

Walking the Walk: Do Green Beliefs Translate Into Green Travel Behavior?

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Abstract

In response to the threat of climate change, there is a rising tide of “green” ideas and beliefs. However, it is open to question as to whether these pro-environment attitudes actually translate into environmentally-friendly behavior. We develop a set of novel measures of community environmentalism for both the state of California and the nation as a whole based on costly behavior in both political settings and consumer markets. We use these environmentalism indicators to examine whether green beliefs are associated with green travel behavior. Previous planning research has shown that household attitudes do influence both place of residence and transport modal choice conditional on where one chooses to live. We build on this past research by documenting that environmentalist communities are generally found closer to the Central Business District, in high density communities that are physically close to rail transit stations. Using as outcome variables, household gasoline consumption and the percentage commuting by transit or non-motorized modes, we find an association between green beliefs and environmentally-friendly travel patterns. We pay careful attention to describing three different causal explanations for our findings. While the policy implications of our findings differ depending on which of the three explanations is the major causal mechanism, all three explanations share the same underlying mechanism that environmentalists seek to live a “green” lifestyle.

Introduction

Due to concerns over global climate change, environmentalism is currently reaching new heights in popular culture and the media (e.g. *An Inconvenient Truth*). At the same time, new “green” technologies like hybrid autos are becoming available. But despite much discussion and speculation about the rising tide of “green” beliefs and values, there has been little quantitative empirical study of whether green beliefs actually translate into green behavior. Since indicators of green attitudes are rarely available in major data sets, it is difficult to test for their importance in consumer behavior. This question is of particular importance in the realm of planning, since the creation of “green communities” is now a major focus in the field.

This paper examines whether people who live in communities that we identify as “environmentalist” engage in “green-friendly” transportation patterns. We construct measures of community environmentalism based on costly choices in political and consumer markets. In particular, for California we collect data on each community’s hybrid vehicle registrations, Green Party membership levels, and voting on binding California referenda related to environmental issues. For the nation as a whole, we observe the voting patterns on environmental legislation by individual members of Congress. This set of variables allows us to construct a proxy for community environmentalism at a point in time.

This paper’s empirical strategy proceeds in three steps. First, we define our measures of community environmentalism. In the second step, we measure whether the communities that score high on our measures of “greenness” are spatially concentrated in locations within metropolitan areas where we would expect to find them (closer to the

Central Business District, in high population density areas, and closer to rail transit station stops). A concentration of environmentalists in these environments supports the claim that greens have a preference for a small ecological footprint.

Recognizing that transportation is a major contributor to urban pollution, we examine whether people who live in environmentalist communities engage in “greener” travel patterns than the average person. We use data on annual gasoline consumption and commute mode patterns to document that households who live in environmentalist communities do exhibit “greener” travel behavior. Finally, we consider three plausible explanations for our results, along with the different policy implications they imply.

Previous Research

This paper builds on an active research agenda in the planning field that examines residential self-selection and the importance of attitudes, beliefs and preferences in determining travel behavior (Krizek, 2000, 2003; Cao, Handy, & Mokhtarian, 2006; Cao, Mokhtarian & Handy 2007a; Boarnet & Sarmiento, 1998; Boarnet & Crane, 2001; Greenwald, 2003; Painter, 1996; McBeth, 1999; Boarnet, Anderson, Day, McMillan, & Alfonzo, 2005; Greenwald & Boarnet, 2001; Cervero & Duncan, 2002, among others).

Recent studies have conducted surveys on subjects' lifestyle preferences and their perceptions of their physical environment, to judge the degree to which their tastes shaped their location decisions and travel behavior (e.g. Handy, Cao, & Mokhtarian, 2005, 2006; Bagley & Mohktarian, 2002; Handy & Clifton, 2001; Hammond, 2005). Cao, Mokhtarian and Handy (2007b) performed a comprehensive literature review analyzing the studies listed above and others, a total of 28 papers. They conclude that “Virtually all of the 28 empirical studies reviewed found a statistically significant

influence of the built environment remaining after self-selection was accounted for.”

Moreover, nearly all of the studies that considered self-selection explicitly found that individuals do sort into communities that match their preferences in terms of built environment and community characteristics.

Another relevant literature focuses on the effects of environmentalism on consumer behavior. Clark, Kotchen, & Moore (2003) investigate participation in green electricity programs in Michigan as a function of stated environmental attitudes. They document that environmentalists are more likely to sign up for green power programs. Messer, Kotchen, & Moore (2000) document stated willingness to pay differences for environmentally-friendly shade grown coffee as a function of stated environmental attitudes. Kahn (2007) finds that stores catering to environmentalists are over-represented in California areas with heavy concentrations of greens. Kurani & Turrentine (2004) document that hybrid auto buyers seek to lessen their impact on the environment. Recent research has shown that stated environmental attitudes correlate with environmentally-friendly behavior such as recycling, avoiding residential energy consumption and driving less (Poortinga, Steg, & Vlek, 2004; Fujii, 2006; Wall, Devine-Wright & Mill, 2007; Barr, 2007).

Finally, there is a literature specifically documenting the role of personal values in shaping the transit/drive decision. Bamberg, Hunecke, & Blöbaum (2007) use attitudinal surveys to study samples drawn from two different German cities. They find that personal norms (specifically feelings of shame, guilt, anger and regret), as well as perceived social norms (which educate the traveler about the environmental impacts of her decisions) are important predictors of transit use; the authors propose public education and awareness

campaigns to induce environmentally-sound travel behavior. Huencke, Blöbaum, Mattheis, & Höger (2001) use interviews, questionnaires and travel diaries to find that “economy” (reduced fares) plus “moral” considerations (a perception of environmental issues and an awareness of the environmental consequences of one’s actions, which they dub “ecological guilt”) are factors which help to promote transit ridership. They also suggest environmental education to increase transit use.

Finally, Heath & Gifford (2002) use the theory of planned behavior and an intervention (the distribution of free bus passes) to examine a number of factors leading to transit use. They use survey data to gauge attitudes to environmentalism. Unlike the previous studies, however, they find that “neither holding an environmental value in higher esteem nor perceiving responsibility for the problems caused by car use significantly predicted the intention to take the bus or actual bus use”; they speculate that transit use was not perceived as pro-environment behavior by their sample.

Our research extends this literature along several dimensions. First, unlike papers that have used subjective surveys to measure environmentalism and other attitudes, our environmentalism indicators represent actual costly choices. As stated preference methods are known to suffer from social acceptability bias (responses may be designed to win approval of the interviewer, or to enhance the subject’s own self-image), our revealed preference approach for gauging environmentalism has advantages. Moreover, we work with data sets that are representative of the nation’s and California’s metropolitan areas. Due to the costs and difficulty involved with collecting attitudinal data, previous studies have been limited to smaller samples and more narrow geographical areas.

Conceptual Framework

People differ along such dimensions as socio-economic status, taste for housing, place of work and degree of environmentalism. Taking these and other factors into account, households will seek out their favorite community to live in. This sorting process will tend to stratify the heterogeneous population into more homogenous residential communities. Put simply, we hypothesize that, on average, environmentalists will seek out “green-friendly” communities both because such communities facilitate living a green life and because they will attract other greens, creating a community with shared values.

The first step in our empirical analysis will be to define our indicators of community environmentalism. Intuitively, we seek to rank communities with respect to their “greenness.” Some communities will be relatively green (i.e. Berkeley or Santa Monica), while others will be in the middle of the distribution and still others will be “brown.” These rankings will be based on revealed choice data. For example, below we will use data on political choices made by community members and consumer purchases of green products.

Once we have defined our environmentalism indicators, we will examine the geography of such communities. Are the communities that we rank as environmentalist located in places within metropolitan areas that are believed to be conducive to living a “green life”? We will present three ordinary least squares estimates of equation (1).

$$Urban\ Form_j = MSA + B_1 * demographics_j + B_2 * Environmentalism_j + e_j \quad (1)$$

The unit of analysis in this regression is a census tract j . In one specification, the dependent variable will be the community’s population density. In a second specification,

the dependent variable will be the log of the community's distance to the Central Business District. In the third specification, the dependent variable will be an indicator variable (0,1) that equals one if the community is located within one mile of a rail transit station. By including metropolitan area fixed effects (MSA in equation (1)), we focus on where environmentalist communities arise within metropolitan areas. Demographics stands for a vector of standard attributes such as household income and ethnicity. Environmentalism represents our measures of community "greenness". Below we will document that environmentalist communities arise in high population density communities that are closer to the CBD and close to rail transit stations. These intuitive results raise our confidence in the quality of our environmentalism indicators.

The third step in our empirical analysis will investigate travel patterns of observationally identical individuals who live in green and brown communities. Using ordinary least squares, we will estimate several versions of equations (2) and (3). The unit of analysis will mainly be a household m who lives in community j . We will also present one set of results where the unit of analysis is a census tract.

$$\text{Green Travel Behavior}_{mj} = B_1 * \text{demographic}_m + B_2 * \text{Environmentalism}_j + V_{mj} \quad (2)$$

$$\text{Green Travel Behavior}_{mj} = B_1 * \text{demographic}_m + B_2 * \text{Environmentalism}_j + B_3 * \text{Urban Form}_j + V_{mj} \quad (3)$$

Using the cross-sectional data sets that we will introduce in the next section, we observe different households' transportation patterns. We posit that there are three different sets of factors that play a role in determining travel behavior. These factors are displayed in Figure One.

First, households differ with respect to their demographics and income. This will affect travel behavior; for example, it is well-documented that lower income populations are more likely to ride transit.

Second, households differ based on their residential location within the metropolitan area. All else equal, if a household lives close to the CBD, at high population density and close to rail transit, this household is more likely to engage in green travel behavior. We acknowledge that our set of urban form variables is by no means exhaustive, and much of the existing literature examines built environment characteristics in greater detail; however, the broad geographic scope of our inquiry limits the urban form variables available to us.

Finally, we also seek to study the role of community environmentalism in determining green travel behavior while holding urban form and household demographics constant. Holding a household's distance to the CBD, local population density, distance to rail transit stations and household demographics constant, do environmentalist households engage in "greener" transit patterns than non-environmentalists? We test this by estimating equations (2) and (3) and testing if B_2 is positive and significant. To be able to test this, we need to assume that our observable measures of community environmentalism (see Figure One), do indeed represent good proxies for unobserved community environmentalism. If our measures of community environmentalism are noisy measures of true community environmentalism, then based on standard classical measurement error results, our estimates of B_2 represent a lower bound on the true effect of green beliefs on green travel behavior.

In terms of the conceptual framework underlying this approach, we recognize that there are three explanations for why we predict that B_2 will be greater than zero. The first explanation is based on “voluntary restraint” (see Kotchen & Moore, 2007). This explanation suggests that “greens” enjoy some utility from conserving natural resources. If this is the case, controlling for household demographics and residential location, environmentalists will engage in “greener” travel than the average person. If we were sure in equation (3) that $E(V_{jm} | X) = 0$, where X is the vector of all explanatory variables, then positive estimates of B_2 would be strong evidence in favor of the voluntary restraint hypothesis.

Recognizing that we cannot test the assumption that the error term in equation (3) is uncorrelated with the explanatory variables, we acknowledge two alternative explanations for why B_2 could be positive. The second is based on environmentalist residential sorting on unobserved exogenous attributes of place. Consider the case where households choosing a residential location have more information concerning the micro-geography of each community than the statistical researcher. If environmentalists seek out the green communities, they will choose those with bike paths, inviting sidewalks, and good bus service, among other characteristics. In this case, environmentalists would be more likely to move to these communities with high unobserved (to the statistician) green transportation opportunities and then practice green travel. The researcher would estimate that B_2 is greater than zero, but this would be caused by environmentalist sorting on unobserved green attributes of communities that the environmentalists take as given in choosing where to locate.

The third explanation for why B_2 could be positive is based on environmentalist residential sorting and subsequent green voting and political activism in local affairs. Suppose that environmentalists concentrate in certain communities such as Berkeley, Santa Cruz or Santa Monica, California. If this is the case they may have sufficient local political clout to influence infrastructure investment patterns, transit spending, and other green local attributes. Higher levels of green travel behavior may result. This case is identical to explanation #2, except now green behavior is not determined by *ex ante* community characteristics that precede location decisions but by a *post hoc* political economy process that “greens” communities. If this is the case, the statistician would observe green travel behavior in environmentalist communities based on unobserved (to the researcher) local characteristics.

We acknowledge that we will not be able to disentangle whether positive estimates of B_2 are caused by each of the three explanations listed above. However, a key point to note is that all three explanations share a common denominator. Should B_2 be positive, it is clear that environmentalists have a taste for a green transportation lifestyle, and they follow through with this agenda even holding constant their observable demographics and the observable attributes of their local community’s geography. Regardless of whether voluntary restraint, sorting, or political economy is the cause of greens’ environmentally-friendly travel behavior, green ideas matter and shape transportation patterns. We acknowledge that the policy implications of our findings hinge on what is the true data generating mechanism. We will return to this point in the conclusion when we discuss a future research agenda and the policy implications of our findings.

In closing this Conceptual Framework section, we would like to address the issue of reverse causality in estimating equations (2) and (3). The reverse causality story posits that people become environmentalists *because* they use green transit modes (e.g. a personal predisposition toward public transit and biking causes environmentalism). The environmentalism proxies we introduce below reduce our concern about this issue. One of our environmentalism indicators will be a community's share of total vehicles that are hybrid, fuel-efficient vehicles. A proponent of the reverse causality conjecture would need to make a cogent case that people buy hybrid autos because they bike, walk, and ride transit to work. A second measure of environmentalism will be a community's share of voters who are members of the Green Party. While the Green Party may espouse an ideology appealing to transit riders or walkers, the party has little political clout or ability to turn its goals into practical policy outcomes. Thus it is highly likely that members join from ideological conviction. Therefore we hypothesize that the causality primarily flows from environmental beliefs to green transportation choices and not vice versa.

Data

Transportation Data

This paper's data on transportation patterns and demographics comes from the 2000 Census of Population and Housing and the 2001 National Household Transportation Survey (NHTS). Two different census data sets are used. The first is year 2000 micro data from the IPUMS data base (<http://usa.ipums.org/usa/>). We also use census tract level data based on year 2000 data.

We also employ household-level data from the 2001 National Household Transportation Survey. This provides self-reported information on gallons of gasoline

consumed annually, as well as household demographics. A special geocoded dataset provides each household's zip code of residence. The geographical identifiers in each of these data sets allow us to merge in the environmental indicators we discuss below.

Urban Form Data

For each census tract and zip code, we construct population density and use GIS to determine the area's distance to the closest central business district (CBD) and to the closest rail transit station. Rail transit is defined as modern rapid transit lines (such as San Francisco's BART), not vintage trolleys or commuter rail lines. For more details on the data set construction, see Baum-Snow & Kahn (2005).² We are assuming that local population density and distance to the CBD proxy for bus access. In addition to these urban form measures, we also construct measures of the metropolitan area's population density.

Identifying Environmentalists

We utilize five different environmental indicators. These are based on consumer behavior and actual costly choices in political markets. These environmentalism indicators allow us to identify which communities are green and which are not.

The first indicator is available for the entire nation. We have collected data on each Congressional Representative's environmental voting record from the 106th Congress (covering the years 2000 to 2002). The annual League of Conservation Voters' (LCV) "Scorecard" determines which legislation is environmentally important and identifies which vote is "pro-environment." (See www.lcv.org)

A Representative's voting record is likely to be positively correlated with unobserved constituent ideology. While Representatives vote on a large number of issues

each year, there are consistent patterns observable in roll call data. Liberal representatives are much more likely to vote the LCV's pro-environment position than are conservatives.³ It is highly intuitive that liberal congressional districts elect liberal representatives to office. In this case, the median voter's preferences in a given congressional district should be well-reflected by how her representative votes. While representative voting is an indirect method for gauging constituent preferences, an advantage of this variable is that we observe it for the entire nation. The LCV score represents the fraction of times that a representative votes the LCV position on legislation from a given year. For example, a representative with a 90% LCV score voted the LCV's preferred position on 90% of the time.

In addition to using national LCV data, we construct four environmentalism indicators using data from California, which is well-known for a high level of environmental consciousness relative to other states. The first indicator is the percentage of each census tract's voters who are registered with the Green Party,⁴ which has a platform which focuses on environmental activism.⁵

California is the state with the highest count of Green Party registered voters both in absolute terms and as share of all registered voters. But even in California, the Green Party's membership is small. Across 7002 California census tracts in the year 2000, the average tract's Green Party share is 0.009 and the median is 0.005. The 10th percentile is 0.0017 and the 90th percentile is 0.019. As a result of its small size, the party has relatively little direct influence on the political process. This makes Green Party membership a costly political choice, because in California, members of this party lose the right to vote in another party's primary election. Since Green Party membership

offers little practical political clout, we assume its members must be expressing their own personal political beliefs, not voting because they expect any tangible benefit from the election of Green Party candidates.

Our third and fourth measures of environmentalism are based on California voting results on Propositions 12 and 13 in the year 2000. Both of these propositions were intended to enable the state to borrow money to enhance overall environmental quality. Proposition 12 proposed to spend over \$2 billion, raised through the sale of general obligation bonds, for state and local projects to acquire, improve, and preserve recreational, cultural, and natural areas (such as parks, wildlife habitats, community centers, and zoos).⁶ Proposition 13 proposed to issue bonds for safe drinking water, flood protection, watershed protection, clean water and water recycling, water conservation, and water supply, reliability and infrastructure.⁷ It is relevant to note that neither of these Propositions is directly tied to public transit improvements. Both of these Propositions are intended to enhance the natural capital stock.

Our final measure of environmentalism is the count of hybrid autos whose owners received a yellow sticker giving them the right to drive in HOV lanes in California. This program was started in August 2005. Through a request put in to the State of California's Department of Motor Vehicles, we received a database with all 85,000 hybrid vehicles (all are Prius, Insight or Accord makes) that received stickers, categorized by zip code. We use this microdata to calculate the total number of stickered hybrids in each zip code and scale this by the total personal vehicle count in the zip code to yield the hybrid auto share. Given the reputation of these cars as "green vehicles," we conjecture that communities with high hybrid counts per-capita are green communities.⁸

To provide one example of the plausibility of the hybrid vehicle indicator as a measure of environmentalism, we calculated the ratio of hybrids near UC Berkeley (zip code number 94707) with the count of hybrids near UC Los Angeles (zip code number 90024). These zip codes have roughly the same average household incomes but there are 5.68 times as many hybrids per vehicle in Berkeley as in Westwood. Given Berkeley's well known reputation for environmentalism, this increases our confidence in this measure.

Results

Residential Self Selection by Environmentalists

Our first empirical goal is to estimate equation (1) using California data to document that environmentalists are clustering in communities with specific urban form attributes. These include distance to the CBD, neighborhood population density, and distance to the closest rail transit station. In Table One, the unit of analysis is a census tract located within thirty miles of a California metropolitan area CBD. Our measure of environmentalism uses each tract's share of Green Party registrants and its percentage of "pro" votes on Propositions 12 and 13. Because we believe each of these environmental indicators represents an expression of what we consider a single underlying "green belief" variable, we extract a single environmentalism factor using Stata 10's principal factor command.

Table One reports six OLS estimates of equation (1). In columns (1) and (2), the dependent variable is the log of a census tract's distance to the CBD. Controlling for metropolitan area fixed effects, we find that environmentalists cluster closer to the city center(s). As shown in column (2), this finding is robust to controlling for the census

tract's average household income and racial composition. Relative to column (1), the estimate of B_2 shrinks, but it is still statistically significant. As is shown in columns (3-6), environmentalist communities are also found in areas with higher population densities and those closer to rail transit stations. For example, the results reported in column (4) indicate that holding tract demographics constant, a one standard deviation increase in community environmentalism is associated with a population density 24 percent higher.

In results available on request, we have regressed each of our environmentalism indicators on the full set of urban form variables (i.e. distance to the CBD, population density and proximity to rail transit station). The R^2 averages 0.5. Urban form variables help to explain where environmentalists locate (again, they prefer high-density areas close to the CBD and to rail transit), but even controlling for such variables there is substantial unexplained spatial variation present. Many factors may account for this. A green may suburbanize because her place of work is in the suburbs or because the public schools in that suburb are particularly strong. Additionally, some greens may locate in an outlying, low density area that they perceive to be "green," perhaps because of proximity to nature, fresh air, or to other like-minded individuals (enclaves). Moreover, there are many reasons a non-environmentalist may live in the center city, such as the proximity to cultural and market amenities.

National Evidence on Environmentalism's Effects on Travel Behavior

Having established that environmentalists are over-represented in green transportation-friendly parts of metropolitan areas, we now turn to estimating equations (2) and (3) in order to examine the travel patterns of environmentalists directly.

Table Two reports four regressions using household level data from the 2001 NHTS. In each regression, a household's annual gasoline consumption is the dependent variable. We report estimates of equation (2) and (3). The signs on the coefficients for household demographic variables are as expected. Wealthier households and households with more people consume more gasoline. Controlling for these demographics, households whose Congressional Representative has a "greener" voting record consume less gasoline. A ten percentage point increase in such a Representative's LCV score (which represents a greener record) is associated with a 24 gallon reduction in annual consumption.

In columns (2) and (4), we introduce the urban form measures. As expected, people who live in higher-density metropolitan areas, high-density communities within metropolitan areas and in areas closer to the CBD all consume less gasoline. Including these urban form variables leads to a significant shrinkage of the B_2 coefficient, from -2.4 to -0.55. This indicates that much of the observed environmental behavior can best be explained by the built environment. However, it is important to note that both coefficient estimates are statistically significant, indicating that environmentalism does play an independent, direct role.⁹ In this table, the reported t-statistics are adjusted to allow for correlation between observations sampled from the same metropolitan area.

Table Three reports national estimates of equations (2) and (3) using year 2000 Census data. Relative to the 2001 NHTS household level data, the Census data offers a larger sample but it does not provide information on annual gasoline consumption. The Census data does, however, provide information on household commute modes. We recognize that the commute trip represents only a small proportion of overall travel, but

are limited by the availability of the data. Table Three's columns (1) and (2) are estimated using census tract level data and columns (3) and (4) are estimated using household level data. It is important to note that the household level data feature more aggregated geographical identifiers called "PUMAs." These PUMAs are spatial aggregates of census tracts and can cover 100,000 people rather than the roughly 5,000 people who comprise a census tract. In columns (1) and (2), the dependent variable is the percentage of workers in each census tract who commute using public transportation. The environmentalism indicator remains the Congressional Representative's LCV score. In each regression, we control for metropolitan area fixed effects. Including such fixed effects means that we estimate the environmentalism effect by using within-metropolitan area variation in community environmentalism. Column (1) presents an estimate of equation (2), and column (2) presents an estimate of equation (3). Controlling for tract demographic attributes, public transit use is higher in communities where the Representative has a higher LCV score. The environmentalism coefficient is statistically significant. Its magnitude indicates that increasing a Representative's LCV score from 0 to 50 would increase a census tract's share of public transit commuters by 2 percentage points. This B_2 coefficient shrinks considerably when we include urban form variables, which indicate that public transit use is higher closer to the CBD, in more dense communities and in communities located closer to rail transit stations (see column 2). But again, even when controlling for the effects of the built environment, the B_2 coefficient remains positive and borderline statistically significant.

In Table Three's columns (3) and (4), we present estimates of equations (2) and (3) using the census household level data. The unit of analysis is a head of household. In

these regressions, state fixed effects are included. These regressions report linear probability model estimates where the dependent variable equals one if the household head commutes using public transit, walks or bikes (i.e. uses a green mode). Controlling for the household's income, age and ethnicity, households who live in green Congressional Districts are more likely to engage in green commutes. This finding is robust to controlling for the urban form variables. While quantitatively small in size, these results support the claim that environmentalists engage in more environmentally-friendly transportation practices than others.

California Results

As discussed in the data section, California offers a richer set of environmentalism indicators than is available for the nation as a whole. In Table Four, we report household level results using Census data for Californians who live in a community (PUMA) whose centroid is located within thirty miles of a Central Business District. Our measure of environmentalism varies across the 220 PUMAs within our sample but does not vary within a PUMA. We employ an environmentalism variable generated using four measures: the census tract's Green Party registrations as a share of total registered voters, the PUMA's average share of vehicles that are hybrids, and the percentage of each tract that voted "yes" votes on Propositions 12 and 13 in the year 2000. We use factor analysis to collapse these four different measures of environmentalism into a single index. In Table Four, this environmental factor is the key explanatory variable.

Table Four reports four linear probability models based on equations (2) and (3). In columns (1) and (2), the dependent variable is a dummy that equals one if the

household head commutes using public transit. Controlling for metropolitan area fixed effects and adjusting the t-statistics for within-PUMA correlation, we find that a one standard deviation increase in community environmentalism increases the probability that a household head commutes by public transit by 0.8 percentage points. This finding is statistically significant. As shown in column (4), we find that a one standard deviation increase in community environmentalism increases the probability that a household head commutes by biking or walking by 0.7 percentage points. This result is borderline statistically significant.

Table Five reports analogous regressions, but in this case the unit of analysis is a California census tract. While this table reports ecological regressions, the advantage of census tract level data is that our environmentalism factor varies by census tract. In columns (2) and (4), we find that, holding a census tract's demographics and urban form attributes constant, a one standard deviation increase in census tract environmentalism increases the tract's share of public transit users by 1.5 percentage points. Given that the average census tract's share of public transit commuters is 6.2%, the environmentalism effect is not small and is strongly statistically significant. It is relevant to note that in estimating this coefficient we are controlling for neighborhood attributes. The results in column (4) indicate that a one standard deviation increase in the environmental factor increases the share of workers who commute by biking or walking by 1.3 percentage points. Again, the result has high significance.

Conclusion

Do environmentalists make greener transportation decisions? The question is not merely of academic importance. Concerns over global warming have sparked new efforts to raise environmental consciousness. This raises the question of whether such beliefs will translate into actual green behavior.

We have introduced five credible indicators of environmentalism to investigate how green beliefs, urban form, and household demographics influence sustainable transportation patterns. Our analysis shows that green beliefs are associated with reduced fuel consumption and greater use of non-auto modes for commute trips. Members of communities that engage in environmentalist behavior, based on consumption data and political choices, tend to choose a green transportation profile.

There are three possible explanations for this finding, and the policy implications of our work hinge on the relative importance of each. One explanation is that environmentalists engage in “voluntary restraint,” motivated by their beliefs. If this is the dominant explanation, then sustainability will be enhanced through education programs that encourage environmentalism.

A second explanation is that environmentalists disproportionately choose to live in communities with exogenous characteristics that facilitate living a green lifestyle, and then they take advantage of these attributes once they have self-selected. While we have documented that environmentalists on average do live in communities with observable green attributes (i.e. close to the city center, dense, and close to rail transit), we cannot

test whether environmentalists are clumping in communities that are “green friendly” based on unobserved exogenous transit dimensions. If this is the true mechanism, then GIS micro-detailed research must identify which specific attributes make these communities green travel-friendly (i.e. what is it about Berkeley?). We should then pursue policies (such as mixed-use, higher-density zoning) to encourage greater build up in those communities to allow more people to live close to this green-friendly infrastructure.

The third mechanism is the local “green clout” explanation; in green communities such as Berkeley environmentalists may use the political process to improve things like local transit service or the pedestrian architecture, and then use these new politically-provided public goods. If this is the case, then sustainability would be enhanced by “packing” environmentalists into sustainable communities rather than spreading them out such that they are a small minority in any one community. Future research here can explore the political economy of local infrastructure investments and zoning decisions in cities as a function of city resident demographics and environmental attitudes (Gerber & Phillips, 2004, 2005).

Figure One

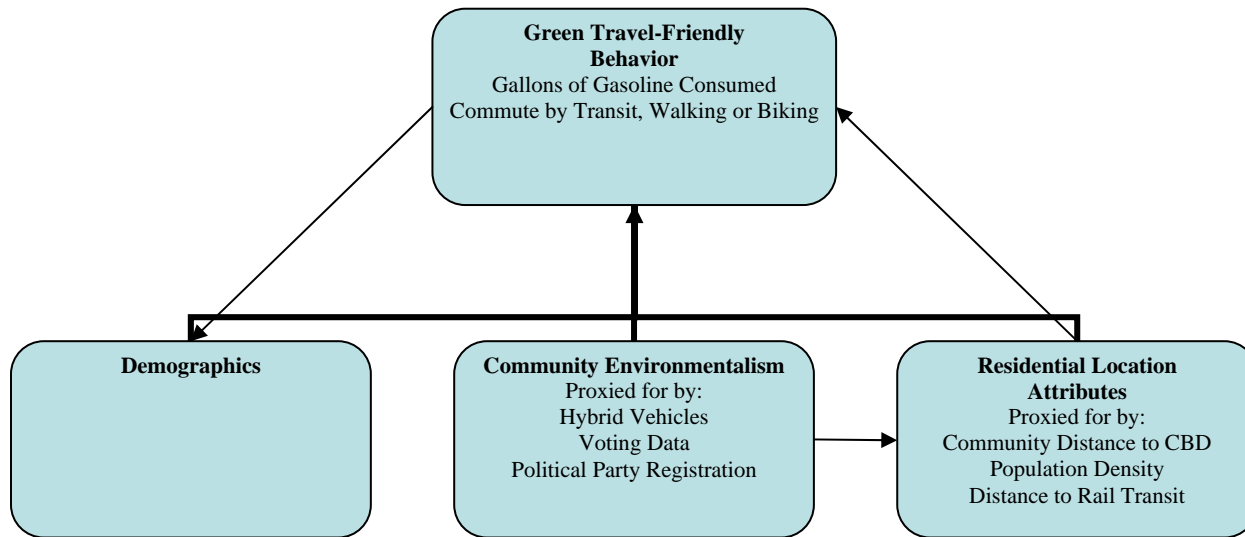


Table One. Where Do Environmentalists Choose to Live within Cities?

Column	Log(Distance to CBD)				Log(Population Density)				Within 1 Mile of Rail Transit Station Dummy			
	(1)		(2)		(3)		(4)		(5)		(6)	
	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat
Environmentalism Factor	-0.2785	-24.6100	-0.1842	-15.1300	0.4299	24.9500	0.2369	13.5200	0.0785	16.6600	0.0511	9.9900
log(Average Household Income)			0.4974	15.8600			-1.3334	-29.5300			-0.2153	-16.3200
Share Black			-0.1422	-1.5700			-0.3452	-2.6500			-0.0074	-0.2000
Share Hispanic			-0.0519	-1.0100			-0.2162	-2.9300			-0.0981	-4.5500
Constant	9.5737	1059.5700	4.1093	11.4900	8.6061	625.6100	23.4145	45.4700	0.1173	31.1800	2.5242	16.7800
observations	6074		6074		6074		6074		6074		6074	
R2	0.189		0.246		0.286		0.406		0.152		0.195	
Fixed Effects	MSA		MSA		MSA		MSA		MSA		MSA	

The unit of analysis is a California census tract located within 30 miles of a CBD. This Table reports results from six OLS regressions of equation (1). The regressions are weighted by the count of the tract's commuters. The demographic data are from the 2000 Census.

Table Two. Household Gasoline Consumption as a Function of Demographics, Urban Form and Local Environmentalism

The Dependent Variable is a Household's Annual Gallons of Gasoline Consumed								
Estimation Method	OLS		OLS		Median Regression		Median Regression	
Column	(1)		(2)		(3)		(4)	
	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat
Congressional Representative's Green Voting Record	-2.4080	-4.28	-0.5528	-2.25	-1.8585	-8.94	-0.4871	-1.71
Log(Distance to Central Business District)			57.4439	3.81			63.7038	4.47
Within 1 Mile of Rail Transit Station Dummy			55.8686	0.84			121.3845	3.19
Log(Census Tract Population Density)			-73.9037	-7.59			-57.9244	-6.64
Log(Metropolitan Area Population Density)			-98.2716	-4.12			-95.9199	-5.29
log(Household income)	310.6148	19.41	296.4291	16.15	253.3528	24.27	240.3356	18.5
People in Household	147.8816	16.44	135.4673	18.06	157.9177	25.7	144.4762	18.88
Minority Dummy	-125.0906	-3.35	-29.2864	-0.68	-141.9117	-5.41	-70.6658	-2.12
Head of household Age	-1.1285	-0.89	-1.4125	-1.08	-0.8877	-1.15	-1.8147	-1.9
Dummy if Household Head Age is missing	-261.7502	-3.94	-301.1244	-4.66	-200.0434	-4.99	-274.8668	-5.52
Constant	-2575.8540	-17.57	1598.3700	-7.15	2149.6910	-18.57	1336.1280	-5.81
Observations	11289		11289		11289		11289	
R2	0.305		0.351		0.204		0.23	

This table reports four estimates of equations (2) and (3) in the text. Columns (1) and (2) are estimated using OLS and columns (3) and (4) are estimated using a quantile median regression. The unit of analysis is a household. The data are from the 2001 National Household Transportation Survey. In columns (1) and (2), the standard errors are clustered by metropolitan area. All observations are sampled from households who live in a metropolitan area. The omitted category is a white household for whom the head's age is reported whose zip code centroid is more than one mile from the closest rail transit station. The dependent variable has a mean of 997.1 and a standard deviation equal to 946.3. A Representative's Green Voting Record is based on his/her League of Conservation Voter's score in the 106th Congress. See text for details. This variable has a mean of 36.5 and a standard deviation of 33.4.

Table Three. National Commuting Choices

Column	% Commuting Using Public Transit				Commute using Public Transit or walk or bike			
	(1) beta	t-stat	(2) beta	t-stat	(3) beta	t-stat	(4) beta	t-stat
Congressional Representative's Green Voting Record	0.0004	3.37	0.0001	1.72	0.0006	6.13	0.0002	2.58
Log(Distance to Central Business District)			-0.0085	-1.7			-0.0075	-1.35
Log(Population Density)			0.0207	6.51			0.0711	9.26
Within 1 Mile of Rail Transit Station Dummy			0.0933	7.84				
log(Average Household Income)	-0.0304	-4.34	-0.0039	-0.55				
Share Black	0.1242	6.88	0.1013	5.75				
Share Hispanic	0.1048	4.45	0.0686	3.09				
log(distance to closest rail transit station)							0.0007	0.24
log(Household Income)					-0.0310	-17.81	-0.0264	-16.68
Black					0.0620	9.98	0.0388	7.28
Age of Household Head					-0.0053	-8.3	-0.0038	-8.21
Age of Household Head Squared					0.0001	8.72	0.0000	8.62
Constant	0.3493	4.5	-0.0071	-0.08	0.5021	21.87	-0.0835	-0.68
Unit of Analysis	Tract		Tract		Person		Person	
observations	43496		43496		2162047		2162047	
R2	0.546		0.627		0.106		0.139	
Fixed Effects	MSA		MSA		State		State	
Standard Error Clustering	Congressional District		Congressional District		Congressional District		Congressional District	

In columns (1) and (2), the sample include all tracts located within 30 miles of a CBD in the year 2000. In columns (1) and (2), the omitted category is a census tract whose centroid is more than one mile from the closest rail transit station. Congressional Representative's Green Voting Record is based on the League of Conservation Voters data from the 106th Congress. This variable has a mean of 36.42 and a standard deviation of 33.36. The mean and standard deviation for the variable "% Commute using Public Transit" is .075 and .134. In columns (3) and (4), the unit of analysis is a head of household and the data are from the 2000 Census. For each head of household, we use information on home's geographical identifier to merge in information on the Congressional Representative for that community. Standard errors are clustered by Congressional District to control for the possibility of within district correlation of the error terms. In columns (3) and (4) the dependent variable is a dummy variable that equals one if the head of household commutes using public transit or by walking or biking. The omitted category is a non-black head of household.

Table Four. California Commuting Choices Based on Individual Level Data

Column	Commute using Public Transit				Commute using Bike or Walking			
	(1)		(2)		(3)		(4)	
	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat
Environmentalism Factor	0.0206	5.87	0.0081	2.22	0.0090	2.95	0.0071	1.87
Log(Distance to Central Business District)			-0.0185	-3.94			-0.0015	-0.42
Log(Population Density)			0.0146	2.16			0.0122	2.37
log(distance to closest rail transit station)			-0.0002	-0.05			0.0081	2.41
log(Household Income)	-0.0049	-5.32	-0.0035	-4.04	-0.0059	-14.6	-0.0055	-16.42
Black	0.0099	3.11	0.0100	3.56	-0.0140	-6.36	-0.0139	-6.23
Age of Household Head	-0.0005	-1.45	-0.0004	-1.27	-0.0017	-5.69	-0.0016	-5.63
Age of Household Head Squared	0.0000	0.26	0.0000	0.04	0.0000	4.87	0.0000	4.73
Constant	0.1028	8.21	0.1369	1.48	0.1301	13.49	-0.0501	-0.79
Unit of Analysis	Person		Person		Person		Person	
Observations	418961		418961		418961		418961	
R2	0.042		0.046		0.012		0.014	
Fixed Effects	MSA		MSA		MSA		MSA	
Standard Error Clustering	PUMA		PUMA		PUMA		PUMA	

The unit of analysis is a head of household who lives in California in a metropolitan area and in a PUMA whose centroid is located within 30 miles of the MSA's Central Business District. This table reports results from four OLS regressions of equations (2) and (3) in the text. The Environmentalism Factor has a mean of zero and a standard deviation equal to one. The dependent variable in each regression is a dummy variable that equals one if the household head commutes using the mode in question. The standard errors are adjusted for within PUMA correlation. The environmental factor is based on a PUMA's Green Party Registration share, Voting Shares in favor Proposition 12 and 13 in 2000 and the PUMA's share of all vehicles that are hybrids based on the Clean Air Access program discussed in the text. There are 220 PUMAs in the sample. The omitted category is non-black head of household.

Table Five. California Commuting Choices Based on Census Tract Level Data

Column	% Commuting Using Public Transit				% Commuting Using Biking or Walking			
	(1)		(2)		(3)		(4)	
	beta	t-stat	beta	t-stat	beta	t-stat	beta	t-stat
Environmentalism Factor	0.0244	23.68	0.0146	16.48	0.0156	16.22	0.0130	13.41
Log(Distance to Central Business District)			-0.0270	-27.49			-0.0122	-11.36
Log(Population Density)			0.0057	8.56			-0.0030	-4.11
Within 1 Mile of Rail Transit Station Dummy			0.0666	29.84			0.0210	8.6
log(Average Household Income)	-0.0570	-21.49	-0.0216	-8.96	-0.0638	-25.69	-0.0572	-21.67
Share Black	-0.0150	-1.96	-0.0163	-2.54	-0.1070	-14.93	-0.1097	-15.6
Share Hispanic	0.0152	3.51	0.0216	5.92	-0.0487	-12.01	-0.0480	-12.03
Constant	0.6854	22.66	0.4945	15.82	0.7757	27.37	0.8429	24.65
observations	6074		6074		6074		6074	
R2	0.483		0.636		0.2		0.233	
Fixed Effects	MSA		MSA		MSA		MSA	

The unit of analysis is a California census tract located within 30 miles of a Central Business District. This table reports results from four OLS regressions of equations (2) and (3) in the text. The regressions are weighted by the count of the tract's commuters. The demographic data are from the year 2000 Census. The omitted category is a tract whose centroid is more than one mile from the closest rail transit station. The mean and standard deviation for the variable "% Commute using Public Transit" is .062 and .085. The mean and standard deviation for the variable "% Commute by Biking or Walking" is .052 and .068. The Environmentalism Factor has a mean of zero and a standard deviation equal to one. The environmental factor is generated using census tract level data on the tract's Green Party Registration share, and its voting shares in favor Proposition 12 and 13 in 2000.

Notes

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² Central Business District definitions are taken from the 1982 Economic Censuses Geographic Reference Manual. They represent agglomerations of census tracts that surveyed local business leaders reported to represent the center of economic activity for each metropolitan region. The basis of the rail transit data is the Bureau of Transportation Statistics’ 2003 National Transportation Atlas Database (see Baum-Snow and Kahn, (2005) for details).

³ In the 1980s, when he was a Representative of Wyoming, Dick Cheney received a LCV score of 0% based on his voting on environmental bills over a two year period.

⁴ The Berkeley IGS (see <http://swdb.berkeley.edu/>) provides data for each California census tract's count of registered Green Party Voters in the year 2000. It is important to note that voting precincts and census tracts spatially overlap but they do not coincide. To translate the voting precinct data into census tract data, The Berkeley IGS takes the precinct data (there are over 1700 Precincts in Los Angeles county alone) and uses a statistical procedure based on ecological inference to create the census tract data.

⁵ See <http://www.cagreens.org/platform/>.

⁶ <http://ca.lwv.org/lwvc.files/mar00/pc/prop12.html>

⁷ <http://ca.lwv.org/lwvc.files/mar00/pc/prop13.html>.

⁸ We acknowledge that a subset of people who apply for these stickers will be high value of time households who seek to save time commuting by accessing the HOV lane. We are positing that there are relatively few “browns” who purchase a hybrid in order to acquire a HOV access program sticker.

⁹ Median regressions are reported in Table Two's columns (3) and (4). Such regressions are robust to outliers.

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