Building Charging Stations to Foster Electric Vehicle Demand

Ajmain Hossain, Cabir Kansupada, Neel Shroff

Range anxiety hinders electric vehicle (EV) sales.

- EVs only make up **<1%** of the global vehicle fleet despite their environmental benefits — largely due to **range anxiety.** *
- **Public charging stations** mitigate range anxiety.

8.5 M
Global EV Fleet

1.2 B
Global Vehicle Fleet

Central Question:

Does local public charging availability increase demand for EVs, and if so, where can new charging infrastructure be built to intentionally foster demand?

* International Energy Agency, 2020

Two-Part Analysis

	Question	Data & Source	Data Science Method
Part 1	Does local public charging availability increase demand for EVs?	• New-build charging station time-series (*Federal Gov.*) • Washington EV Registration Activity (*State Gov.*)	T-test, Diff-in-Diff Test
Part 2	If so, where can new charging infrastructure be built to intentionally foster demand?	• Income Data (*IRS*) • Educational Attainment (*Census*) • Population Data (*State Gov.*)	Regression Prediction

New charging stations increase EV demand.

OLS Regression Results

Dep. Variable:	count	**R-squared:**	0.404
Model:	OLS	**Adj. R-squared:**	0.404
Method:	Least Squares	**F-statistic:**	2521.
Date:	Thu, 03 Dec 2020	**Prob (F-statistic):**	0.00
Time:	10:43:08	**Log-Likelihood:**	-66238.
No. Observations:	22343	**AIC:**	1.325e+05
Df Residuals:	22336	**BIC:**	1.325e+05
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-1579.5018	27.484	-57.470	0.000	-1633.372	-1525.632
i_treatment	-0.5990	0.100	-6.015	0.000	-0.794	-0.404
year_indicator	0.7808	0.014	57.327	0.000	0.754	0.808
i_treatment_post_first_station	0.4686	0.085	5.496	0.000	0.302	0.636
avg_agi	0.0021	0.000	4.422	0.000	0.001	0.003
perc_bach_plus	0.1497	0.002	64.695	0.000	0.145	0.154
POP	0.0001	2.33e-06	60.287	0.000	0.000	0.000

Key Takeaway

Building a zip code's first charging station has a statistically significant, positive effect on EV demand.

Charging stations could be more effective in some zip codes than others.

- Using **linear regression**, we can predict how many EVs *should* be in each zip code based on its demographic data (income, education, population).
- The **difference** between the predicted and actual EV population shows where charging stations are most needed.

Total: $29.2 M

Top 5 eligible zip codes in Washington State:

state	zip	POP2020	avg_agi	perc_bach_plus	sum_vehicles	sum_charging_stations	diff	profit_potential
WA	99301	85,131.44	61.43	18.97	247.00	4.00	601.05	6,750,761.08
WA	98101	17,849.82	217.40	60.93	380.00	42.00	566.76	6,365,586.40
WA	98112	24,054.27	331.93	80.35	1,063.00	1.00	543.90	6,108,800.61
WA	99163	36,614.67	61.88	63.82	91.00	5.00	458.41	5,148,671.49
WA	98119	26,505.15	190.29	74.01	586.00	2.00	431.58	4,847,313.94

Stations likely generate enough demand to justify their cost.

Average Station Cost *: $123,000

Average profit per EV **: $54,500 ASP * 20.6% EBITDA margin = $11,200

Required Demand Generation per Station = Station Cost / Profit per EV
= **~11 EVs/Station**

Is this believable?

Recall: Regression coefficient in Diff-in-Diff = 0.47
So, 11/0.47 = roughly 23 months to generate enough demand

* International Council on Clear Transportation, 2019
** Tesla Q3 2020 Shareholder Letter