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Research Brief

Beyond the Early Era of EVs: Evidence from the Staggered Rollout of the HOV Lane Network in California

Eric Avis, Jing Li, and Katalin Springel

Electric vehicle adoption is a key part of climate and transportation goals, and local policies can make a big difference. One such policy is allowing EVs to use high-occupancy vehicle lanes even with a single driver. Using data on California's HOV lanes and vehicle registrations from 2012 to 2024, we examine how these exemptions affected EV adoption. We find that access to HOV lanes led to more EV purchases, especially in later years as technology improved and more models became available. The effects are strongest in areas with heavy traffic and long commutes, and they are concentrated in higher-income neighborhoods. These results highlight how HOV incentives can accelerate EV uptake while raising important questions about who benefits from them.

Electric vehicles (EVs) have played a central role in climate and transportation policy efforts, yet many drivers still face practical barriers to adoption. To help make EV ownership more appealing, California's Clean Air Vehicle Decal Program granted eligible EV drivers access to high-occupancy vehicle (HOV) lanes, allowing them to bypass traffic even when traveling alone. The policy offered a direct, daily benefit that made EV ownership more attractive, particularly for commuters in congested areas such as Los Angeles, San Diego, and the San Francisco Bay Area. With the program's expiration in September 2025, an important question arises: how much did these HOV lane privileges influence EV adoption, and which communities benefited the most?

We study this question using a detailed dataset that combines twelve years of monthly vehicle registration records with a spatial history of every HOV lane segment in California between 2012 and 2024. By tracking when and where each HOV segment became operational and matching that information to census tract-level vehicle registrations, we can observe how EV adoption changed in neighborhoods that suddenly gained HOV access compared with those that did not. We exploit the staggered expansion of the HOV network in California to isolate the policy's causal impact on EV purchases rather than simply reflecting broader market trends. While prior research has documented sizeable effects of HOV incentives in the early years of the U.S. EV market (DeShazo et al., 2017; Jenn et al., 2018), the EV market and access to the HOV network have evolved substantially in recent years. Coupled with a longer time horizon and detailed census tract-level registration data, our study provides new evidence on how the role of HOV exemptions has changed in a more developed EV market and within a rapidly changing policy landscape.

Our findings demonstrate a strong, positive, and statistically significant impact of HOV lane exemptions on EV adoption in California between 2012 and 2024. When a new HOV lane segment opened within five miles of a census tract's population center, the tract-level EV market share rose by about 1.2 percentage points, an increase of roughly 16

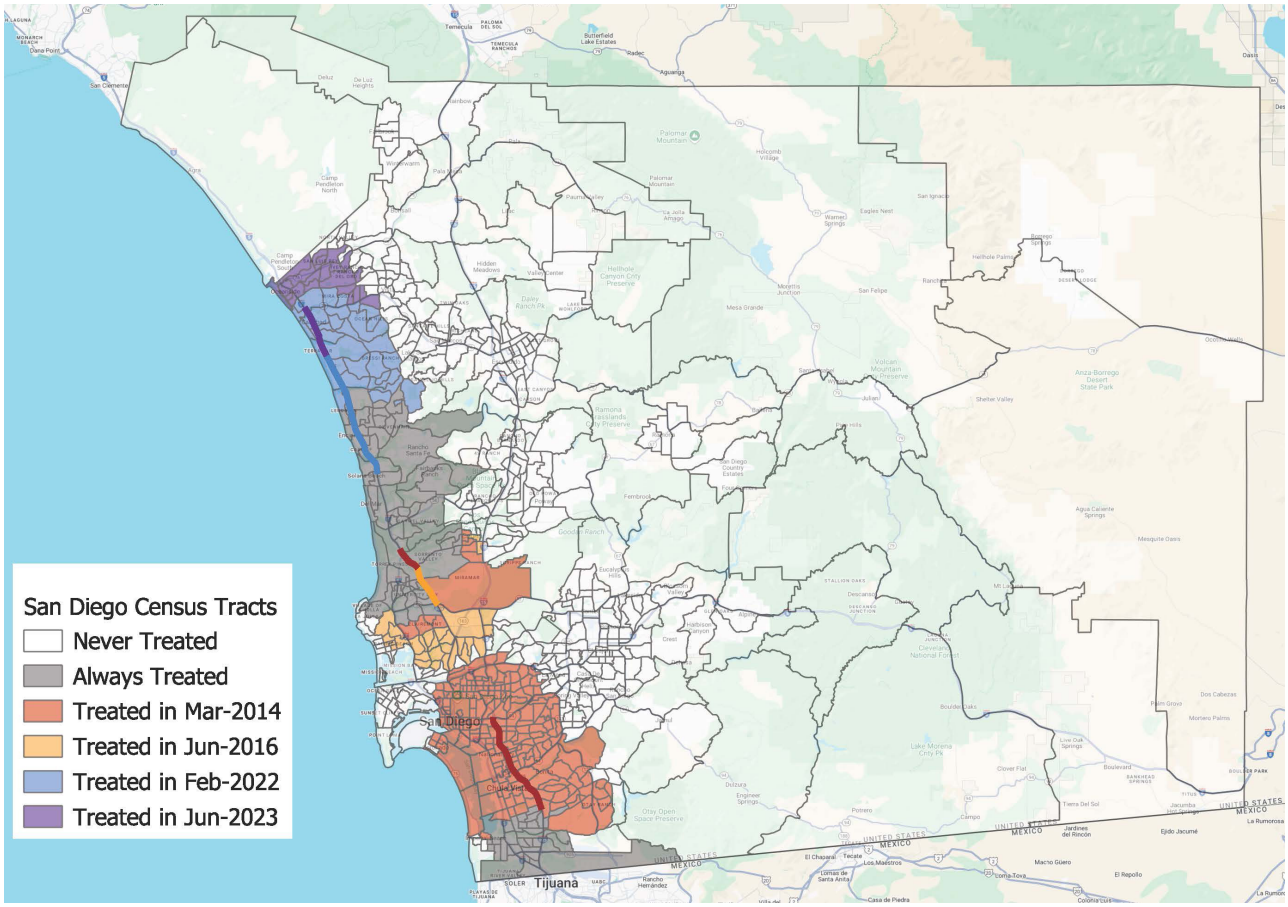

Figure 1. Illustration of HOV Treatment of Census Tracts in San Diego County.

Notes: This figure illustrates how we define the treatment of census tracts based on the addition of new HOV lane segments within 5 miles of the population centroid of a tract. The map shows all census tracts in San Diego County, color-coded according to their treatment status. Census tracts that are not colored were never treated because no operational HOV lanes were within 5 miles of their population centroid at any time between 2012 and 2024. Grey tracts are always treated, as operational HOV lanes were already within 5 miles of their centroids before the start of the observation period in 2012. Red tracts gained access to an HOV lane within 5 miles of their population centroid when new HOV segments were added to the HOV lane network in March 2014. Similarly, yellow tracts were treated following HOV lane additions in June 2016, blue tracts in February 2022, and purple tracts in June 2023. The map also includes the HOV lanes added to the road network during the sample period, color-coded to match the treatment of tracts. For example, red lane segments represent those that became operational in March 2014.

percent relative to the average EV share at the time. Our results are robust to how we define HOV lane availability and proximity, specifically whether we use population rather than geographic centroids of census tracts and the choice of the distance threshold. We also find that the effects of HOV policies are not uniform across the state. The effect is strongest in tracts with higher shares of peak-time commuters and in those areas where commutes are more time-intensive, confirming that the value of HOV access stems from the time savings it provides.

Consumers may also be influenced not only by whether they have access to at least one HOV lane within their vicinity, but by the extent of HOV lane availability in their area. To capture this, our study looks beyond simple access and examines whether EV adoption increases as the number of nearby HOV segments increases. The results show that communities with more HOV lanes close by see higher EV adoption, suggesting that greater HOV lane availability also plays an important role in driving EV adoption.

A natural question, extending beyond prior research that focused on the early U.S. EV market, is whether and how the impact of HOV lane exemptions has changed over time as the market matured. Unlike in the early stages of the market, our study spans recent years with a more mature EV market, in which hundreds of EV models, including larger vehicle classes, are commercially available, battery technology has advanced considerably, charging networks have expanded substantially, and EVs are better understood by consumers. Our findings indicate that the policy had a larger impact in the later years of the study period, suggesting that as battery

ranges improved, more EV models became available, and consumer awareness of EVs grew, drivers became increasingly responsive to non-financial incentives such as HOV access.

However, the distribution of benefits from HOV exemptions is uneven and reveals an important equity concern. We find that the estimated impact of HOV lane access is concentrated entirely in higher-income tracts, suggesting that the policy disproportionately encouraged EV adoption among wealthier households. This distributional pattern highlights that while HOV exemptions can be effective, they may also reinforce existing disparities in access to clean technology.

References

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Jenn, Alan, Katalin Springel, and Anand R Gopal, "Effectiveness of electric vehicle incentives in the United States," Energy policy, 2018, 119, 349–356.

Link to the full working paper discussed in this brief:

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About the Authors

Eric Avis is an Assistant Professor in the Department of Applied Economics at HEC Montréal. He is an applied microeconomist whose research interests span political economy, public economics and environmental economics. His work examines how institutions shape economic policymaking and how policy design influences outcomes in areas such as corruption, governance, and the adoption of green technologies. His research employs both reduced-form and structural methods to study the mechanisms driving economic behavior and to quantify the welfare impacts of policy interventions. He holds a B.A. in Economics and Mathematics from McGill University, an M.A. in Economics from the University of British Columbia, and a Ph.D. in Economics from UC Berkeley.

Jing Li is an Assistant Professor in the Tufts University Department of Economics. Jing's research interests are at the intersection of energy/ environmental economics and industrial organization, focusing on development and adoption of new technologies. Her most recent work examines automakers' compliance strategies for diesel vehicles in Europe, compatibility and investment in electric vehicle recharging networks in the United States, and cost pass-through in the E85 retail market. Jing received double B.Sc. degrees in Mathematics and Economics from MIT in 2011 and her Ph.D. in Economics from Harvard in 2017. From 2017-2018, Jing was a Postdoctoral Associate of the MIT Energy Initiative. Before joining Tufts, Jing was an Assistant Professor in Applied Economics at the MIT Sloan School of Management.

Katalin Springel is an Assistant Professor at the Department of Applied Economics of HEC Montréal. Katalin's main research areas are in Industrial Organization, Energy and Environmental Economics and Public Economics. Her research focuses on the effects of environmental policies and economic incentives for new technologies in the transportation sector. This research aims to have practical implications for business and public policy through understanding the impacts of environmental policies and efficient policy design. In her current work, Katalin studies how US federal government subsidies can be efficiently allocated and how the EV charging industry can become profitable earlier and outgrow reliance on subsidies from government and automobile manufacturers. Katalin holds a Ph.D. in Economics from UC Berkeley. Before joining HEC Montréal, she spent a year as a Postdoctoral Fellow at Resources for the Future then joined as an Assistant Professor in the Strategy, Economics, Ethics and Public Policy area in the McDonough School of Business at Georgetown University.