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ENERGY FINDINGS

Electric Vehicle Charging and Car Dependency

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Findings

We explore whether policies to promote electric vehicles (EVs) impede efforts to reduce vehicle travel. We hypothesize that the presence of EV chargers reduces respondents' willingness to support (i) the removal of on-street parking to make space for bicycle lanes, and (ii) infill development on surface parking lots. We also hypothesize that the availability of EVs reduces public support for broader vehicle travel reduction policies. Using a randomized survey-based experiment, we find no evidence to support any of these hypotheses.

1. Questions

A shift from gasoline- and diesel-powered cars to electric vehicles (EVs) is a critical part of climate policy efforts. However, the negative side effects of electrification have increasingly come into focus. The greater weight of EVs amplifies the risks to pedestrians and other road users, and increases particulate emissions from tire and brake wear (Shaffer, Auffhammer, and Samaras 2021; Fussell et al. 2022). And mining for cobalt, lithium, and other minerals used in EV battery production often comes with severe environmental and social impacts (Sovacool et al. 2020).

We ask whether promotion of EVs has another unintended consequence—hampering the implementation of policies to reduce vehicle travel. We analyze the impacts on two specific policies—bicycle lanes and infill development, the climate benefits of which are supported by a large body of evidence (Salon et al. 2012). For example, infill development increases densities, which tends to reduce vehicle travel. We also examine the impact of electrification on willingness to support broader vehicle travel reduction policies.

We test three specific scenarios. First, the existence of on-street chargers may reduce public willingness to support the removal of parking to create space for bicycle lanes. Second, the existence of off-street chargers in surface parking lots may reduce support for infill development on these sites. Third, the availability of EVs may reduce support for policies to reduce driving, such as public transit improvements. In the first two cases, public support might decline because of perceptions of the sunk costs of charger installation. In all three cases, public support might decline because EVs and vehicle travel reduction are perceived as substitutes—the more that the transportation system electrifies, the less the need to reduce driving.

2. Methods

For the first analysis, we deployed a randomized survey experiment to assess support for bicycle lane infrastructure. We assigned respondents to one of three groups. Each group was shown the same "after" image—a photosimulation of a bicycle lane replacing on-street parking (Figure 1). The "before" image and text varied as follows:

- Group A was shown an image with on-street parking **without EV chargers**. The text noted that "sometimes parking must be removed to make space for the bicycle lanes."
- Group B was shown the same image of on-street parking, but **with EV chargers** digitally added. The text was the same as Group A.
- Group C was shown the same images as Group B (with EV chargers). However, the **respondents' attention was also drawn to the chargers through the text**: "sometimes parking and electric vehicle chargers must be removed to make space for the bicycle lanes."

Respondents were asked to rate their support for a series of statements (Table 1) using a 5-point Likert scale from "strongly agree" to "strongly disagree." If on-street EV chargers reduce public support for on-street parking removal, groups B and C should express less support for implementation of bicycle lanes than group A. Group C should express less support than group B, because the presence of chargers was reinforced in the text.

We used the same approach for the second set of images, this time on infill housing. Each group was shown the same "after" image – a photosimulation of an infill development project on the parking lot (Figure 1). The "before" image varied by randomly assigned group – group A was shown a surface parking lot, group B was shown the same parking lot with EV chargers, and group C was shown the same image as group B but with the presence of chargers reinforced in the text. The group assignment was the same as for the previous set of questions on bicycle lanes.

The third group of statements referred to transportation policy more generally. The first group saw a statement about climate change and vehicle travel. The second group saw a similar statement, except it also highlighted the role of EVs in reducing emissions. Because there were only two groups (compared to three groups for the bicycle lanes and infill housing questions), a separate random assignment was used.

We also asked questions about age, gender, political party affiliation, commute mode, car ownership, and home ZIP code. The survey was available in Spanish and English. We pretested the survey and deployed it via Qualtrics and Amazon Mechanical Turk in April 2023, limiting eligibility to California residents. We received a total of 907 responses, not counting the 8 respondents who we

BIKE LANE			
Image 1	**Image 2**	**Image 3**	**After Image**
No chargers 	Chargers 	Chargers 	Bike lane in parking lane 
Many cities in California are creating bike lanes that separate bikes from cars and other vehicles. This increases the safety and ease of bike travel across these cities, encouraging physical activity and reducing car congestion. However, sometimes parking must be removed to make space for the bike lanes.	Many cities in California are creating bike lanes that separate bikes from cars and other vehicles. This increases the safety and ease of bike travel across these cities, encouraging physical activity and reducing car congestion. However, sometimes parking must be removed to make space for the bike lanes.	Many cities in California are creating bike lanes that separate bikes from cars and other vehicles. This increases the safety and ease of bike travel across these cities, encouraging physical activity and reducing car congestion. However, sometimes parking and electric vehicle chargers must be removed to make space for the bike lanes.	*The after image is identical for each of the 3 randomized groups.*

HOUSING DEVELOPMENT			
Image 1	**Image 2**	**Image 3**	**After Image**
No chargers 	Chargers 	Chargers 	Housing development on parking lot 
Many cities in California are planning for new housing. At times, this housing is built on sites that were formerly used as parking lots.	Many cities in California are planning for new housing. At times, this housing is built on sites that were formerly used as parking lots.	Many cities in California are planning for new housing. At times, this housing is built on sites that were formerly used as parking lots and electric vehicle charging sites.	*The after image is identical for each of the 3 randomized groups.*

CLIMATE POLICY	
Text 1	**Text 2**
Transportation is the single largest source of global warming emissions and air pollution in California. The California Air Resources Board has set goals to reduce the amount people drive. Reducing the amount of driving in California can help to drastically reduce vehicle emissions that pollute our air and contribute to climate change.	Transportation is the single largest source of global warming emissions and air pollution in California. The California Air Resources Board has set goals to reduce the amount people drive. When people drive less, they pollute less from car emissions. The state will also require all new cars sold in the state to be zero emission or electric by 2035 and is providing incentives for electric vehicles and chargers. Electric vehicles can help to drastically reduce vehicle emissions that pollute our air and contribute to climate change.

Figure 1. Images and accompanying text

excluded because they completed the survey rapidly (<60 seconds; the median completion time was 199 seconds). Our results are virtually identical when including these 8 respondents. We preregistered our analysis plan at the Center for Open Science (https://osf.io/8f46e). We do not claim that our responses are representative of California residents. Rather, we rely on the randomization of survey respondents into different groups to causally identify the effects of EVs on their support for each policy.

Table 1. Statements posed to respondents

Bicycle infrastructure
I would support a project like this in my neighborhood
My city should do more to make bicycling safer
It's okay if some parking is lost to make space for bicycling
Infill development
I would support a project like this in my neighborhood
My city should be working to build more housing
It's okay if some parking is lost to make space for housing
Transportation policy
Californians need to drive less so that we can meet our climate goals
To help meet climate goals, California should improve public transit to give people alternatives to driving
I would like to drive less to help meet California's climate goals

Respondents were asked to rate their support on a five-point Likert scale, after viewing the images and accompanying text in Figure 1.

3. Findings

We find no evidence to support our hypotheses, either graphically (Figure 2 and Figure SI-1) or statistically (using both two-sample *t*-tests and ordered logistic regression). In general, there are minimal differences between the groups of survey respondents, and the few statistically significant differences run in the opposite direction to our hypotheses. The presence of electric vehicle infrastructure does not affect our respondents' stated support for bicycle lanes, infill development, or climate policies that aim to reduce driving. While our findings are null, it is important to report them in order to mitigate publication bias (Brown, Mehta, and Allison 2017).

One explanation for the null results could be that our survey respondents did not pay sufficient attention to the questions and images. However, our results exclude responses that were completed very quickly, and other researchers have successfully used Mechanical Turk for survey-based experiments (e.g. Berinsky, Huber, and Lenz 2012).

Instead, we suggest that there are two interpretations of our results. The first and most straightforward is that EV charging infrastructure has no measurable consequences in terms of reducing support for policies or infrastructure that reduce driving. The second is that our results are driven by the hypothetical nature of our questions. Indeed, the high level of support for parking removal and reductions in driving (a mean score of more than 4 on a 1-to-5 scale) is somewhat inconsistent with the political difficulties that cities have in practice when they try to remove parking. It is possible that respondents might be less supportive when confronted with a real-life choice in their own neighborhood. Those opposed to parking removal might also invoke EV chargers in a pretextual fashion, using the presence of chargers to bolster their argument against a project that removes parking. We leave these possibilities to explore in future research.

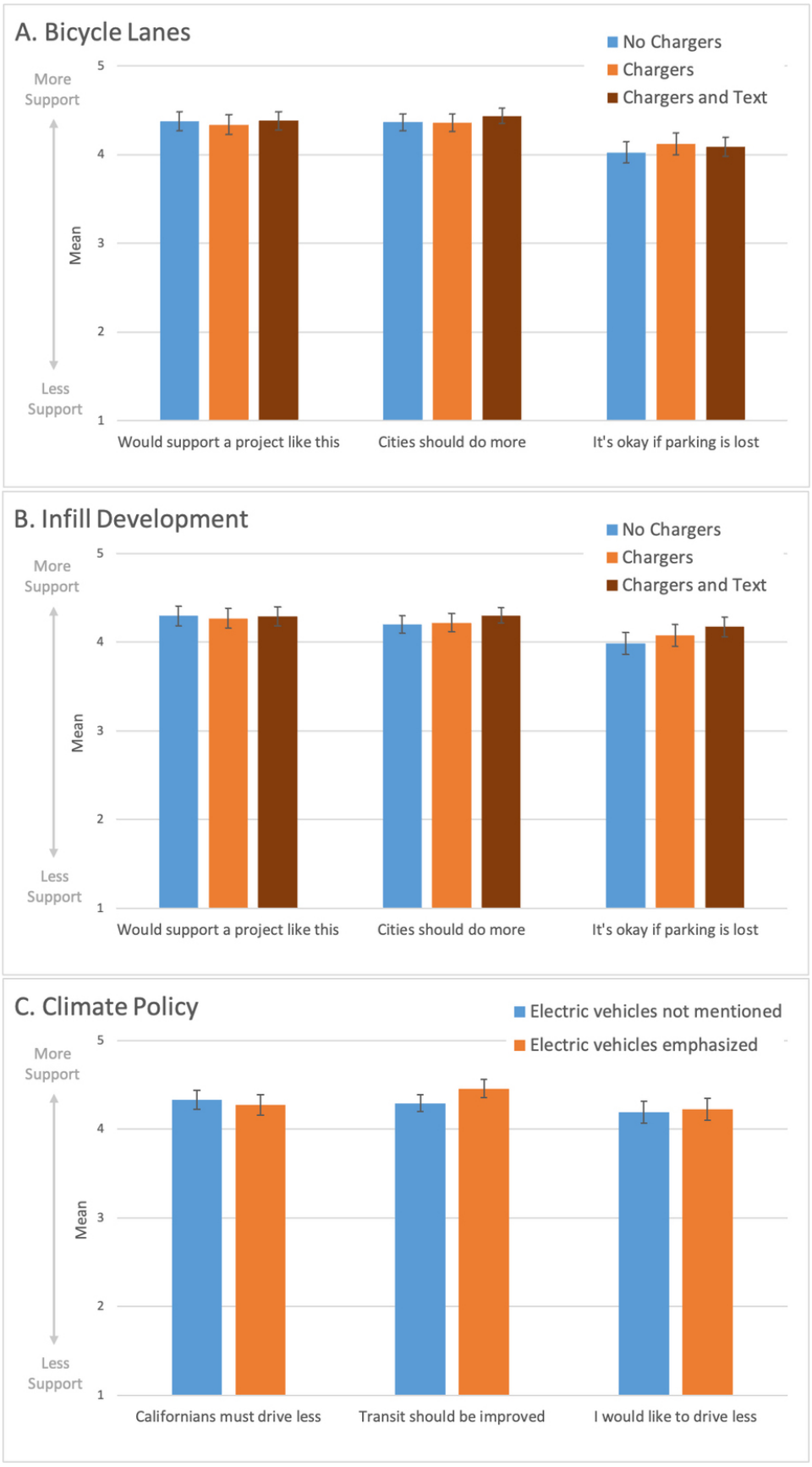

Figure 2. Survey results

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SUPPLEMENTARY MATERIALS

Supplementary Information

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