

How Does the Public Charging Network Fuel Plug-in Electric Vehicle Uptake?

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Policy action targeting plug-in vehicle sales and use

- Bipartisan Infrastructure Bill (2021)
 - ▶ \$7.5 billion investment in charging stations
 - ▶ Expect a network of a half million charging stations by 2030
- Inflation Reduction Act (2022)
 - ▶ Light-duty plug-in electric (PEV) tax credit/subsidy
 - ▶ EV charging equipment tax credit

New investments prioritize:

- Public charging in low-income, rural, and multi-family housing regions
- Fast-charging network along the highway/interstate corridor

!! First round of funding under the CFI program released recently

Questions we ask

- 1 How does public charging affect EV sales? Distinguish the effects of level-2 and level-3 (DC) fast-chargers.
- 2 How strongly do low-income and rural vehicle buyers respond to public charging stations?

To answer these questions

- We use household level survey data from 2010 to 2020
- Estimate an econometric model to predict consumer choices

Policy evaluation

- Predict the future demand based on the current rounds of investment
- Cost-effectiveness of the scheme and other ways of subsidizing consumers

Data description

- Survey data of new car buyers from 2010-2020, including:
 - ▶ Details of the new vehicle purchased, transaction price, and vehicle attributes
 - ▶ Household demographics and residential zipcode
 - ▶ Info on other vehicle holdings and other vehicle(s) considered
- Annual new registrations by state and vehicle
- Public charging stations with location, service date, and characteristics

Data Coverage

- Total obs=2.26 million
 - ▶ Sample represents about 1.7% of the new car buyers from 2010-2020
 - ▶ Weight observations to account for non-random response
- Overall, the data capture 74% of the total sales from 2010-2020
 - ▶ 73% of the total PEV regs
 - ▶ Some states/automakers aren't included
 - For example, Tesla buyers from AZ, PA, and some other states

Infrastructure and PEV sales growth

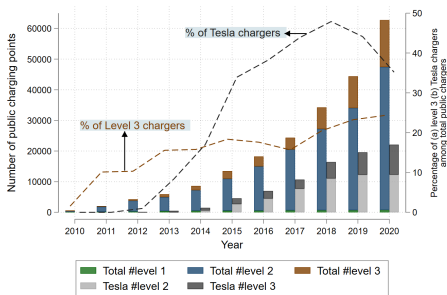


Figure: Public charging points

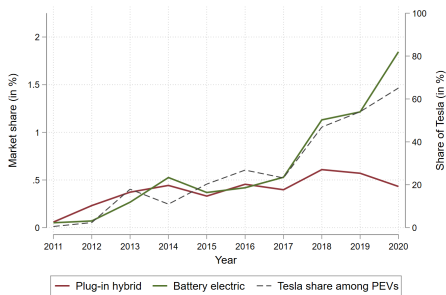


Figure: PEV market share

Public charging density in 2020

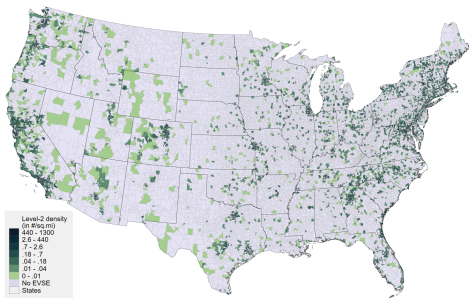


Figure: Level-2 charging

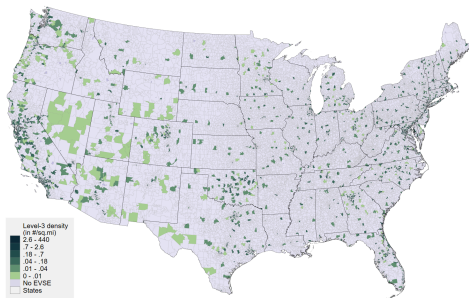


Figure: Level-3 charging

Plug-in electric vehicles per household by zipcode in 2020

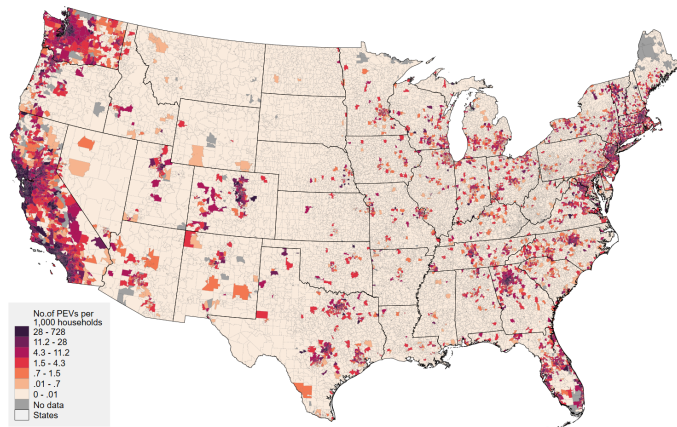


Figure: Uptake of EVs

PEV market share in 2020

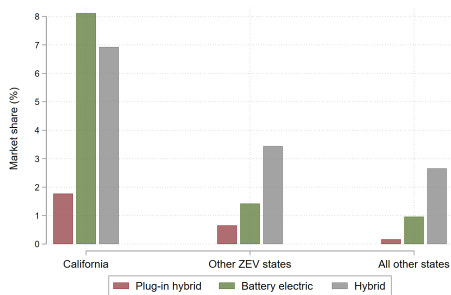


Figure: by regions

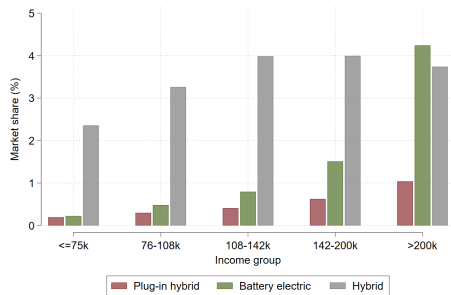
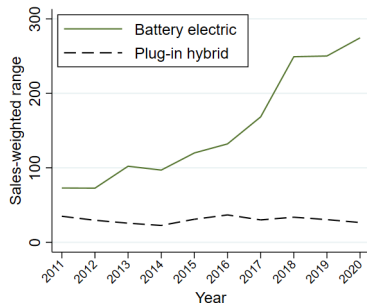
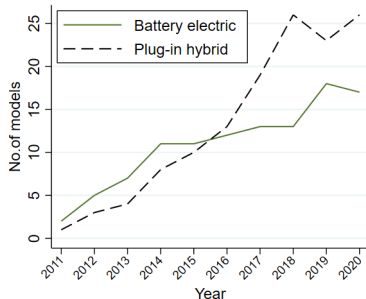
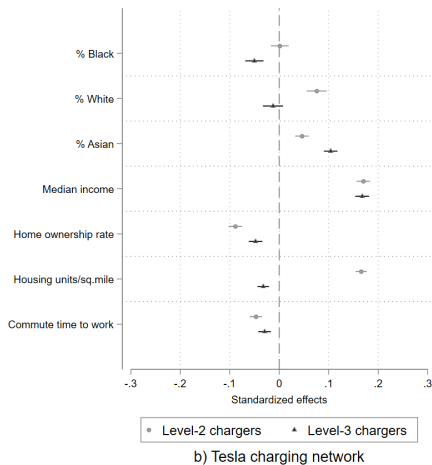
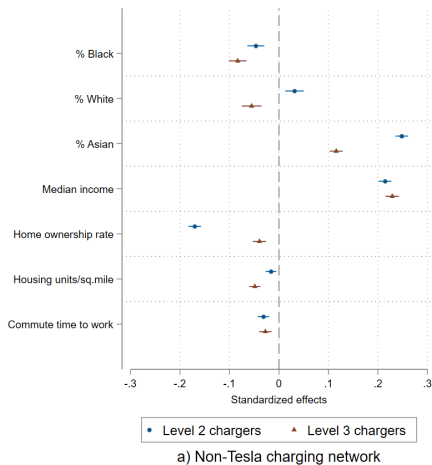


Figure: by income groups

Trends in the PEV market



Charging stations and demographics



Endogeneity of Charging Stations

Chicken and egg problem

- Charging station availability affects EV adoption
- Higher EV adoption leads to increased demand for charging infrastructure
- More charging stations encourage further EV purchases

⇒ Feedback loops in the EV market

⇒ Makes it challenging to accurately model the relationship

Approach

We build an econometric model

→ distinguishing between the demand for Tesla and non-Tesla plug-ins

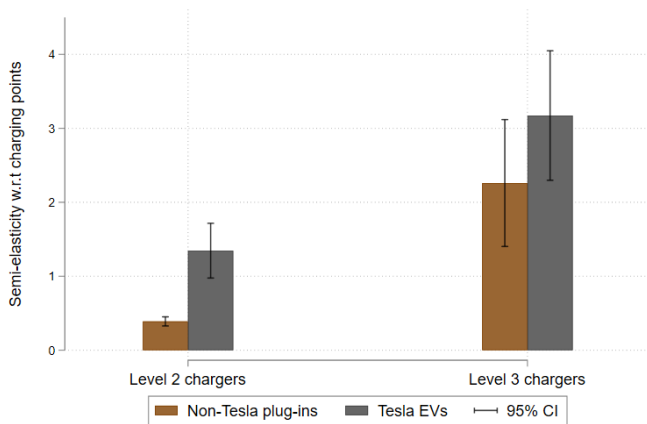
→ assuming investments in charging stations depend on historic sales and expected future sales

We predict the probability of buying a plug-in EV as a function of

- availability of level-2 and level-3 charging points
- household income and other demographics
- residential location characteristics
- travel patterns, regional gas price
- other national shocks and trends

Results

Effect of chargers on Tesla and non-Tesla plug-ins

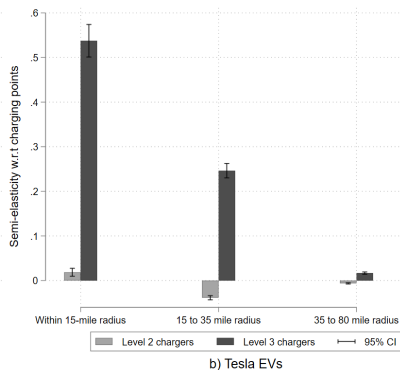
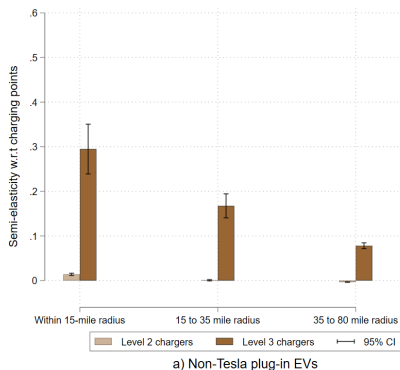


◀ Tesla vs non-Tesla buyers

Results (contd)

Effect of chargers on Tesla and non-Tesla plug-ins

If we include counts of charging points within 15 miles, 15-35 miles, and 35-80 miles from the centroid of the residential zip code



Heterogeneous effects of charging availability

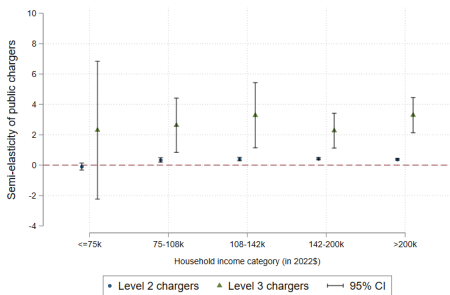


Figure: by household income

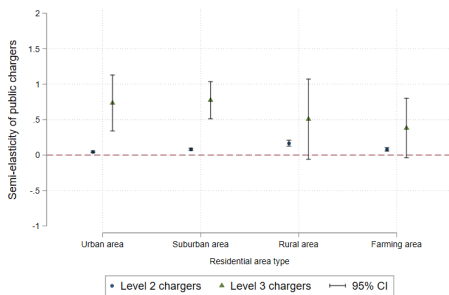


Figure: by residential area type

Heterogeneous effects of charging availability (contd)

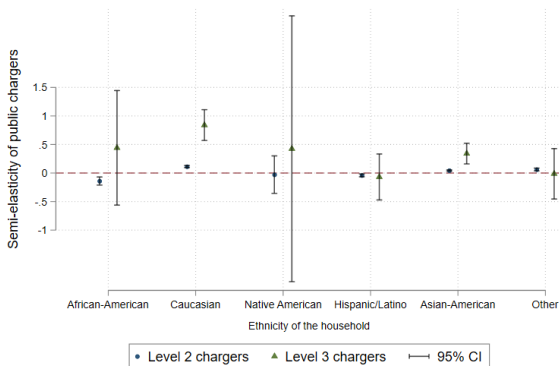


Figure: by household race

To sum up

Main findings:

- Level 3 chargers have a stronger effect on the PEV demand
- The effect of public chargers diminishes with the distance
- Stronger impact on higher-income, urban and suburban demographics
→ demand disparity in PEV adoption
- Demand for Tesla vehicles is more responsive to its chargers

Future work

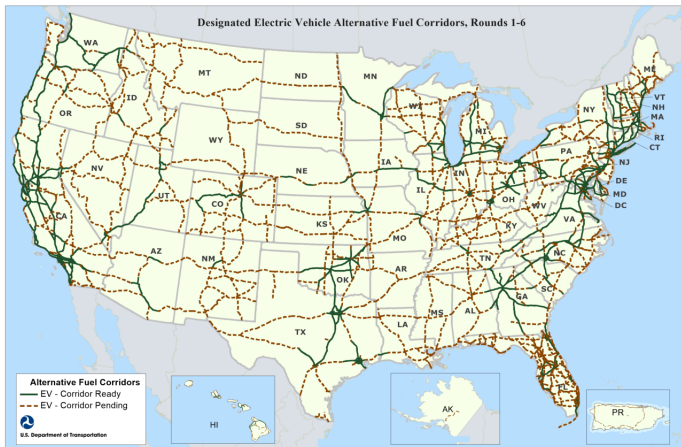
- Tesla opened access to its Supercharger network to other EVs
→ Implications on the demand for non-Tesla plug-ins
- Estimate charging side of the market
- Predict the effect of CFI & NEVI program
→ across regions by share of households in multifamily housing
- Additional suggestions?
→ other forms of heterogeneity
→ other policy scenarios to consider

Thank you [◀ Return](#)

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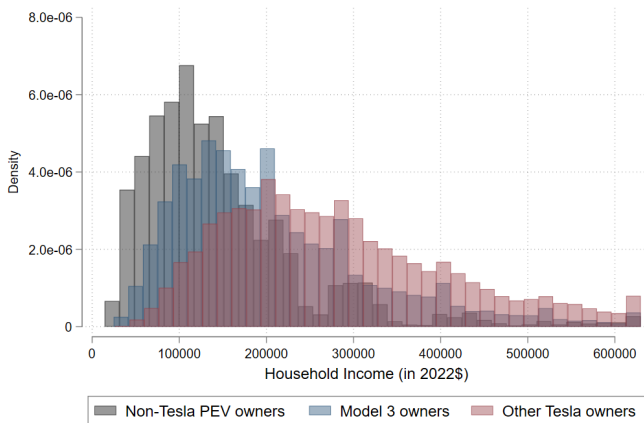
1 Appendix

Designated US EV charging corridor



Source: U.S. DoT Federal Highway Administration

Income distribution of households with Tesla and non-Tesla PEVs



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