioeconomic factors to explain cross-national variation in rates of voting (for a review, see Blais, 2006). At the sub-national and individual-levels, work on turnout as a specific act of participation has tended to respond in some way, shape or form to the question of why individuals engage in such a seemingly irrational act. This, of course, follows from seminal takes on *homo economicus* that struggled to explain observed levels of turnout in the United States (Downs, 1957); classic formulations posited that factors like "social duty" may explain why people vote when the costs of doing so likely far outweigh the benefits one receives from their preferred party/candidate winning, or the probability that their vote will be pivotal (Riker and Ordeshook, 1968).

Decades of subsequent work have commented either directly or indirectly on Riker and Ordeshook's famous calculus. Some scholars have addressed broad conversations about the cost-dimension, evaluating the effects of innovations/reforms intended to make voting easier (e.g., Stein and Vonnahme, 2008; Burden et al., 2014). Others have tackled parts of the formulation through either more social-psychological Campbell (1980) or more social lenses Lazarsfeld, Berelson and Gaudet (1968). The most comprehensive behavioral takes have focused on how resources, recruitment and engagement come together to explain political participation (Verba, Schlozman and Brady, 1995). Sub-literatures have homed in on specific aspects of such a tri-partite framework. For example, many papers and books have addressed questions of citizen-capacity in terms of knowledge (Carpini and Keeter, 1996; Prior, 2005), education (Sondheimer and Green, 2010), and socialization/life-cycle effects (Jennings and Niemi, 1968; Plutzer, 2002). Other research has considered the nature of campaigns (e.g., Farrell and Schmitt-Beck, 2003), and of how being asked to participate may matter. Indeed, scholars have considered mobilization efforts via formal channels in the political system (e.g., Rosenstone and Hansen, 1993; Holbrook and McClurg, 2005), through everyday political conversations in informal social networks (e.g., Klofstad, 2010), and from canvassing-based asks that may spread via social ties and shared environments (Nickerson, 2008).

In this paper we shift our attention to something quite different, for despite the aforementioned, vast literatures, relatively little attention has been given to how physical, inhabited spaces—what we will refer to as *built environments*—shape political behavior in general and turnout in particular. The concept of the built environment receives frequent attention in fields like hazards research, urban planning and public health; it is defined as the man-made structures, features, and facilities that, viewed collectively, make-up an environment in which people live and work (Lawrence and Low, 1990). Work on the built environment in health geography and cognate fields is characterized by a variety of measurement approaches and research designs (for a review, see Mazumdar et al., 2018). In looking at the relationship between the built environment and electoral participation in the US, we choose to focus on the idea of walkability. Walkability is closely related to the many ways scholars assess the built environment; it is defined as the ease of walking to amenities within a given area (Forsyth, 2015). Looking across the 25 largest Metropolitan Statistical Areas (MSAs) in the US, we find a consistent, significant, positive association between walkability ratings and reported voter turnout at the Census block group level. This association is robust to the inclusion of a variety of controls and modeling choices.

In the sections that follow we begin by expanding on the idea of the built environment. We discuss potential connections to (the precursors of) political activity, and some mechanisms through which walkability may influence political participation—we divide these into *cost-based* vs. *socially-grounded* explanations. After giving our formal hypotheses, we address the strengths and weaknesses of our data, note our plan of analysis, and present primary and secondary results. We close by sketching out some next steps while also addressing the implications of our findings for studies involving space and politics, as well as longstanding theories of democratic functioning.

2 Unresolved Questions about the Built Environment and Political Participation

The built environment is frequently defined as the whole of the man-made structures, features, and facilities that make-up the environment in which people live and work (Lawrence and Low, 1990). Scholars from different fields within the social and behavioral sciences (e.g., urban planning, public health, hazards analysis) have long-given substantial attention to the built environment's consequences for a variety of social, mental, and physical health outcomes (Mazumdar et al., 2018). Still, examinations of more direct connections to political variables have been fewer and further between. In a prominent early exception, Putnam (2000) interrogated suburbanization as a major factor in the decline of social capital in the US (though, notably, did not find support for the thesis). Other now aging work reported mixed results: in a study set in Ireland, Leyden (2003) linked individuals in more walkable, mixed-use neighborhoods to higher levels of "social capital."[1] Using Census tract and Social Capital Benchmark Study Data, Hopkins and Williamson (2012) reported that built environmental factors did not have any impact on turnout (though they did suggest that some suburban design features may impact other forms of participation like protesting and attending town halls).

In some contemporary takes on spatial dynamics, Enos (2017) uses observational and experimental data to look at how spatial features in environments structure people's perceptions of groups; he does not focus on questions of civic engagement. Makse, Minkoff and Sokhey (2019) consider the impact of neighborhoods on attitudes and behaviors, but are concerned with the effects of visible political signaling rather than the built features of residential spaces. Most recently, Nathan (2023) reports on the results from a study set in Ghana—he concludes that more gridded and orderly streets reduce social cohesion and depress political turnout, but does not take on the idea walkability. Thus, despite some early and adjacent efforts suggesting that features of the built environment may matter for opinion and action, it remains an open question as to whether walkability relates to rates of voting.

3 Why Walkability Might Facilitate Turnout: Cost-Based vs. Socially-Grounded Takes on Participation

Questions remain about the relationship between walkability as a feature of the built-environment and voting behavior. But why might we suspect such a relationship to begin with? We focus on two perspectives which motivate our analysis: one grounded in traditional notions of "cost," and one anchored in social approaches to the study of mass political behavior.

3.1 The Cost-Based Logic of Participation

In rational choice takes voting always has some cost greater than zero (Riker and Ordeshook, 1968). And, the higher the cost, the less likely it should be for an individual to vote, all else equal. Of course, voting does not have equal costs for all individuals—work in political psychology documents the fact that it is harder for some people to acquire and process information than it is for others. But in addition to information costs, for many voters the action of voting remains a physical one—by that we mean that individuals must either go to a polling location to vote, or go to a location (or a dropbox) to return their ballot. Thus, in addition to information costs, one must travel to a polling location, potentially wait in line, and take the time to fill out a ballot. Convenience voting reforms can influence turnout; these vary across states (Burden et al., 2014). However, the majority of voters (at least prior to COVID-19) cast their ballots in person on election day. And, even if we start to think about voting as more of a continuous process given early and mail voting options, individuals still face the same calculi (even if its timing is shifted).

Where does walkability enter such a story? A primary way walkability may reduce the costs of voting is through the benefits it provides in transportation options. Distance from residence to polling booth has been shown to decrease the likelihood of turning out (Brady and McNulty, 2011). Gimpel and Schuknecht (2003) provides additional evidence on this point, finding that voter turnout is reduced in suburban precincts when the polling location is between 2-5 miles away. Given that much of American society is car-centric, transportation issues can magnify the cost of traveling to the polls. A walkable environment not only provides the opportunity to literally stroll to the polls, but can provide alternative options in

[1] In this study "social capital" was measured in terms of knowing neighbors, trusting others, engaging with others, and reported scores on an index of participatory acts.

the form of subways, buses, or bike-lanes/bike-accessibility. Simply put, a walkable environment can reduce the objective cost of traveling to the polls both directly and indirectly.

Importantly and additionally, a walkable environment may reduce *perceived* costs of voting. Studies from ecology and cognate fields find built environments conducive to walking do indeed influence walking patterns. And, the action of walking can reduce stress, improve mental and physical health, and increase cognition (Finlay et al., 2022; Johansson, Hartig and Staats, 2011; Roe and Aspinall, 2011). Thus, it's possible that walking could cost an individual the same (or even more) in terms of time but provide a net positive via cognitive benefits—the perceived effort might be lower than if the person had gotten in a car and driven. The larger point is that through these physical and mental channels walking may reduce the cost of voting, thus increasing rates of turnout.

3.2 Socially-Grounded Theories of Participation

Viewed through a more social-lens, there are a couple of ways in which walkability might matter for turnout. We discuss these in terms of ideas of social cohesion, which, broadly speaking, involves interaction and engagement with others, and social pressure, which relates to individuals' ideas about how others expect them to behave.

3.2.1 Social Cohesion

Environments (i.e., contexts) structure and influence opportunities for political participation (Huckfeldt, 1979). On this point, Jacobs (1992) describes the importance of city design in shaping social networks:

> *The trust of a city street is formed over time from many, many little public sidewalk contacts. . . Most of it is ostensibly trivial but the sum is not trivial at all.*

Indeed, social interactions via the "slow drip of everyday life" can expose people to different types of politically relevant information (Huckfeldt, 2001), not to mention different opportunities to develop and practice "civic skills" that might assist with entry into public life (Verba, Schlozman and Brady, 1995) (see also Putnam, 2000). We argue that the design of the built environment can influence the nature and relevance of social contexts, and thus by extension, the character and frequency of one's social interactions. Walkable areas have been found to increase the regularity of face-to-face interactions (Van den Berg, Sharmeen and Weijs-Perrée, 2017). And, these interactions may matter for turnout either through something like unscripted contact or facilitated recruitment (Hopkins and Williamson, 2012). With respect to the latter, Klofstad (2010) finds that political talk leads to recruitment, while work set in the UK reports that neighbors that talk together vote together, suggesting neighborhood socialization effects on behavior (Pattie and Johnston, 2000). Meanwhile, field experimental studies indicate that in-person requests to vote are particularly effective relative to some other methods of contact and canvassing (Green and Gerber, 2019).

With respect to the former, greater unscripted contact means that individuals may be interacting with individuals outside of their "core networks"(Marsden, 1987)—that is, with broader sets of acquaintances and weaker ties (Granovetter, 1983). Weak ties have (famously) been theorized to be vital in fostering and sharing new ideas (Granovetter, 1983)—they are characterized by less intimacy and fewer overlapping social roles. More generally, we might suspect that *walkable areas are important because they effectively increase the size of people's networks.* Rolfe (2012) provides support for such a story by arguing that individuals' decisions to vote are rarely independent, but instead are actually conditional on the vote decisions of friends, family, neighbors, coworkers and other ties. She suggests that interactions with the actors in an individual's broader social network can have a powerful mobilizing effect on the likelihood of voting. Speaking to these ideas, Pietryka and DeBats (2017) use historical records in American cities to show that people's social proximity to elites affected their rates of turnout. Viewed in the context of the built environment, then, this perspective suggests that we should expect more walkability to lead to more turnout: larger networks facilitate turnout via mobilization—this happens because they amplify ambient information and raise awareness that an election is taking place (Rolfe, 2012).

3.2.2 Social Pressure

An alternative possibility with respect to walkability involves the idea of social pressure. Given that walkability has been shown to increase social interactions, it is not unreasonable to think that such run-ins could lead to political discussions and the intentional or unintentional revealing of information about (otherwise unobserved) actions like voting. In light of such potential social dynamics, individuals may be inclined to turnout to vote in order to avoid disappointing others or revealing to their friends, family and neighbors that they have not performed their civic-duty. In field experiments Gerber, Green and Larimer (2008) provide compelling evidence that the threat of being shamed can encourage people to turnout.

4 Hypotheses

Given the literatures on the built environment, political participation, and social influence, our main hypothesis is that:

H_1 Block groups that have higher walkability scores will have higher rates of turnout.

Our second hypothesis is intended to help us begin adjudicating between different mechanisms that could underlie the relationship articulated in H1. If walkability relates to turnout because it is helping to offset the traditional costs of voting (the "costs-based" story), we should see evidence in support of the following:

H_2 The effects of walkability on turnout will be larger in census tracts with higher costs of voting.

5 Data and Design

5.1 Independent Variable: Walkability Index

Our main independent variable assessing the effects of the built environment is walkability. Walkability is defined as the ease of walking to amenities within an area (Forsyth, 2015). We use walkability to operationalize the built environment because it captures the layout of an area and mutes variation in architectural design. While previous research has found evidence for links between architectural features and voter turnout, we are only concerned about the built environment from an urban planning perspective (LeVan, 2020). Our decision to use this measure rests comfortably against previous work that has looked at how features of suburbia relate to political participation (e.g., Hopkins and Williamson, 2012).

Of course, it is important to distinguish walkability from population density, and we do so in the analyses that follow. (Oliver, 2001) argues that greater density should reduce political participation in municipal elections. We do not test the effects of walkability in municipal elections, but take Oliver (2001)'s point seriously. Population density refers to the amount of people in a defined area, and it should be distinguished from walkability. A highly dense area does not necessarily mean a walkable one. Similarly, a walkable area does not necessarily mean a dense area.

To operationalize walkability, we use the Environmental Protection Agency's (EPA) walkability index. The walkability index scores all Census block groups from least to most walkable on a 1-20 scale, with 1 being the least walkable and 20 the most walkable. The walkability index is time invariant and was created in 2021 and uses data compiled from 2017-2020. The EPA measures walkability using the following formula:

$$National\ Walkability\ Index = (w/3) + (x/3) + (y/6) + (z/6)$$

Where:
$w = intersection\ density$
$x = proximity\ to\ transit\ stops$
$y = employment\ mix$
$z = employment\ and\ household\ mix$

Summary statistics for the walkability index used in our data-set can be found in Table 1. For a discussion of the strengths and limitations of the measure (relative to others and theoretical frameworks), see (Venerandi et al., 2024).

5.2 Dependent Variable: Voter Turnout 2016-2018

Our dependent variable is the proportion of voter turnout within a Census block group (for a given election). We calculate this by taking the number of voters who turned out in an election divided by

Table 1: Summary Statistics: Walkability Index

Summary Statistics: Walkability Index					
Statistic	**N**	**Mean**	**St. Dev.**	**Min**	**Max**
National Walkability Index	83,608	11.66	3.9411	1.000	20.000

Observations are Census block groups.

the number of registered voters in a Census block group. Summary statistics for general election voter turnout for the 2016, 2018, and 2020 federal elections can be found in Table 2. Turnout data is sourced using the L2 voter file accessed through the Redistricting Data Hub, a nonprofit that purchased the file for the purpose of research on gerrymandering.

Turnout data is, of course, available for earlier eras. However, for the present analysis we choose to focus on the 2016, 2018, and 2020 election cycles. We do this because the walkability measure is time invariant; it was created by the EPA in 2018, and has not been updated. Accordingly, we make the assumption to apply the index temporally backwards and forwards across this interval. Given that the built environment is the culmination of buildings constructed over many years, and the fact that typical construction of a building can take anywhere from 6 to 17+ months (Statista, 2025), this assumption strikes us as a reasonable one—change in walkability is likely negligible between across the observed internal. We would feel less confident about extending this assumption to earlier or later elections.

Table 2: Summary Statistics: General Election

Summary Statistics: General Election Voter Turnout					
Statistic	**N**	**Mean**	**St. Dev.**	**Min**	**Max**
Voter Proportion 2016	83,608	.5725	.1157	0.000	1.000
Voter Proportion 2018	83,608	.5148	.1285	0.000	1.000
Voter Proportion 2020	83,608	.7313	.1318	0.000	1.000

Observations are Census block groups.

5.3 The Units of Analysis: Census Block Groups and MSAs

Previous studies taking spatial approaches to the study of politics have varied in their units of (geographical) aggregation (for a discussion, see (Makse, Minkoff and Sokhey, 2019)). With respect to built environments, choices about boundaries and units can dramatically influence the measurement of something like walkability. So why not work with units like counties or zip codes? Counties are too large to capture individuals' experiences with their "everyday" milieu, and sometimes have irregular boundaries. Zip codes are problematic for similar reasons (not to mention the fact that they actually capture postal *routes*). These mailing codes are familiar to many, but they too are large, are often oddly-shaped, and don't always do a great job mapping residences to spaces.

By contrast, Census tracts hold more promise as a starting point for spatial aggregation; they are often less contorted, having been systematically defined by the U.S. Census Bureau for the explicit purpose of tracking populations. Still, one would be hard-pressed to say spaces as large as Census tracts adequately approximate an individual's "neighborhood" — after all, these are drawn to contain roughly 2,000-8,000 people. Likewise, while the Census' smallest units of aggregation—blocks—hold some appeal, these tend to contain only about 100 people on average and might cover an area as small as a city block.

Admittedly, how one defines their 'neighborhood' is quite subjective (on this point, see e.g., Makse, Minkoff and Sokhey, 2019; Wong et al., 2020). Still, given our interest in the dynamics of walkability in localized spaces, we are drawn to the intermediate unit of Census block groups. Census block groups typically contain between 600-3,000 people, thus they are designed to be smaller than tracts but larger than blocks; Census block groups result from combining Census blocks in a given area. Given our interest in capturing the *realistic immediacy* of amenities and features that surround an individual (i.e., not just what is within "a stone's throw," and not what one would rarely if ever actually walk to), block groups are a natural choice. Fortunately, the EPA's walkability index is measured at this same Census block group level, thereby jelling with preferred unit of spatial aggregation given the research question at hand.

We restrict our study of walkability and turnout to the 25 most populous Metropolitan Statistical Areas (MSAs) in the United States. The list of MSAs in our study can be found in Table 3. MSAs

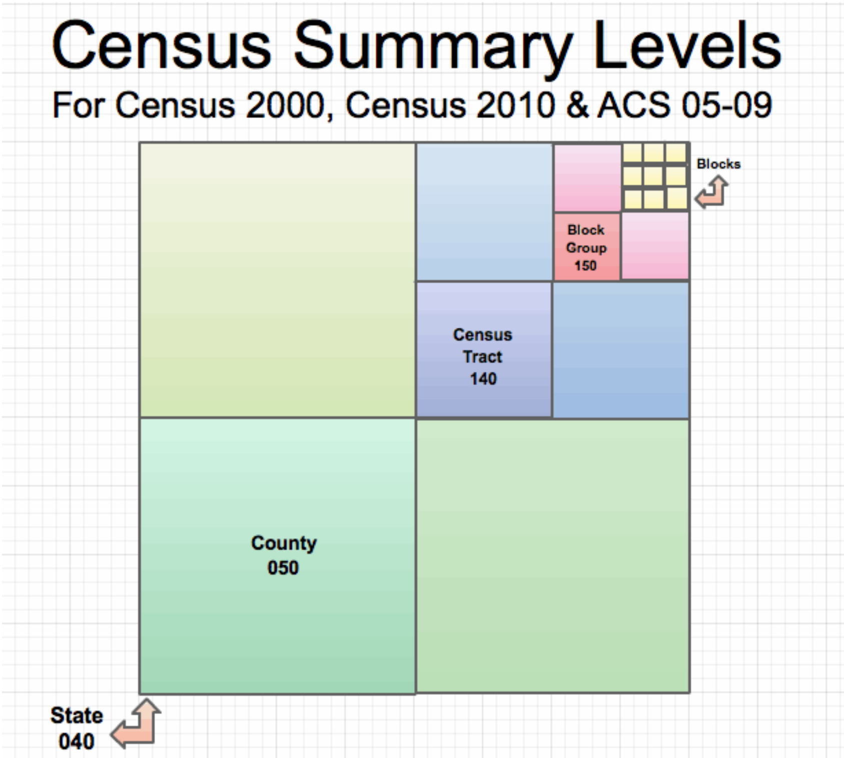

Figure 1: Block groups relative to other census units of spatial aggregation.

are a variation on the census defined "core based statistical area". MSAs can span multiple states and are characterized by having a population of at least 50,000, at least 50% of their population in urban areas, and surrounding areas with strong economic activity. Our choice to only focus on Census block groups within the 25 most populous MSAs is driven by our need to isolate the effects of (urban) design variability. MSAs contain a lot of urban areas, though they contain suburbs and even some rural areas as well. Most importantly, however, they provide sufficient variability in their walkability. If we were to include all Census block groups in the United States, we would have many rural census block groups that would have little to offer us in terms of testing theories of walkability.

6 Plan of Analysis

To test the effect of walkability on voter turnout, we employ ordinary least squares (OLS) to regress voter turnout on the walkability index at the Census block group level. We estimate separate models for turnout in the 2016, 2018, and 2020 elections. All analyses are restricted to Census block groups in the top 25 most populated MSAs. The following equation conveys the logic of the models:

$$Voter\ Turnout_{ikj} = Walkability_{ikj}\ + Aggregate\ Level\ Controls_{ikj} + \epsilon$$

Where i is the election year.
Where k is the Metropolitan Statistical Area.
Where j is the Census block group.

We include a variety of controls in the models; these were chosen based on previous studies of walkability and traditional factors that influence voter turnout. Because our analysis takes place at Census block group level, our controls are also measured at this level—they include population density, median home age, home value, the proportion of various social and racial demographics, proportion of property type, and the proportion of registered partisan[2]. In the penultimate section of the paper we revisit our specifications to include an "ease of voting" index; this allows us to test H2, which is intended to help

[2]Importantly, electoral competitiveness and vote propensity is a strong indicator of voter turnout (Blais, 2006). While these variables are ommitted from our current analysis, we intend to incorporate them in future model specifications.

Table 3: Metropolitan Statistical Area (MSA) List

Metropolitan Name	**State(s)**
New York-Newark-Jersey City	NY-NJ
Los Angeles-Long Beach-Anaheim	CA
Chicago-Naperville-Elgin	IL-IN
Dallas-Fort Worth-Arlington	TX
Houston-Pasadena-The Woodlands	TX
Washington-Arlington-Alexandria	DC-VA-MD-WV
Philadelphia-Camden-Wilmington	PA-NJ-DE-MD
Atlanta-Sandy Springs-Roswell	GA
Miami-Fort Lauderdale-West Palm Beach	FL
Phoenix-Mesa-Chandler	AZ
Boston-Cambridge-Newton	MA
Riverside-San Bernardino-Ontario	CA
San Francisco-Oakland-Fremont	CA
Detroit-Warren-Dearborn	MI
Seattle-Tacoma-Bellevue	WA
Minneapolis-St. Paul-Bloomington	MN-WI
Tampa-St. Petersburg-Clearwater	FL
San Diego-Chula Vista-Carlsbad	CA
Denver-Aurora-Centennial	CO
Baltimore-Columbia-Townson	MD
St. Louis	MO-IL
Orlando-Kissimmee-Sanford	FL
Charlotte-Concord-Gastonia	NC-SC
San Antonio-New Braunfels	TX
Portland-Vancouver-Hillsboro	OR-WA

discriminate between cost-based and socially-grounded explanations for voter turnout (Schraufnagel, Pomante Ii and Li, 2020).

Because Census block groups are nested within MSAs, in all models we cluster our standard errors at the MSA-level to account for this non-independence of observations and produce more conservative test statistics. For the initial models we employ fixed effects at the MSA level to account for variation across these major metro-areas.

7 Results

7.1 General Elections

The OLS regression estimates for the 2016, 2018, and 2020 general elections are shown in Table 4. Of the 83,608 Census block groups in our data set, 74,534 Census Block groups remain in the model after accounting for missing data via listwise deletion.

Across all three elections, walkability's effect is consistently positive and statistically significant (p-value: <.01), even in presence of controls for a variety of socioeconomic factors. These results provide initial support for H1. Substantively, a one unit change in a Census block group's level of walkability predicts an increase in voter turnout of .13 percentage points in the 2016 and 2020 general elections (all else equal). In 2018, the effect is slightly larger as evinced by the coefficient estimate. The R^2 is sizeable for all models, indicating that covariates explain over 70 percent of the variation in turnout rates at the block group level. The coefficient estimates (Table 11) appear substantively small at first blush. However, if we consider that the margins of victory in the presidential elections in 2016 and 2020 were extremely slim—and that many down ballot races were actually decided by a handful of votes—the size of the walkability effects take on new meaning. Across the full range of our index, the turnout difference between the least walkable (1) and the most walkable (20) Census block groups was 2.6%.

7.2 An Application to a Primary Election

While we find a consistent, significant and positive relationship between walkability and turnout in the three general election years (and the varying contexts of presidential vs. midterm elections), do we observe the same patterns in less salient elections? To address this question, we re-estimate our model for voter turnout in the 2016 primaries— a year in which both parties had (meaningful) primaries due to Obama being term-limited. For this application, we add control variables for primary type based on who was able to vote in the primary. MSAs in Kansas and Minnesota, which were originally included in the general election results, are not included here because these states conducted caucuses for their primary elections. In Appendix A we provide summary statistics of voter turnout at the Census block group level for this case.

Table 4: Predicting Turnout in General Elections
Estimates by Year with Clustered Standard Errors and MSA-Fixed Effects

Dependent Variables: Model:	General Election 2016 (1)	General Election 2018 (2)	General Election 2020 (3)
Variables			
Walkability Index	0.0015***	0.0017***	0.0015***
	(0.0003)	(0.0003)	(0.0003)
Population Density	-0.0061	0.0269	-0.1227
	(0.0876)	(0.0935)	(0.0835)
Median Home Value	0.0016	0.0071	-0.0214
	(0.0201)	(0.0192)	(0.0253)
Median Household Income	0.0604***	0.0744***	0.0937***
	(0.0091)	(0.0088)	(0.0101)
Median Home Age	-0.0071	-0.0140***	-0.0016
	(0.0045)	(0.0039)	(0.0033)
Age: 30-54	0.3607***	0.3196***	0.2340***
	(0.0301)	(0.0402)	(0.0496)
Age: 55+	0.3604***	0.3375***	0.1137***
	(0.0309)	(0.0480)	(0.0398)
Gender: Female	0.1357***	0.0367	0.0990
	(0.0458)	(0.0608)	(0.0757)
Party: Democrat	-0.0122	0.0911**	-0.0431
	(0.0298)	(0.0328)	(0.0376)
Party: No Party Preference	-0.1338**	-0.0786	-0.1167
	(0.0537)	(0.0642)	(0.0695)
Race: White	0.2117***	0.2740***	0.1139**
	(0.0235)	(0.0380)	(0.0439)
Race: Hispanic	0.1278***	0.0981**	-0.0337
	(0.0204)	(0.0370)	(0.0395)
Race: African-American	0.1425***	0.1358***	-0.0297
	(0.0154)	(0.0381)	(0.0421)
Education: HS Diploma	-0.0581	-0.3457***	-0.3438***
	(0.0649)	(0.0869)	(0.0581)
Education: Some College	0.7953***	0.9215***	1.295***
	(0.1752)	(0.2118)	(0.1985)
Education: Bachelor Degree	0.7039***	0.7714***	0.6489***
	(0.0745)	(0.0564)	(0.0708)
Education: Graduate Degree	0.7457***	0.8384***	0.4497***
	(0.0844)	(0.0929)	(0.0931)
Property Type: Condominium	0.0629*	0.0628**	0.1221***
	(0.0334)	(0.0266)	(0.0224)
Property Type: Duplex	-0.0341	-0.0653	-0.1056***
	(0.0454)	(0.0457)	(0.0225)
Property Type: Mobile Home	-0.0445	-0.0558	-0.0539
	(0.0344)	(0.0398)	(0.0425)
Property Type: Residential	0.0393**	0.0339**	0.0262**
	(0.0162)	(0.0130)	(0.0124)
Fixed-effects			
CBSA_Name	Yes	Yes	Yes
Fit statistics			
Observations	74,534	74,534	74,534
R^2	0.82708	0.81555	0.72950
Within R^2	0.77911	0.77018	0.65174

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

OLS regression estimates for the 2016 primary are reported in Table 6.[3] Column 1 reports the results for walkability with clustered standard errors at the MSA level. Again we see that walkability's effect is positively and statistically significant, with a one unit change in a Census block score associated with a .3 percentage point increase in 2016 primary turnout in that block group, ceteris paribus. Column 2 presents the estimates from a specification that includes fixed effects (dummy indicators) for MSA. The effect of walkability with the fixed effects specification remains positive and statistically significant (p-value: <0.01).

8 Addressing Potential Mechanisms: Modeling Costs

We observe a significant relationship between walkability and voter turnout at the block group level. This relationship obtains in the presence of a variety of controls, and manifests across different types of general elections *and* an examination of a primary contest. But what might be driving this relationship? To start to get some purchase on this question (and to evaluate the support for H2), we now add a direct measure of the (institutional) cost of voting and circle back to our previous analyses.

To do so we use a cost of voting index reported by Schraufnagel, Pomante Ii and Li (2020); it ranks the ease of voting across states and years[4] Our intent in including such an item is to start to sort out the extent to which turnout's relationship with walkability may be explained by walkability lowering costs, by walkability proxying for network-mobilization dynamics, or by some combination of both stories.

Since we are using a state-level variable to address voting costs—and there is a lot of, though non-perfect, overlap between states and our MSAs— we do not include fixed effects for the next set of models. Tables 6 & 7 provide the general (2016, 2018, 2020) and primary (2016) election results with clustered standard errors and the inclusion of this "ease of voting" control. Importantly, we also include an additional specification for each election (the second column in each case) that contains an interaction between walkability and the ease of voting index[5]. If walkability is primarily about social (network) factors, we should see its effects change very little with the addition of costs to the model. If walkability is essentially substituting for addressing costs (with costs being an omitted variable of sorts), then the effects of walkability should be diminished when costs are added to the models and the costs parameter should emerge. If walkability is potentially operating through both dynamics, then we would expect walkability to matter across a range of cost-scenarios—it having an effect when costs are low would be consistent with socially-grounded explanations, but it mattering more when costs are high would be consistent with more cost-based explanations.

8.1 Cost and Walkability: General Election Results

Table 6 reports the general election OLS estimates for these model specifications. Column 1 displays the effect of walkability when controlling for the "ease of voting" variable for the 2016 case, and we see that the effect of walkability remains positive and significant—a one unit change in walkability is associated with a .17 percentage point increase in 2016 voter turnout. Note that this is actually a larger effect for walkability than in the previous sets of models. Interestingly, the cost measure emerges as a negative, significant predictor of lowered turnout at the block group level. Column 2 reports the same model with an interaction between walkability and 'ease of voting'. In this case we see little evidence of conditioning, with the interaction term being substantively small and not close to statistically significant.

Columns 3 and 4 repeat this modeling strategy, but for the 2018 midterms and the 2020 general election, respectively.[6] In the midterm model, the effect of walkability remains positively signed, but is no longer statistically significant. At the same time, the cost of voting item again emerges as a significant (negative) predictor of turnout. However, when we look at the 2020 results we see the opposite pattern: the walkability measure emerges as positive and significant, but the ease of voting item fails to achieve statistical significance upon its inclusion. In the case of the 2020 data we also see some evidence of a conditional relationship between walkability and costs—the effect of walkability is largest in MSAs where the index of costs is the highest. But, the effects of walkability do appear to also matter in MSAs

[3] Of the 81,329 Census block groups we have observations on, 72,361 block groups remain in the model after listwise deletion is applied for missing data on covariates.

[4] The index provides scores for each presidential election from 1996-2020. The following information is included in the index: Registration deadlines, Voter reg. restrictions, Reg. drive restrictions, Pre-registration laws, Automatic voter reg.,Voting inconvenience info., Voter ID laws, Poll hours, Early voting days, and Absentee voting.

[5] The "ease of voting" index was adjusted to have a zero point. A lower value is associated with lower voting costs.

[6] It is important to note that the 'ease of voting' index is only calculated for presidential election years, so the 2016 index scores are used for the 2018 model.

Table 5: Predicting Turnout, 2016 Primary Election

Dependent Variable:	primary_2016	
Model:	(1)	(2)
Variables		
Constant	-0.1657	
	(0.1036)	
Walkability Index	0.0031***	0.0015***
	(0.0007)	(0.0004)
Population Density	0.0124	0.1840**
	(0.0602)	(0.0845)
Median Home Value	0.1432***	-0.0044
	(0.0492)	(0.0123)
Median Household Income	-0.0225	0.0247**
	(0.0231)	(0.0113)
Median HomeAge	-0.0388***	-0.0177***
	(0.0117)	(0.0056)
Age: 30-54	0.0748	0.2491***
	(0.0808)	(0.0493)
Age: 55+	0.2596***	0.3847***
	(0.0895)	(0.0551)
Gender: Female	-0.0567	0.0366
	(0.0824)	(0.0470)
Party: Democrat	0.0740	0.0418
	(0.0666)	(0.0462)
Party: No Political Preference	-0.0083	-0.2124***
	(0.1159)	(0.0753)
Race: White	0.1950***	0.1975***
	(0.0399)	(0.0211)
Race: Hispanic	0.1104***	0.1166***
	(0.0383)	(0.0185)
Race: African American	0.1589***	0.1056***
	(0.0331)	(0.0191)
Education: HS Diploma	-0.0011	-0.1880**
	(0.1719)	(0.0730)
Education: Some College	0.5844	0.4734**
	(0.3436)	(0.1978)
Education: Bach. Degree	0.4172**	0.3067***
	(0.1772)	(0.0646)
Education: Grad. Degree	0.7217***	0.6408***
	(0.1757)	(0.0762)
Property Type: Condominium	0.0751	-0.0027
	(0.0498)	(0.0354)
Property Type: Duplex	-0.0665	0.0411
	(0.0589)	(0.0597)
Property Type: Mobil Home	0.0169	-0.0359
	(0.0546)	(0.0264)
Property Type: Residential	0.0144	0.0101
	(0.0273)	(0.0185)
Partially Open Primary	0.1399***	-0.0125
	(0.0237)	(0.0370)
Open to Unafilliated Voters	0.0282	0.1661***
	(0.0422)	(0.0277)
Open Primary	0.0610**	-0.0496*
	(0.0291)	(0.0259)
Fixed-effects		
CBSA_Name	No	Yes
Fit statistics		
Observations	72,361	72,361
R^2	0.51833	0.80011
Within R^2		0.65138

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

that are decidedly less costly by this measurement strategy (this is also where many of our cases lie; see Figure 2). These conditional effects provides some support for H2, though we are cautious about this interpretation given the minimal evidence of moderation in the 2016 and 2018 cases.

8.2 Cost and Walkability: A Primary Election

Our last piece of empirical evidence is reported in Table 7; it provides the estimates for the 2016 primary election with the "ease of voting" variable included. We again report two models, one simply adding the control, and one incorporating an interaction between walkability and this item. Column 1 provides the estimates when simply controlling for "ease of voting," and walkability remains a positive and significant predictor of turnout, while ease of voting enters the models pointed firmly (and significantly) in the opposite direction. Column 2 adds the specification with the conditional effect between walkabiltiy and "ease of voting," and the results are revealing—here we see the strongest overall evidence of a conditioning effect (in terms of interaction effects), but the pattern reverses from the general election case. As visualized in the bottom panel of Figure 2, in the 2016 primary case walkability seems to have a positive relationship with turnout, but only when the costs in MSAs are lower.

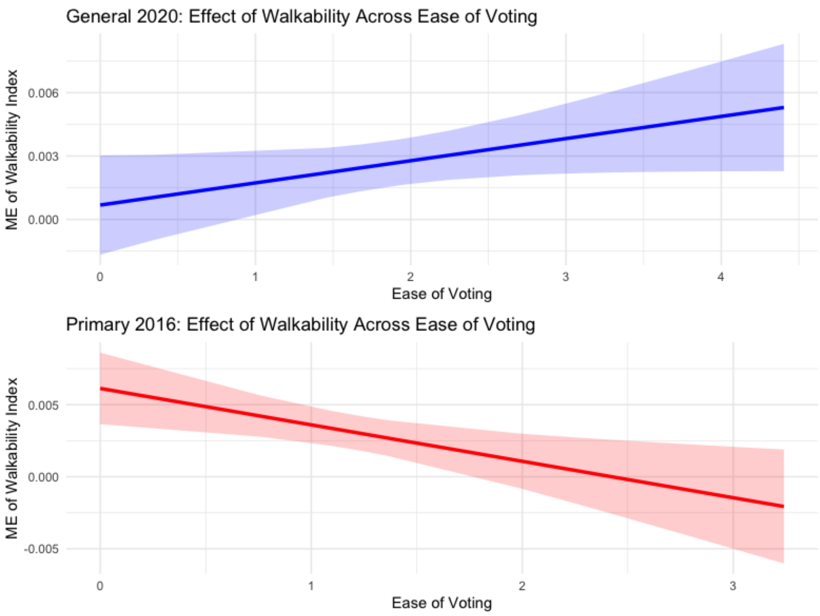

Figure 2: Marginal effects plot between Walkability * Ease of Voting in the 2020 General Election (top) and 2016 Primary Election (bottom).

9 Discussion

Do features of the built-environment influence rates of political participation? We have addressed this question by considering the relationship between walkability—i.e., the ease of walking to amenities in an area—and voter turnout in various elections between 2016 and 2020. We used the Environmental Protection Agency's (EPA) measure of walkability at the Census block group level, thereby providing a systematic measure of the built environment across the United States (though our analysis was, by necessity, restricted to Census block groups in the 25 most populated Metropolitan Statistical Areas (MSAs)). In examining the relationship between walkability and voter turnout across different years and types of elections, we find consistent support for the idea that walkability is associated with higher voter turnout—that is, for the idea that the built environment does matter for how people participate politically. Additionally, we find evidence that this relationship is robust to the inclusion of controls for institutional barriers, and some evidence that the effects of walkability depend on the presence and severity of costs when they are operationalized in these ways.

Previous studies of the built environment and voter turnout have yielded mixed results. We suspect that this constellation of results may be due, at least in part, to differences in the operationalization of

Table 6: Predicting Turnout
General Election Results Incorporating Ease of Voting Information

Dependent Variables:	2016		2018		2020	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Constant	-0.0412	-0.0248	-0.0478	-0.0554	0.4864***	0.5175***
	(0.0636)	(0.0721)	(0.0776)	(0.0852)	(0.0788)	(0.0788)
Walkability Index	0.0021***	0.0009	0.0020***	0.0026*	0.0032***	0.0007
	(0.0007)	(0.0013)	(0.0006)	(0.0013)	(0.0007)	(0.0012)
Ease of Voting	-0.0333***	-0.0411***	-0.0263***	-0.0227**		
	(0.0084)	(0.0113)	(0.0065)	(0.0093)		
Population Density	-0.0087	-0.0116	-0.1331**	-0.1317**	-0.2924***	-0.2928***
	(0.0973)	(0.0945)	(0.0580)	(0.0566)	(0.0769)	(0.0762)
Median Home Value	0.0180	0.0190	0.0471	0.0466	0.1196**	0.1203**
	(0.0305)	(0.0303)	(0.0331)	(0.0331)	(0.0441)	(0.0445)
Median Household Income	0.0520***	0.0512***	0.0354**	0.0358**	0.0518***	0.0517***
	(0.0168)	(0.0170)	(0.0144)	(0.0143)	(0.0131)	(0.0131)
Median Home Age	-0.0162*	-0.0164*	-0.0125	-0.0124	0.0039	0.0036
	(0.0087)	(0.0089)	(0.0074)	(0.0075)	(0.0075)	(0.0076)
Age: 30-54	0.3347***	0.3351***	0.3352***	0.3351***	0.2474***	0.2492***
	(0.0598)	(0.0597)	(0.0636)	(0.0637)	(0.0693)	(0.0685)
Age: 55+	0.3511***	0.3501***	0.3822***	0.3827***	0.1906***	0.1900***
	(0.0520)	(0.0522)	(0.0547)	(0.0549)	(0.0606)	(0.0602)
Gender: Female	0.0999*	0.1006*	-0.0638	-0.0641	0.0023	0.0051
	(0.0541)	(0.0545)	(0.0672)	(0.0670)	(0.0948)	(0.0964)
Party: Democrat	0.0180	0.0176	0.0911**	0.0912**	-0.0958*	-0.0980*
	(0.0374)	(0.0375)	(0.0400)	(0.0403)	(0.0498)	(0.0490)
Party: No Party Preference	-0.0270	-0.0284	-0.0658	-0.0652	-0.1405*	-0.1429**
	(0.0520)	(0.0525)	(0.0489)	(0.0488)	(0.0692)	(0.0680)
Race: White	0.2374***	0.2369***	0.3014***	0.3016***	0.0968*	0.0957*
	(0.0274)	(0.0279)	(0.0407)	(0.0408)	(0.0484)	(0.0488)
Race: Hispanic	0.1075**	0.1067**	0.1169**	0.1173**	-0.0086	-0.0104
	(0.0415)	(0.0418)	(0.0474)	(0.0478)	(0.0556)	(0.0557)
Race: African American	0.1649***	0.1635***	0.1496***	0.1502***	-0.0334	-0.0356
	(0.0269)	(0.0269)	(0.0394)	(0.0400)	(0.0514)	(0.0515)
Education: HS Diploma	-0.0455	-0.0485	-0.7372***	-0.7358***	-0.7322***	-0.7382***
	(0.0995)	(0.0977)	(0.1281)	(0.1269)	(0.1216)	(0.1182)
Education: Some College	0.6588*	0.6720*	1.110***	1.104***	1.478***	1.502***
	(0.3363)	(0.3341)	(0.3386)	(0.3384)	(0.4047)	(0.4024)
Education: Bach. Degree	0.7226***	0.7200***	0.6536***	0.6548***	0.4549***	0.4530***
	(0.1002)	(0.1010)	(0.0814)	(0.0806)	(0.1005)	(0.1006)
Education: Grad. Degree	0.7257***	0.7200***	0.5257***	0.5283***	-0.0451	-0.0554
	(0.1098)	(0.1074)	(0.1162)	(0.1148)	(0.1448)	(0.1429)
Property Type: Condominium	0.1370***	0.1363***	0.1637***	0.1640***	0.2456***	0.2427***
	(0.0390)	(0.0378)	(0.0343)	(0.0345)	(0.0368)	(0.0359)
Property Type: Duplex	-0.0405	-0.0416	-0.1549***	-0.1544***	-0.2082***	-0.2060***
	(0.0397)	(0.0401)	(0.0296)	(0.0298)	(0.0399)	(0.0391)
Property Type: Mobile Home	-0.0604	-0.0581	-0.0121	-0.0132	0.0431	0.0474
	(0.0463)	(0.0465)	(0.0456)	(0.0456)	(0.0663)	(0.0640)
Property Type: Residential	0.0547***	0.0548***	0.0827***	0.0827***	0.0832***	0.0823***
	(0.0187)	(0.0186)	(0.0198)	(0.0198)	(0.0190)	(0.0186)
Walk Index × EOV		0.0007		-0.0003		
		(0.0010)		(0.0009)		
COVID Ease of Voting					-0.0117	-0.0235***
					(0.0090)	(0.0077)
Walk Index × COVID EOV						0.0010*
						(0.0006)
Fit statistics						
Observations	74,534	74,534	74,534	74,534	74,534	74,534
R^2	0.72377	0.72413	0.72769	0.72775	0.60044	0.60151
Adjusted R^2	0.72369	0.72404	0.72761	0.72766	0.60032	0.60139

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 7: Predicting Turnout
2016 Primary Election with "Ease of Voting" Control Variable

Dependent Variable:	primary_2016	
Model:	(1)	(2)
Variables		
Constant	-0.0940	-0.1486
	(0.0883)	(0.1017)
Walkability Index	0.0017**	0.0061***
	(0.0007)	(0.0013)
Ease of Voting	-0.0443***	-0.0155
	(0.0090)	(0.0153)
Population Density	0.0726	0.0731
	(0.0653)	(0.0642)
Median Home Value	0.0379	0.0372
	(0.0294)	(0.0287)
Median Household Income	-0.0232	-0.0216
	(0.0261)	(0.0263)
Median Home Age	-0.0399***	-0.0388***
	(0.0108)	(0.0106)
Age: 30-54	0.1491*	0.1476*
	(0.0758)	(0.0734)
Age: 55+	0.2848***	0.2874***
	(0.0758)	(0.0756)
Gender: Female	0.0030	-0.0004
	(0.0467)	(0.0448)
Party: Democrat	0.0502	0.0532
	(0.0689)	(0.0682)
Party: No Political Preference	-0.1296	-0.1291
	(0.1168)	(0.1182)
Race: White	0.2092***	0.2096***
	(0.0370)	(0.0369)
Race: Hispanic	0.1182***	0.1207***
	(0.0338)	(0.0343)
Race: African American	0.1623***	0.1648***
	(0.0335)	(0.0345)
Education: HS Diploma	0.0631	0.0672
	(0.1476)	(0.1465)
Education: Some College	0.2224	0.1847
	(0.3318)	(0.3239)
Education: Bach. Degree	0.4326***	0.4389***
	(0.1520)	(0.1553)
Education: Grad. Degree	0.9238***	0.9350***
	(0.1479)	(0.1492)
Property Type: Condominium	0.0789*	0.0829*
	(0.0449)	(0.0455)
Property Type: Duplex	-0.0405	-0.0400
	(0.0534)	(0.0511)
Property Type: Mobile Home	-0.0696	-0.0740
	(0.0416)	(0.0437)
Property Type: Residential	0.0084	0.0093
	(0.0265)	(0.0267)
Partially Open Primary	0.1306***	0.1293***
	(0.0227)	(0.0226)
Open to Unaffiliated Voters	0.0385	0.0375
	(0.0432)	(0.0427)
Open Primary	0.0566**	0.0528**
	(0.0233)	(0.0225)
Walk Index × EOV		-0.0025**
		(0.0009)
Fit statistics		
Observations	72,361	72,361
R^2	0.58936	0.59433
Adjusted R^2	0.58921	0.59419

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

the built environment, and in the use of self-reported data to measure turnout. To be clear, we would be the first to admit that neither our plan of analysis nor our evidence is perfect. Still, we would argue that we advance existing conversations by using a systematic measure of the built environment (that can be applied widely and fairly easily), and by using validated turnout data vs. self-reports.

Of course, while our approach and analysis has some strengths, it also has some weaknesses. For example, we are constrained in our ability to definitively differentiate between *cost-based* and *socially-grounded* explanations of participation (and between different the social dynamics of cohesion vs. pressure). At a minimum, our various modeling strategies suggest that a mix of cost-reducing and social network based explanations are likely involved in the relationship between walkability and turnout. When we control for (institutional) costs, we find that walkability's effects almost always hold—this suggests that the walkability effects are not simply the result of some omitted variable that we can easily capture via the cost indices. Equally compelling in these cases is the fact that although the costs variable emerges as negative and significant in multiple specifications, its addition does not cut into the size of the walkability effect—if anything, the walkability effects themselves become larger. In other words, there is little initial evidence of mediation between these factors.

Things are equally interesting when we look at the conditional relationships, and it is for this reason that we think our—admittedly imperfect—evidence points more towards social than cost-based explanations. If walkability is really about subsidizing costs, we would expect it to have its most-pronounced effects when (institutional) costs are high. However, not only do we see inconsistent evidence of this across years, but when we do (the COVID-19 case of 2020), walkability exerts positive effects on turnout across much of the range of costs—it is not just assisting in the places with higher barriers to voting. Moreover, we see the exact opposite interactive pattern in the primary scenario that we modeled in 2016: walkability mattered when costs were lower, but did not track with higher participation in MSAs where costs were higher. Overall, then, in our read these varied findings direct us back to logic we articulated previously when introducing theories of social cohesion. Recall that Rolfe (2012) suggests that larger networks—and the interactions with acquaintances and others that take place therein—increase the salience of and information shared about political events and topics, most notably elections. The effects for walkability we observe across election years and types, and under the conditions of more versus fewer costs, are consistent with the idea that walkability operates by effectively making individuals' networks larger. If we think about turnout as an interdependent and fundamentally social act, we should expect to observe a positive relationship between walkability and turnout.

10 Conclusion

Relative to other forms of political participation, voter turnout is a low cost political activity. However, if the design of the built environment can influence voter turnout, as our results suggest, it's design can likely influence other forms of political participation as well.

Ultimately, how we construct and design physical spaces is a fundamentally social process—one that in turn shapes how we think and socialize politically. As politics in the US becomes more polarized and polarizing, the need to interact with other partisans will become even more important for democratic functioning and any sort of resurgence. With growing evidence pointing towards fewer partisan interactions in recent years (e.g Brown and Enos, 2021; Lyons and Utych, 2023; Rogers, 2022), understanding the design of the built environment may be more important than ever, as it may facilitate/hinder greater social interaction between partisans.

Finally, by understanding the relationship between the built environment and political behavior, we may not only better understand how spatial, social and psychological factors combine to influence opinion and action, but may be able to better assess disparities in access to the political process. At a time when many cities and states are re-evaluating their planning policies and their allocations of resources, studies like this one could help officials steer their communities towards physical development plans that are important for democratic functioning and shared governance.

11 Future Directions

Thus far, we have looked at the relationship between walkability and voter turnout across various specifications. In ongoing work, we are looking at the following extensions: survey experiment to better distinguish between cost-based and socially-grounded explanations; decomposed analysis of the walkability index; election competitiveness by district/state; and individual level analysis.

12 Appendix

12.1 Appendix A: 2016 Primary Descriptives

Table 8: Summary Statistics: 2016 Primary Election

Summary Statistics: 2016 Primary Election					
Statistic	**N**	**Mean**	**St. Dev.**	**Min**	**Max**
Voter Proportion 2016	81,329	.2727	.1072924	0.000	1.000

Observations are Census block groups.

12.2 Appendix B: Variables

Table 9: Variable List

Variable Name	Type	Scale	Definition	Source
Walkability Index	Continuous	0-20	Measure of Census block group's walkability level	Environmental Protection Agency (EPA)
Population Density	Continuous	0-1	*Standardized to a 0-1 Scale. Number of individuals by square mile.	ACS 2018
Median Home Value	Continuous	0-1	*Standardized to a 0-1 Scale. Median home value in Census block group.	ACS 2018
Median Household Income	Continuous	0-1	*Standardized to a 0-1 Scale. Median household income in Census block group.	ACS 2018
Median Home Age	Continuous	0-1	*Standardized to a 0-1 Scale. Median home age in Census block group.	ACS 2018
Age	Continuous	0-1	Proportion of voters between given ages in a Census block group	L2 Voter File
Gender	Continuous	0-1	Proportion of voters with specified gender in a Census block group	L2 Voter File
Party	Continuous	0-1	Proportion of voters with specified party ID in a Census block group	L2 Voter File
Race	Continuous	0-1	Proportion of voters with specified race in a Census block group	L2 Voter File
Education	Continuous	0-1	Proportion of voters between given education level in a Census block group	L2 Voter File
Property Type	Continous	0-1	Proportion of voters in Census block group living property type (apartment/condominium/duplex/triplex/mobile home/residential).	L2 Voter File
Primary Election Type	Discrete	0-4	Primary election type: Closed primary, partially open primary, open to unaffiliated voters, open primary	National Conference of State Legislators (NCSL)
Ease of Voting Index	Continuous	0-4.403738	Ease of voting by state level. Re-adjusted with zero level. Lower value represents lower cost of voting.	Cost of Voting Index: https://costofvotingindex.com/

12.3 Appendix C: Walkability Index

There are many ways to measure walkability. The index we use is provided through the Environmental Protection Agency (EPA). Their measurement choices are motivated by theoretical choices and data availability. The index is entirely constructed through the EPA's Smart Location Database. This provides over 90 variables at the Census block group level for the entire United States. This ensures a complete and standardized coverage of the index.

Measures for the walkability index were chosen based off a meta-analysis of built environment studies (Ewing and Cervero, 2010). Each variable is shown to strongly correlate with greater walkability. The walkability index is composed of four variables:

1. D2A_EPHHM - The mix of employment types and occupied housing. A block group with a diverse set of employment types (such as office, retail, and service) plus a large quantity of occupied housing units will have a relatively high value. Higher values correlate with more walk trips. SOURCED FROM: Derived from multiple variables (Smart Location Database)

2. D2b_E8MIXA - The mix of employment types in a block group (such as retail, office, or industrial). Higher values correlate with more walk trips. SOURCED FROM: Derived from multiple variables (Smart Location Database)

3. D3b_Street intersection density (pedestrian-oriented intersections). Higher intersection density is correlated with more walk trips. Measured in street density per acre. SOURCED FROM: 2018 HERE Maps NAVSTREETS (Smart Location Database)

4. D4a - Distance from population center to nearest transit stop in meters. Shorter distance correlate with more walk trips. Measured in meters from population-weighted centroid of block group to nearest transit stop. SOURCED FROM: 2020 GTFS, 2020 CTOD (Smart Location Database)

12.4 Appendix D: Walkability Distribution Across MSA

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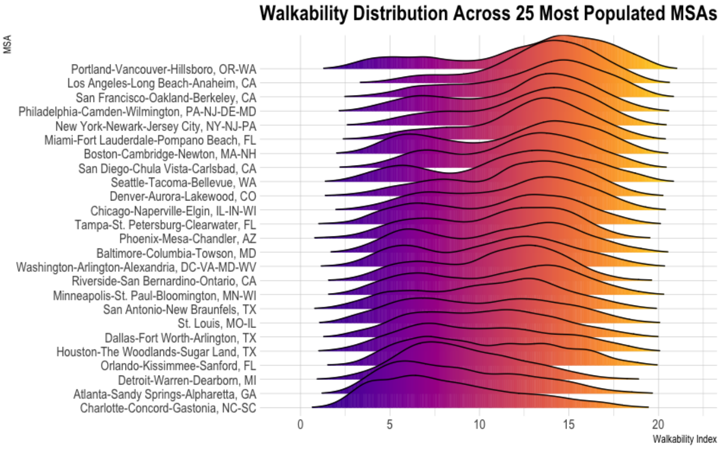

Figure 3: Distribution of walkability across all 25 metropolitan statistical areas (MSA).

12.5 Appendix E: Unpacking Motivations

We are in the process of unpacking results from a survey experiment on the American West Time-Sharing Survey (April 2025).[7] To test the potential mechanisms we have discussed previously, we plan to randomly assign respondents to 1 of 3 conditions. We combine the social capital/socialization and social pressure mechanisms into one treatment. The conditions are as follows:

Now that we have established an association between the walkability of an area and voter turnout, we turn to testing why this relationship exists. Recall we theorized three potential mechanisms: cost, social capital/socialization, and social pressure. Our goal is to identify which one of these mechanisms has the greatest influence in mediating the relationship between walkability and voter turnout. It is likely that both of these mechanisms have influence; however, to what extent is unknown and is the purpose of this survey experiment.

12.5.1 Control

> *Imagine you live in a highly walkable neighborhood where businesses and homes blend together, with tree-lined sidewalks, bike lanes, and bus stops. Grocery stores, coffee shops, restaurants, and retail shops are just a short walk away, and people are out and about.*

12.5.2 Treatment 1: Cost

> *Imagine you live in a highly walkable neighborhood where businesses and homes blend together, with tree-lined sidewalks, bike lanes, and bus stops. Grocery stores, coffee shops, restaurants, and retail shops are just a short walk away, and people are out and about. Moreover, post offices, libraries, churches, and community centers are just a short walk away, making regular errands and occasional activities easy to access.*

12.5.3 Treatment 2: Socialization/Social Pressure

> *Imagine you live in a highly walkable neighborhood where businesses and homes blend together, with tree-lined sidewalks, bike lanes, and bus stops. Grocery stores, coffee shops, restaurants, and retail shops are just a short walk away, and people are out and about. It is a vibrant, socially-connected community where people know each others' names, notice things, and expect people to look out for one another.*

[7] This collaboration fields questions to undergraduate students at the following institutions: Arizona State University; Colorado State University, Fort Collins; Colorado State University, Pueblo; Texas Tech University; Texas A&M; California State University, Fullerton; San Diego State University; University of Arizona; University of California, Merced; University of Colorado Boulder; University of Florida; University of New Mexico; University of Missouri; University of Nebraska; University of Texas, Austin; University of Texas, El Paso; University of Texas, Rio Grande Valley; University of Utah; University of Houston.

12.5.4 Outcomes:

Each respondent will then be asked three questions on a 0-10 scale, with 0 = extremely unlikely; 10 = extremely likely. The question order will be randomized for all respondents. These questions serve as our dependent variable and are as follows:

- How likely would you be to vote in presidential elections if you lived in this community?
- How likely would you be to vote in local and off-year elections if you lived in this community?
- How likely would you be to vote in nonpresidential elections (like midterms) if you lived in this community?

12.6 Appendix F: Decomposition Analysis

Recall the walkability index is made of four component parts. One part is distance from population center to nearest transit stop in meters. Living near a bus stop is a strong predictor of riding transit and supports the broad standard of running busses within a quarter mile of most residents Ewing and Cervero (2010). However, choice of where to place transit stops can be variable and further, may drive the walkability score to be a proxy for transit mode choices available. What is the effect of physical walkability across different levels of transit access?

We decompose our walkability measure by removing the transit portion of the index. We re-estimate the index without the proximity to transit variable and rescale on the same 1 to 20 scale of the original walkabiltiy index. We rerun our models from our initial analysis but instead use the decomposed measure. We further provide an interaction between the decomposed model and the individual transit variable.

Figure 4: Interaction between transit score and decomposed walkability index. Model does not include fixed effects or clustered standard errors.

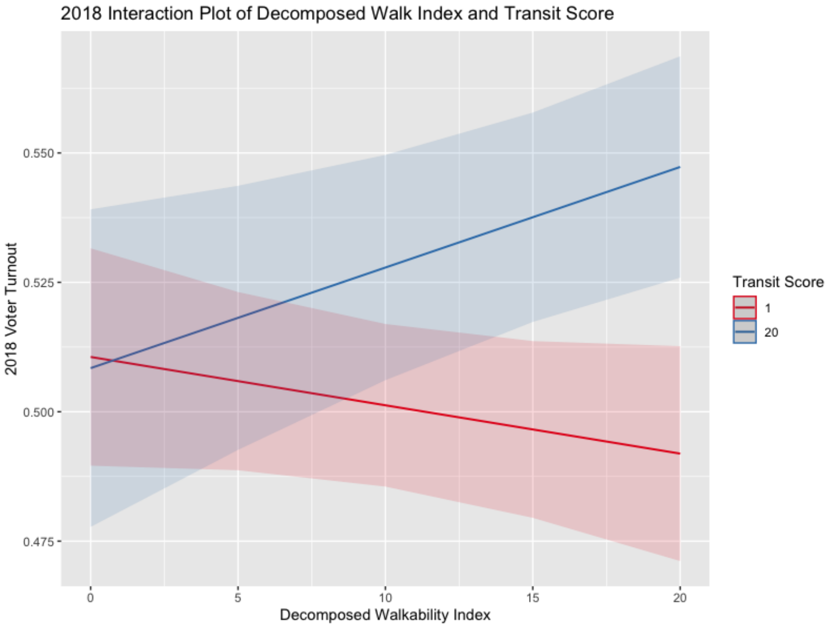

Figure 5: Interaction between transit score and decomposed walkability index. Model does not include fixed effects or clustered standard errors.

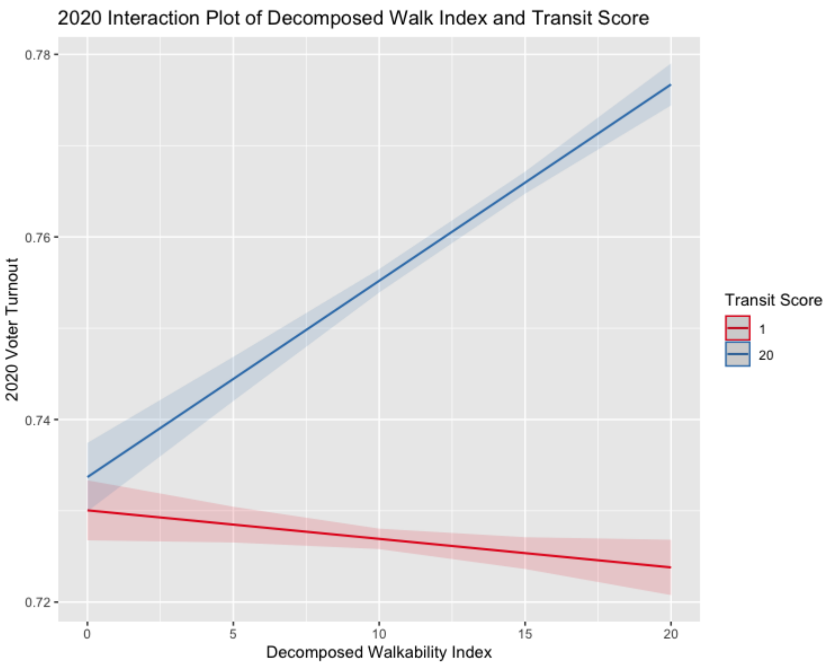

Figure 6: Interaction between transit score and decomposed walkability index. Model does not include fixed effects or clustered standard errors.

Table 10: Predicting Turnout in General Elections With Decomposed Walkability Index
Estimates by Year with Clustered Standard Errors and MSA-Fixed Effects

Dependent Variables:	General Election 2016	General Election 2018	General Election 2020
Model:	(1)	(2)	(3)
Variables			
Decomposed Walk Index	0.0010***	0.0012***	0.0012***
	(0.0003)	(0.0003)	(0.0002)
Population Density	-0.0052	0.0307	-0.1158
	(0.0911)	(0.0980)	(0.0875)
Median Home Value	0.0018	0.0073	-0.0213
	(0.0203)	(0.0194)	(0.0254)
Median Household Income	0.0587***	0.0728***	0.0925***
	(0.0095)	(0.0092)	(0.0101)
Median Home Age	-0.0081*	-0.0150***	-0.0024
	(0.0047)	(0.0041)	(0.0033)
Age: 30-54	0.3674***	0.3262***	0.2389***
	(0.0307)	(0.0401)	(0.0495)
Age: 55+	0.3640***	0.3412***	0.1168***
	(0.0305)	(0.0470)	(0.0396)
Gender: Female	0.1334***	0.0334	0.0953
	(0.0441)	(0.0587)	(0.0738)
Party: Democrat	-0.0038	0.0997***	-0.0360
	(0.0290)	(0.0321)	(0.0376)
Party: No Political Preference	-0.1295**	-0.0743	-0.1134
	(0.0538)	(0.0644)	(0.0698)
Race: White	0.2096***	0.2718***	0.1122**
	(0.0238)	(0.0385)	(0.0440)
Race: Hispanic	0.1275***	0.0980**	-0.0334
	(0.0206)	(0.0373)	(0.0397)
Race: African American	0.1401***	0.1337***	-0.0308
	(0.0155)	(0.0384)	(0.0422)
Education: HS Diploma	-0.0546	-0.3404***	-0.3372***
	(0.0640)	(0.0867)	(0.0580)
Education: Some College	0.7635***	0.8893***	1.270***
	(0.1772)	(0.2138)	(0.2009)
Education: Bach. Degree	0.7051***	0.7720***	0.6485***
	(0.0743)	(0.0557)	(0.0707)
Education: Grad. Degree	0.7535***	0.8472***	0.4577***
	(0.0855)	(0.0939)	(0.0930)
Property Type: Condominium	0.0630*	0.0632**	0.1228***
	(0.0338)	(0.0267)	(0.0225)
Property Type: Duplex	-0.0322	-0.0630	-0.1033***
	(0.0447)	(0.0454)	(0.0226)
Property Type: Mobile Home	-0.0496	-0.0609	-0.0578
	(0.0357)	(0.0409)	(0.0433)
Property Type: Residential	0.0357**	0.0304**	0.0236*
	(0.0161)	(0.0129)	(0.0123)
Fixed-effects			
CBSA_Name	Yes	Yes	Yes
Fit statistics			
Observations	74,534	74,534	74,534
R^2	0.82598	0.81470	0.72907
Within R^2	0.77770	0.76913	0.65118

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 11: Predicting Turnout in General Elections with Decomposed Index with Ease of Voting Control Estimates by Year with Clustered Standard Errors

Dependent Variables: Model:	General Election 2016 (1)	General Election 2018 (2)	General Election 2020 (3)
Variables			
Constant	-0.0312	-0.0388	0.5002***
	(0.0658)	(0.0798)	(0.0797)
Decomposed Walk Index	0.0011*	0.0011**	0.0018***
	(0.0006)	(0.0005)	(0.0005)
Ease of Voting	-0.0345***	-0.0275***	
	(0.0084)	(0.0065)	
Population Density	-0.0118	-0.1349**	-0.2960***
	(0.1026)	(0.0624)	(0.0835)
Median Home Value	0.0179	0.0469	0.1219**
	(0.0301)	(0.0327)	(0.0446)
Median Household Income	0.0486***	0.0322**	0.0463***
	(0.0173)	(0.0141)	(0.0130)
Median Home Age	-0.0180*	-0.0142*	0.0013
	(0.0093)	(0.0079)	(0.0083)
Age: 30-54	0.3474***	0.3469***	0.2628***
	(0.0601)	(0.0632)	(0.0685)
Age: 55+	0.3580***	0.3886***	0.1991***
	(0.0515)	(0.0541)	(0.0605)
Gender: Female	0.0996*	-0.0644	-0.0010
	(0.0534)	(0.0658)	(0.0935)
Party: Democrat	0.0272	0.0997**	-0.0828
	(0.0363)	(0.0394)	(0.0515)
Party: No Political Preference	-0.0243	-0.0633	-0.1354*
	(0.0526)	(0.0497)	(0.0715)
Race: White	0.2347***	0.2989***	0.0926*
	(0.0276)	(0.0411)	(0.0490)
Race: Hispanic	0.1081**	0.1176**	-0.0070
	(0.0421)	(0.0479)	(0.0568)
Race: African American	0.1608***	0.1459***	-0.0386
	(0.0283)	(0.0405)	(0.0534)
Education: HS Diploma	-0.0473	-0.7385***	-0.7363***
	(0.1033)	(0.1290)	(0.1296)
Education: Some College	0.6000*	1.056***	1.406***
	(0.3439)	(0.3355)	(0.4112)
Education: Bach Degree	0.7268***	0.6571***	0.4603***
	(0.1007)	(0.0820)	(0.1037)
Education: Grad Degree	0.7371***	0.5365***	-0.0323
	(0.1123)	(0.1182)	(0.1473)
Property Type: Condominium	0.1373***	0.1641***	0.2471***
	(0.0398)	(0.0350)	(0.0381)
Property Type: Duplex	-0.0385	-0.1529***	-0.2067***
	(0.0382)	(0.0294)	(0.0418)
Property Type: Mobile Home	-0.0703	-0.0213	0.0315
	(0.0489)	(0.0488)	(0.0711)
Property Type: Residential	0.0483**	0.0768***	0.0747***
	(0.0176)	(0.0198)	(0.0189)
COVID Ease of Voting			-0.0125
			(0.0091)
Fit statistics			
Observations	74,534	74,534	74,534
R^2	0.72082	0.72567	0.59577
Adjusted R^2	0.72073	0.72559	0.59565

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 12: Predicting Turnout in General Elections with Interaction between Decomposed Walk Index and Ease of Voting: with Clustered Standard Errors

Dependent Variables: Model:	General Election 2016 (1)	General Election 2018 (2)	General Election 2020 (3)
Variables			
Constant	-0.0152	-0.0447	0.5154***
	(0.0717)	(0.0854)	(0.0788)
Decomposed Walk Index	-0.0002	0.0015	0.0005
	(0.0012)	(0.0011)	(0.0010)
Ease of Voting	-0.0430***	-0.0243***	
	(0.0094)	(0.0078)	
Population Density	-0.0133	-0.1344**	-0.2986***
	(0.1012)	(0.0620)	(0.0826)
Median Home Value	0.0194	0.0463	0.1226**
	(0.0300)	(0.0328)	(0.0449)
Median Household Income	0.0477**	0.0326**	0.0459***
	(0.0175)	(0.0141)	(0.0131)
Median Home Age	-0.0181*	-0.0141*	0.0012
	(0.0094)	(0.0079)	(0.0083)
Age: 30-54	0.3488***	0.3463***	0.2637***
	(0.0597)	(0.0632)	(0.0682)
Age: 55+	0.3585***	0.3884***	0.1994***
	(0.0512)	(0.0540)	(0.0603)
Gender: Female	0.0984*	-0.0640	-0.0014
	(0.0530)	(0.0657)	(0.0940)
Party: Democrat	0.0275	0.0996**	-0.0828
	(0.0361)	(0.0393)	(0.0513)
Party: No Political Preference	-0.0249	-0.0630	-0.1357*
	(0.0528)	(0.0497)	(0.0713)
Race: White	0.2345***	0.2990***	0.0923*
	(0.0276)	(0.0411)	(0.0491)
Race: Hispanic	0.1077**	0.1177**	-0.0075
	(0.0420)	(0.0481)	(0.0568)
Race: African American	0.1601***	0.1461***	-0.0393
	(0.0281)	(0.0407)	(0.0534)
Education: HS Diploma	-0.0483	-0.7381***	-0.7368***
	(0.1027)	(0.1287)	(0.1287)
Education: Some College	0.6034*	1.055***	1.409***
	(0.3426)	(0.3352)	(0.4106)
Education: Bach. Degree	0.7252***	0.6577***	0.4591***
	(0.1008)	(0.0816)	(0.1038)
Education: Grad. Degree	0.7324***	0.5382***	-0.0360
	(0.1103)	(0.1171)	(0.1461)
Property Type: Condominium	0.1382***	0.1638***	0.2477***
	(0.0400)	(0.0350)	(0.0380)
Property Type: Duplex	-0.0393	-0.1526***	-0.2064***
	(0.0382)	(0.0294)	(0.0418)
Property Type: Mobile Home	-0.0678	-0.0222	0.0335
	(0.0491)	(0.0484)	(0.0706)
Property Type: Residential	0.0486**	0.0767***	0.0748***
	(0.0177)	(0.0197)	(0.0189)
Decomposed Walk Index × EOV	0.0007	-0.0003	
	(0.0007)	(0.0006)	
COVID Ease of Voting			-0.0187**
			(0.0084)
Decomposed Walk Index × COVID EOV			0.0005
			(0.0004)
Fit statistics			
Observations	74,534	74,534	74,534
R^2	0.72111	0.72571	0.59597
Adjusted R^2	0.72103	0.72562	0.59585

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 13: Predicting Turnout in General Elections With Decomposed Interaction between Decomposed Index and Transit Score: Estimates by Year with Clustered Standard Errors and MSA-Fixed Effects

Dependent Variables:	General Election 2016	General Election 2018	General Election 2020
Model:	(1)	(2)	(3)
Variables			
Decomposed Walk Index	-0.0005	-0.0007*	-0.0006
	(0.0004)	(0.0004)	(0.0004)
Transit Score	-0.0005	-0.0010*	-0.0012**
	(0.0004)	(0.0005)	(0.0005)
Population Density	-0.0040	0.0361	-0.1078
	(0.0880)	(0.0958)	(0.0885)
Median Home Value	0.0007	0.0059	-0.0227
	(0.0198)	(0.0187)	(0.0245)
Median Household Income	0.0599***	0.0737***	0.0929***
	(0.0090)	(0.0086)	(0.0100)
Median Home Age	-0.0067	-0.0135***	-0.0013
	(0.0044)	(0.0038)	(0.0031)
Age: 30-54	0.3588***	0.3176***	0.2324***
	(0.0299)	(0.0402)	(0.0494)
Age: 55over	0.3576***	0.3343***	0.1112**
	(0.0307)	(0.0478)	(0.0399)
Gender: Female	0.1496***	0.0534	0.1138
	(0.0476)	(0.0628)	(0.0774)
Party: Democrat	-0.0117	0.0932***	-0.0396
	(0.0297)	(0.0326)	(0.0372)
Party: No Political Preference	-0.1314**	-0.0748	-0.1126
	(0.0537)	(0.0641)	(0.0694)
Race: White	0.2109***	0.2725***	0.1121**
	(0.0241)	(0.0388)	(0.0447)
Race: Hispanic	0.1267***	0.0971**	-0.0342
	(0.0206)	(0.0374)	(0.0397)
Race: African American	0.1418***	0.1354***	-0.0296
	(0.0156)	(0.0384)	(0.0422)
Education: HS Diploma	-0.0672	-0.3538***	-0.3481***
	(0.0631)	(0.0853)	(0.0577)
Education: Some College	0.8018***	0.9261***	1.296***
	(0.1715)	(0.2059)	(0.1934)
Education: Bach. Degree	0.7140***	0.7840***	0.6604***
	(0.0740)	(0.0563)	(0.0695)
Education: Grad. Degree	0.7469***	0.8428***	0.4566***
	(0.0848)	(0.0935)	(0.0943)
Property Type: Condominium	0.0616*	0.0617**	0.1217***
	(0.0333)	(0.0260)	(0.0223)
Property Type: Duplex	-0.0367	-0.0678	-0.1071***
	(0.0441)	(0.0444)	(0.0219)
Property Type: Mobil Home	-0.0442	-0.0559	-0.0544
	(0.0346)	(0.0400)	(0.0428)
Property Type: Residential	0.0405**	0.0353**	0.0274**
	(0.0160)	(0.0128)	(0.0121)
Decomposed Walk Index × Transit	0.0001***	0.0001***	0.0001***
	(3.33×10^{-5})	(3.96×10^{-5})	(3.87×10^{-5})
Fixed-effects			
CBSA_Name	Yes	Yes	Yes
Fit statistics			
Observations	74,534	74,534	74,534
R^2	0.82782	0.81644	0.73034
Within R^2	0.78005	0.77129	0.65282

Clustered (CBSA_Name) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

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