Washington State Electric Vehicles

January 2024

Objectives

We are performing an exploratory data analysis (EDA) of electric vehicles (EVs), specifically of what factors (e.g. income) are associated with electric vehicle purchase, how existing infrastructure in an area (e.g. charging stations) provides insight into EV ownership in that area. Other variables we have followed include EV Make and Model, EV Type (BEV vs. PHEV), EV Price and Year, and overall geographic location that may correlate to an increase in EVs.

Questions Addressed

Income

How does income affect the likelihood of a consumer to own an EV, and does it affect the brand they will tend to purchase?

Make and Type

What is the ratio of BEV vs PHEV ownership? Does median income make an impact on which of these EV's or which make of EV one is likely to buy?

Charging Stations

Is there a strong correlation between the number of EV charging stations in an area and EV ownership? Is there a correlation between charging stations and the median per capita income of an area?

Methodology and Sources

Population:

Washington State Electric Vehicle (BEV or PHEV owners)

Analysis Performed:

Comparative analysis

Per capita medians

Linear regression

Data Plotting

Sources:

https://www.kaggle.com/datasets/utkarshx27/electric-vehicle-population-data?resource=download

https://data.census.gov/

Population

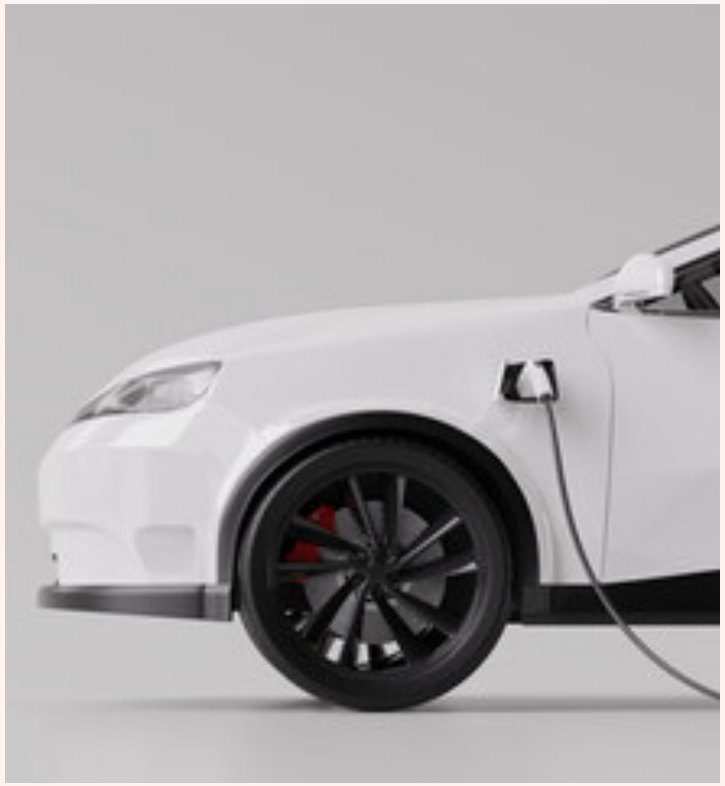
Location

N = 112,633

- Exploratory data analysis of an electric vehicle population in a certain geographic area. We have chosen, in part due to the region's particular affinity to electric technological innovation and alternative energy options, to refine our analysis to Washington state.

Data

- We have utilized datasets from two sources: a 2023 EV dataset published on Kaggle.com that shows the Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) that are currently registered through Washington State Department of Licensing (DOL); and U.S. Census Bureau data (agsc5) for 2022, the latest available. The former gives us a dataset of 8340 unique electric vehicles with which to work.



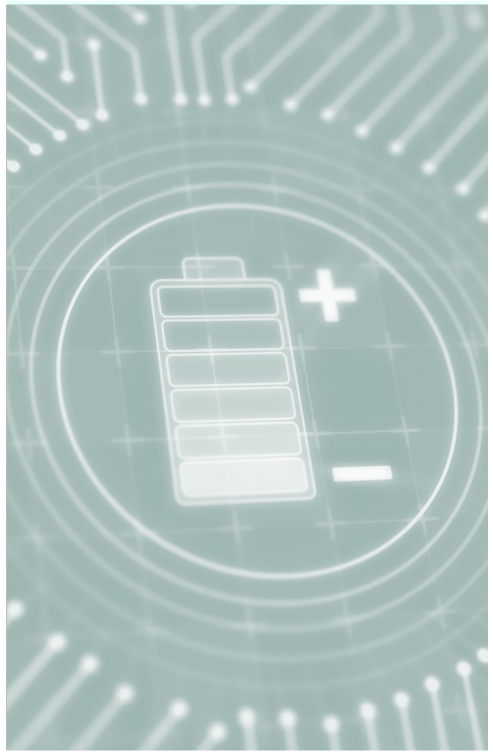
Key Insights

- There is a strong positive correlation between ownership of EV by per capita income
- EV ownership by zip code is spread out widely, with no discernable correlation found between wealthier zip codes and EV ownership
- PHEVs are purchased by a larger range of Median Incomes Per Capita, with the median income being $50,000 per year versus nearly $60,000 for BEVs
- When using the Make of EV as the independent variable, its price/brand is strongly positively correlated to the Median Income Per Capita of the buyer
- When we conducted linear regression of number of charging stations vs. income per capita there was a very weak positive correlation of r = 0.12

In-Depth Analysis

Section One

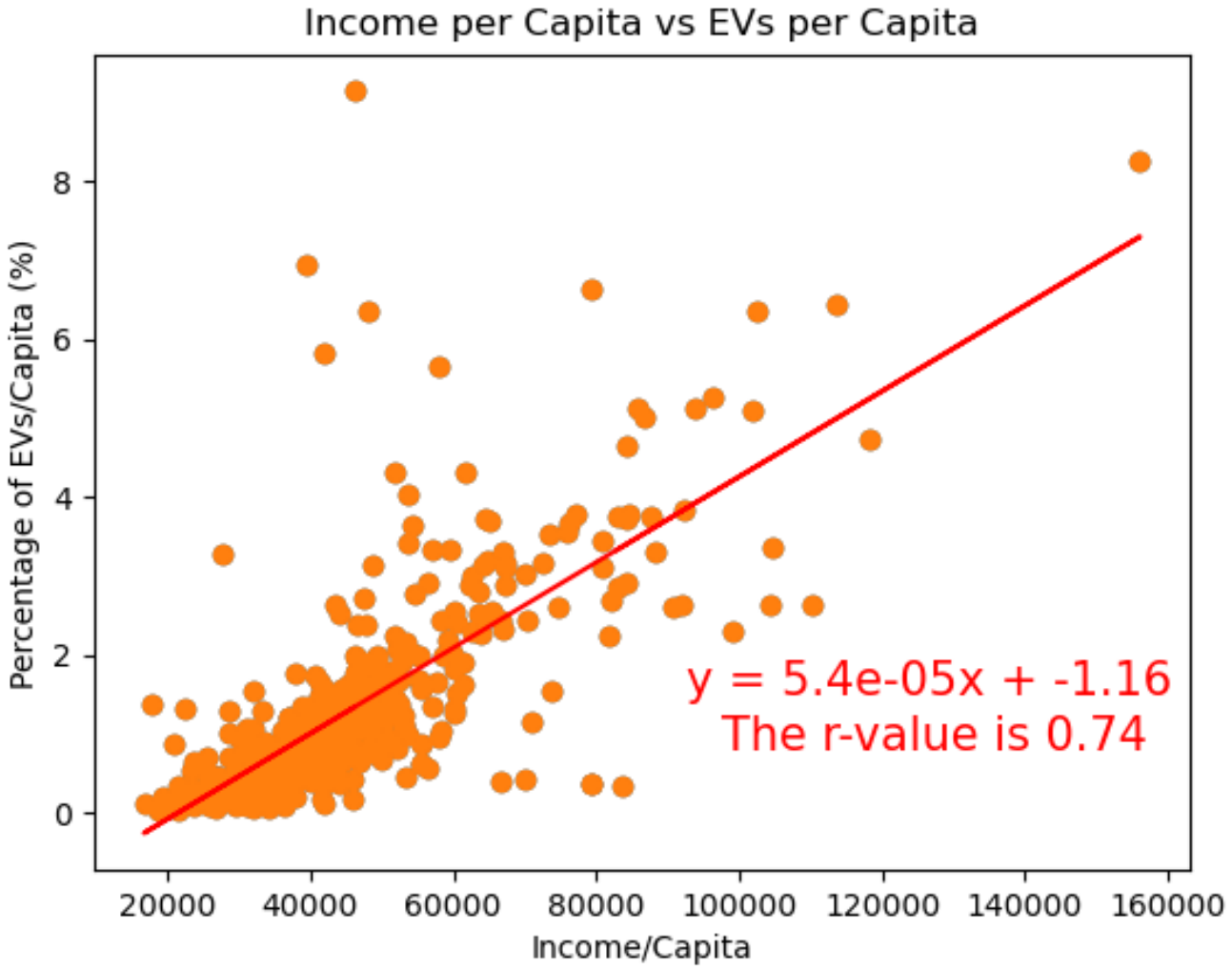
Income



Make and Type

Charging Stations

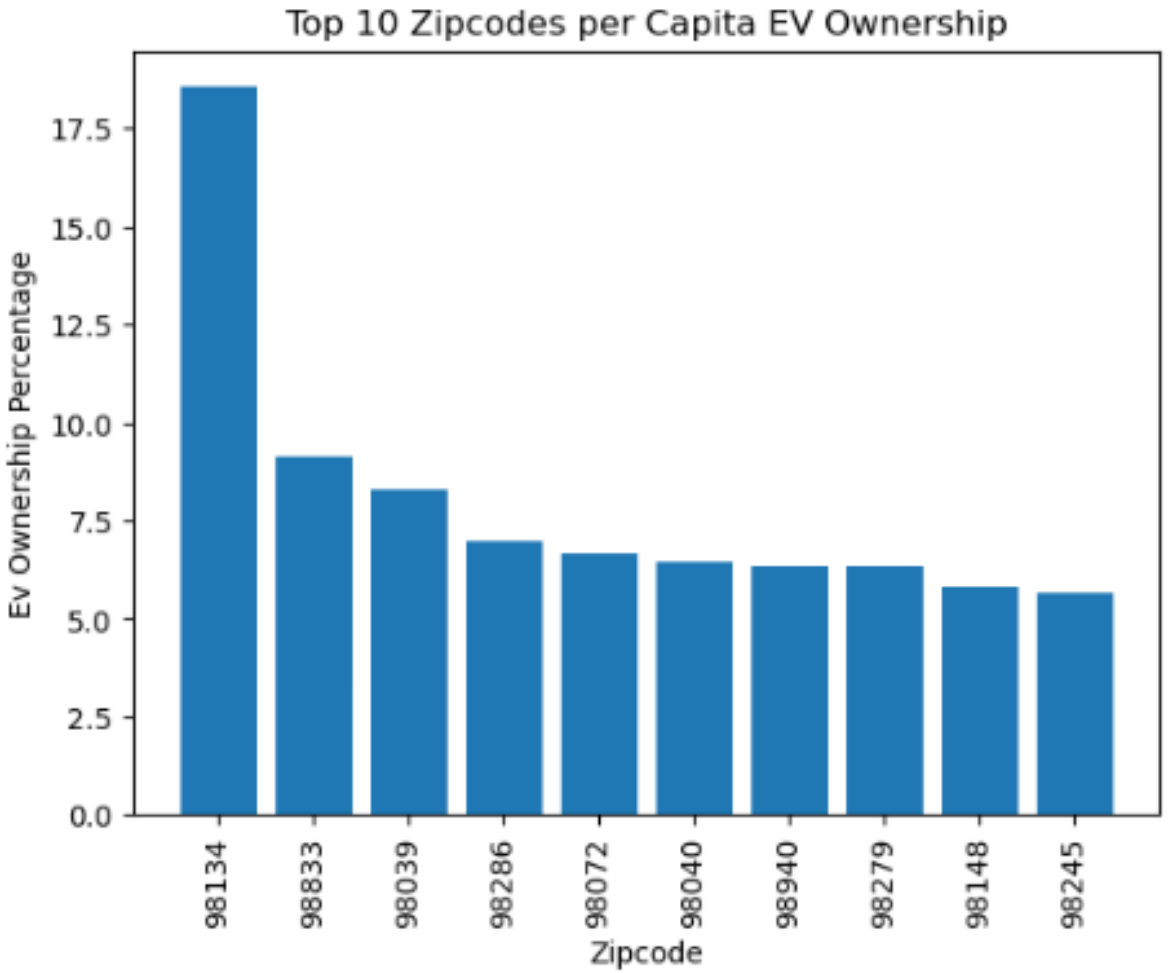
Ownership by Income



NOTE

- Overall, there is a clear positive correlation between ownership of EV by per capita income with r = 0.74

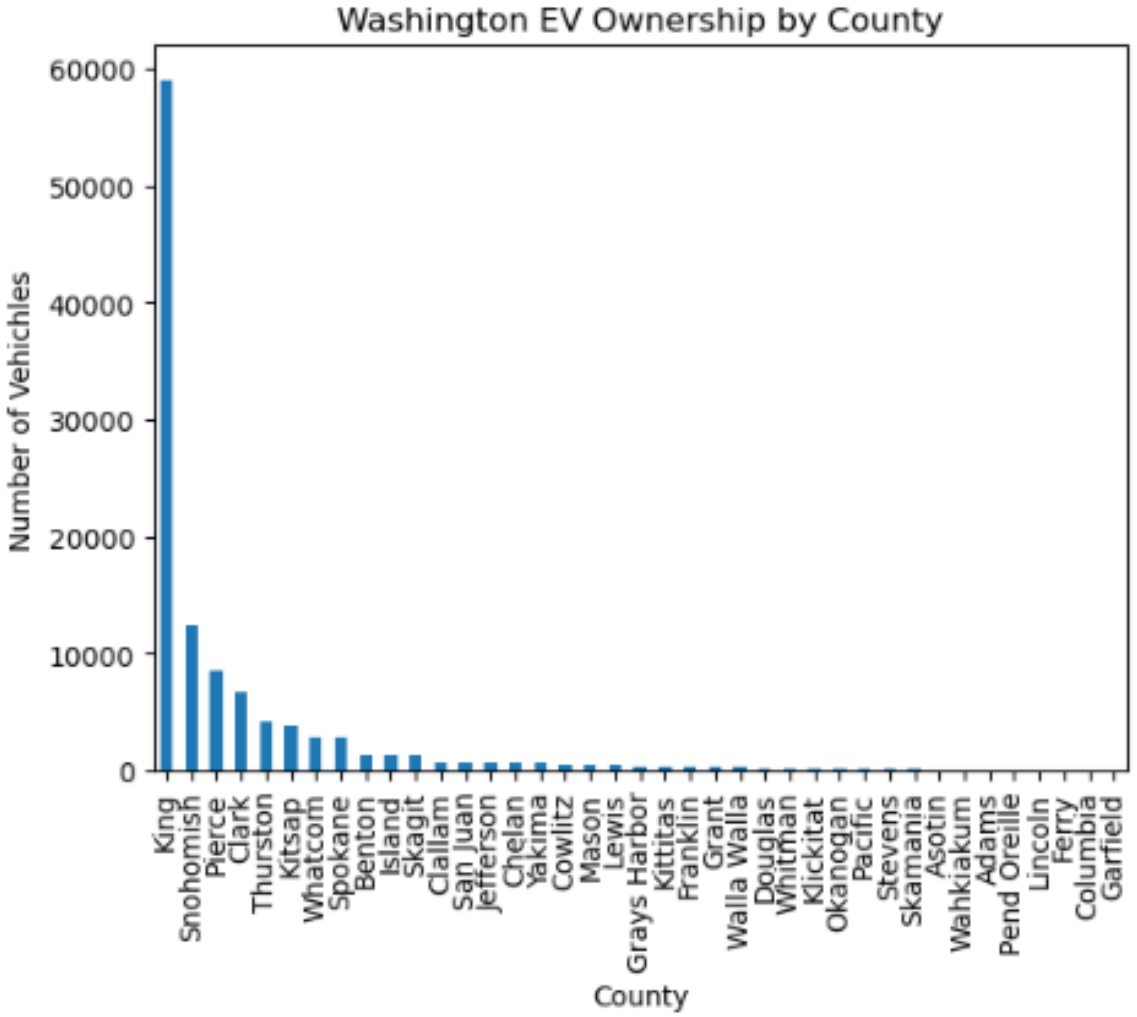
Top Zip Codes for EV Ownership



NOTE

- Zip code 98134 leads the state with 18.45% of the population owning EV's
- There is a sizeable gap (6-7%) between EV ownership by zip codes, demonstrating how spread-out ownership is

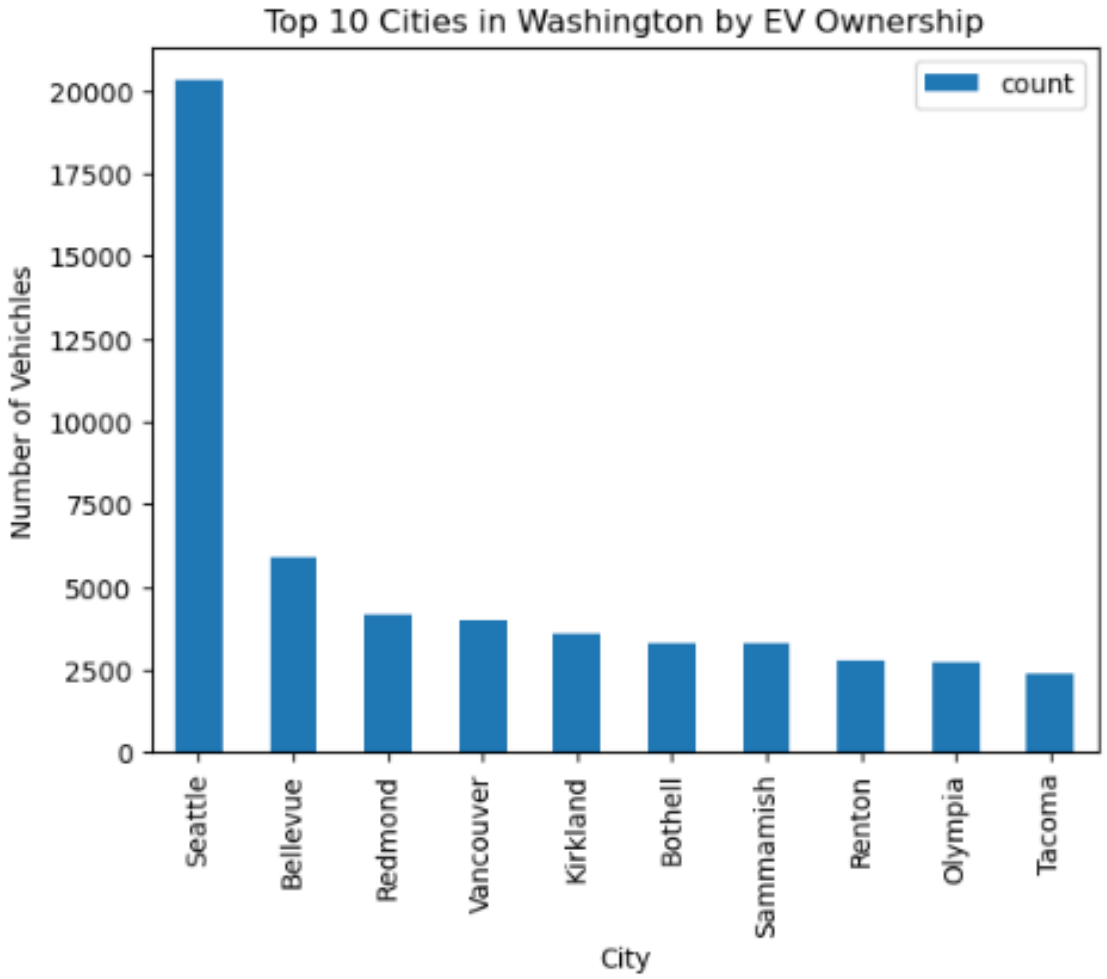
Ownership by County



NOTE

- There is a significant drop in EV ownership outside of King County (where Seattle is), although more data would be needed to truly understand this dynamic

Ownership by City



NOTE

- Redmond, WA (in King County) has the highest EV ownership by far of any city, which is also the headquarters of Microsoft (which could indicate a population that makes a higher income and is more technologically “savvy”)

Income - Notes

Method

First, we addressed that the amount of owned EVs in one zip code could be higher than another simply due to population size. To accommodate for this, our analysis utilizes income per capita & ownership of EVs per capita for each zip code. Next, we plotted this data in a scatterplot and used a linear regression to determine the strength of the correlation between these two variables.

Results

After analysis we did find that the make of an EV owned strongly positively correlates with median income per capita of buyers. We also found that the majority of EV's owned per capita and overall are spread across zip codes and counties throughout Washington state. While most ownership appears to be in King County, more analysis was necessary to get the full picture.

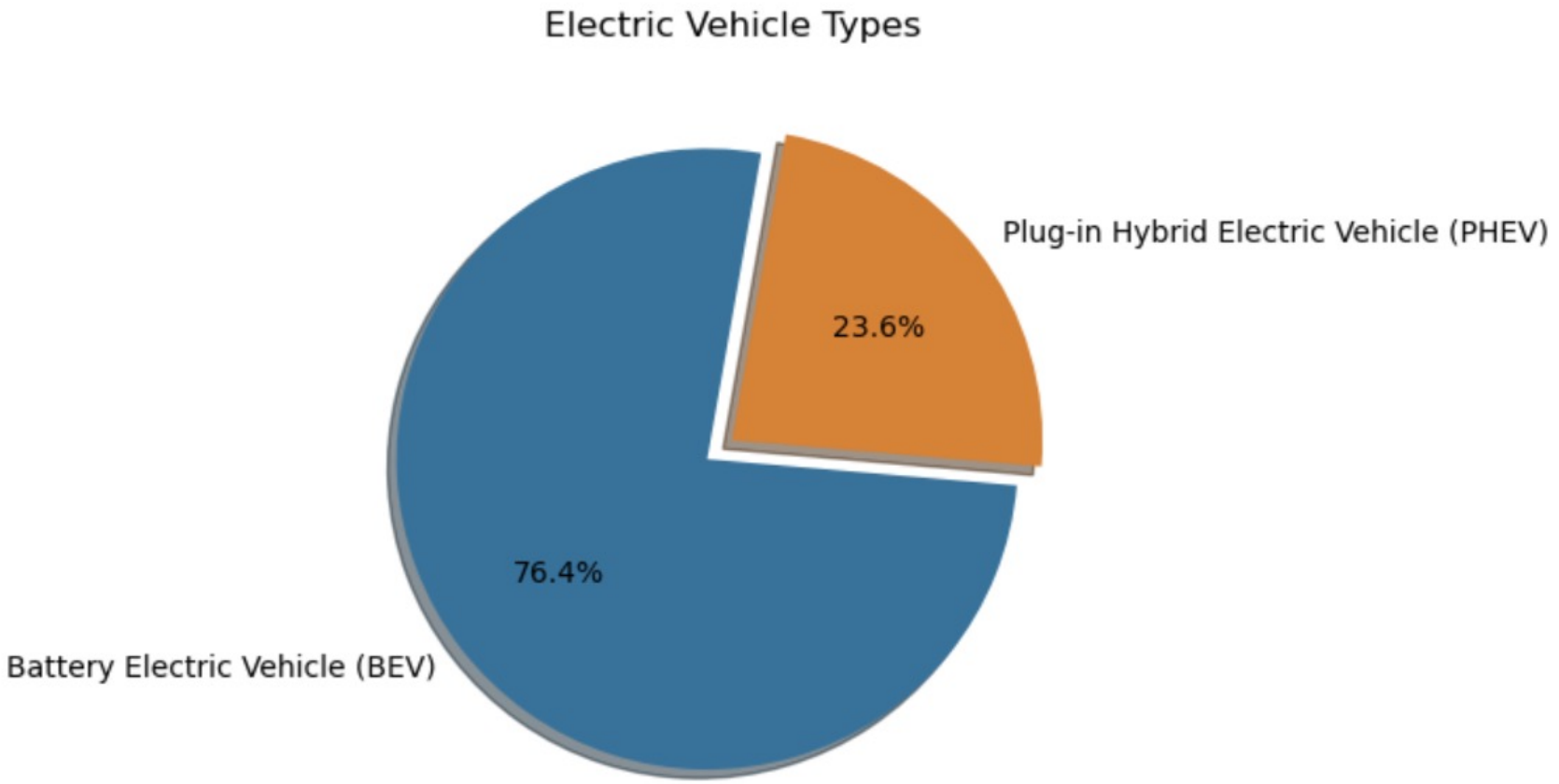
Section Two

Income

Make and Type

Charging Stations

BEV and PHEV Ownership

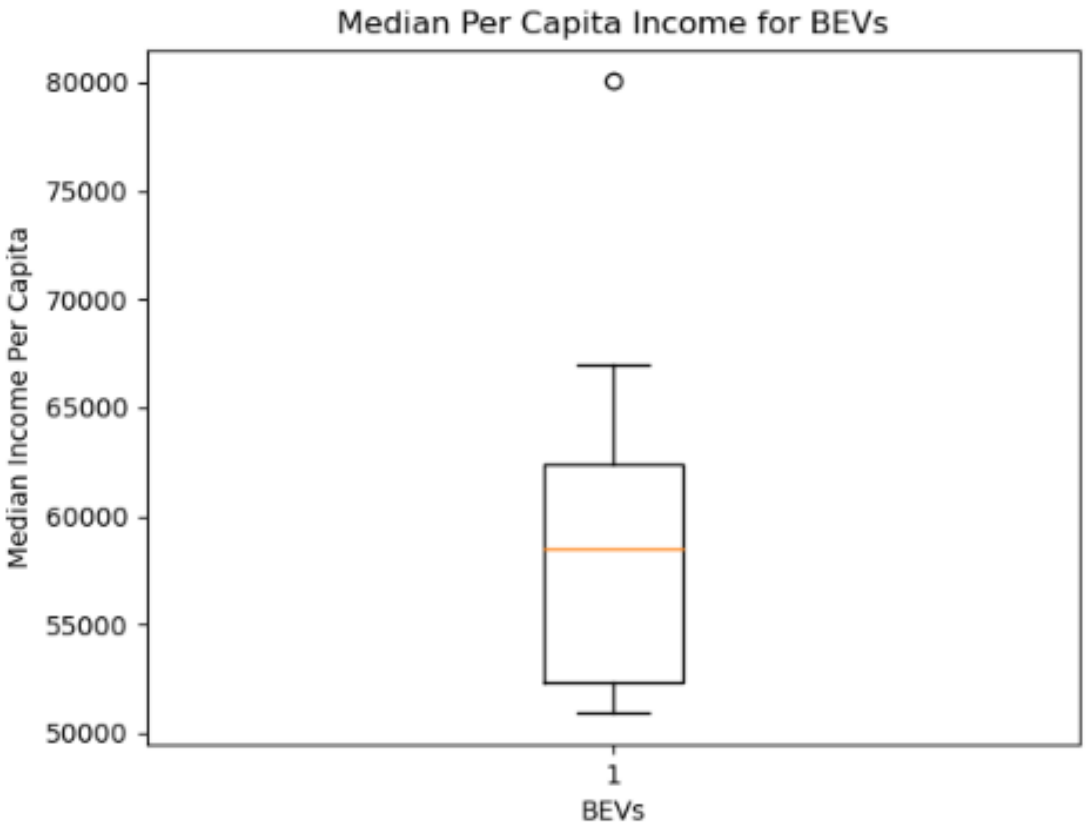


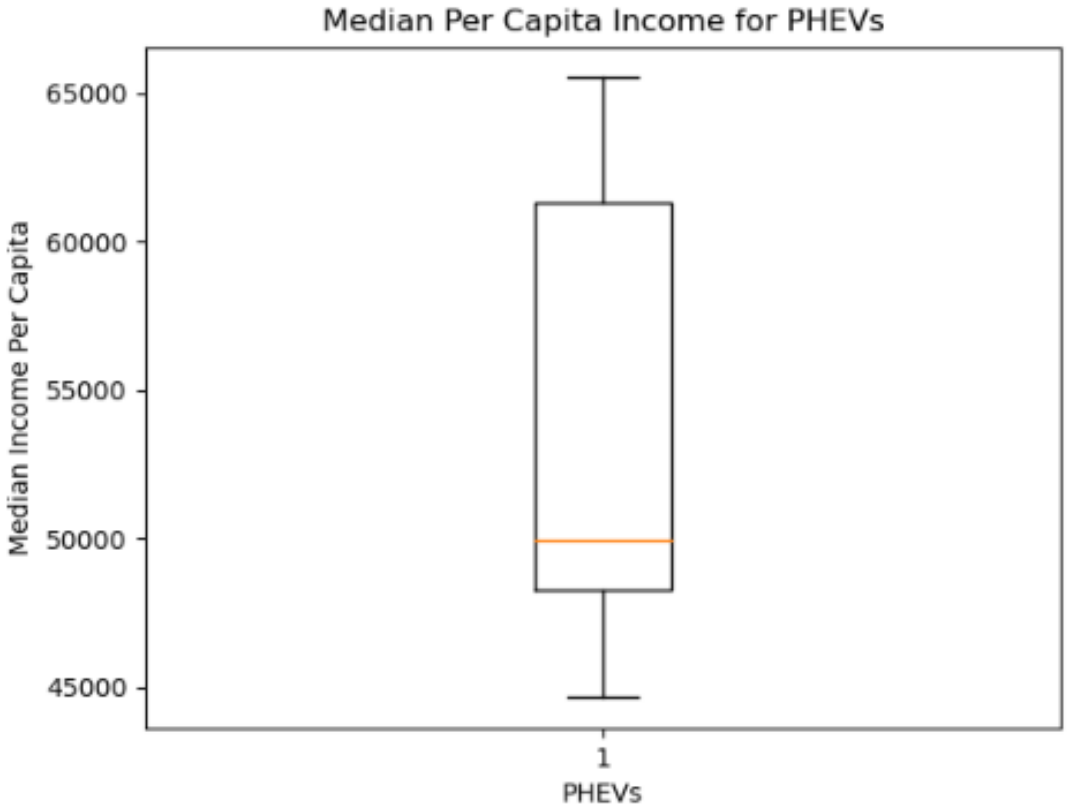
NOTE

- While in total, 76.4% of our sample owns Battery Electric Vehicles, and only 23.6% owns Plug-in Hybrid Electric Vehicles, this is not representative of the population in terms of other factors

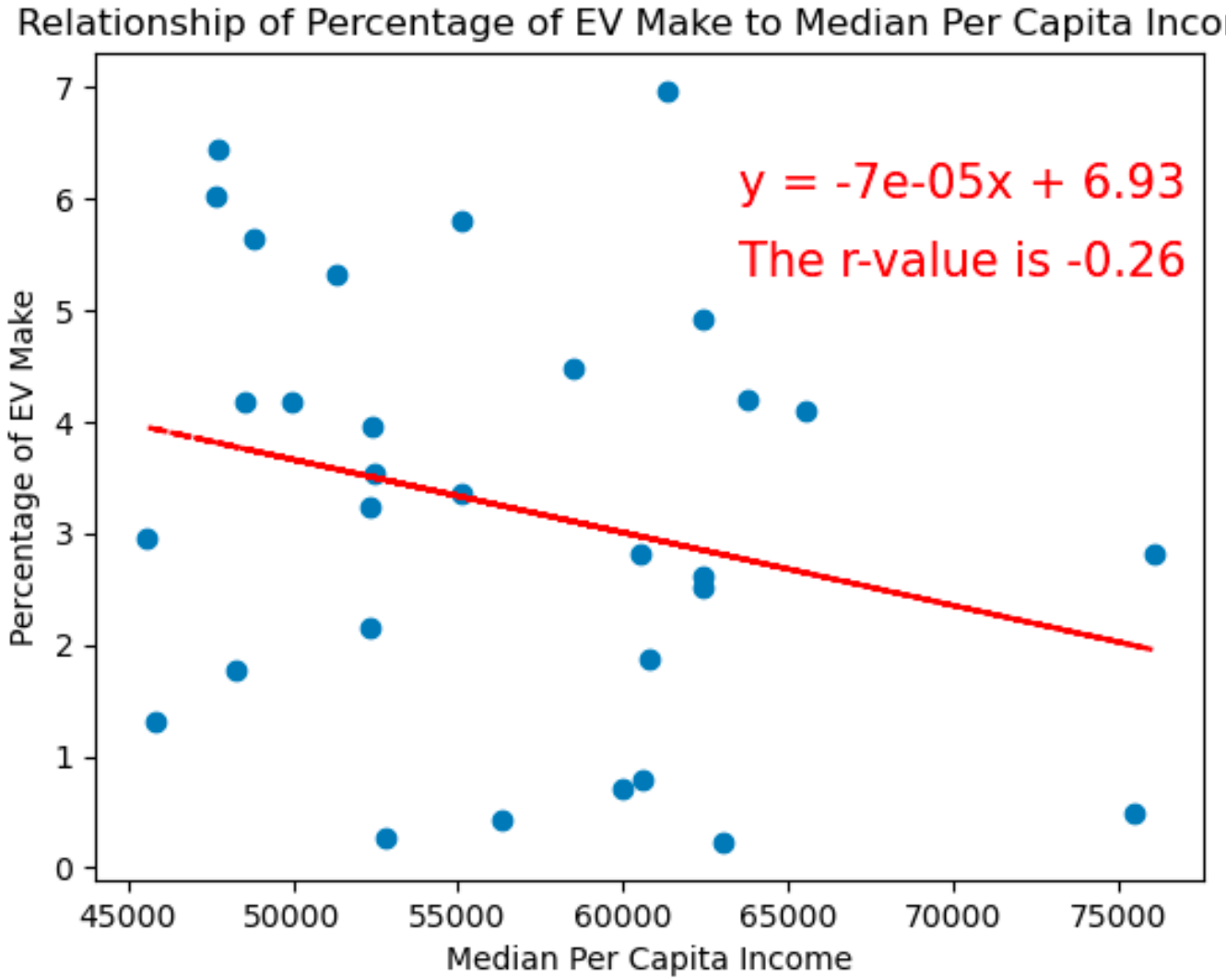
Ownership by Income

BEV vs. PHEV





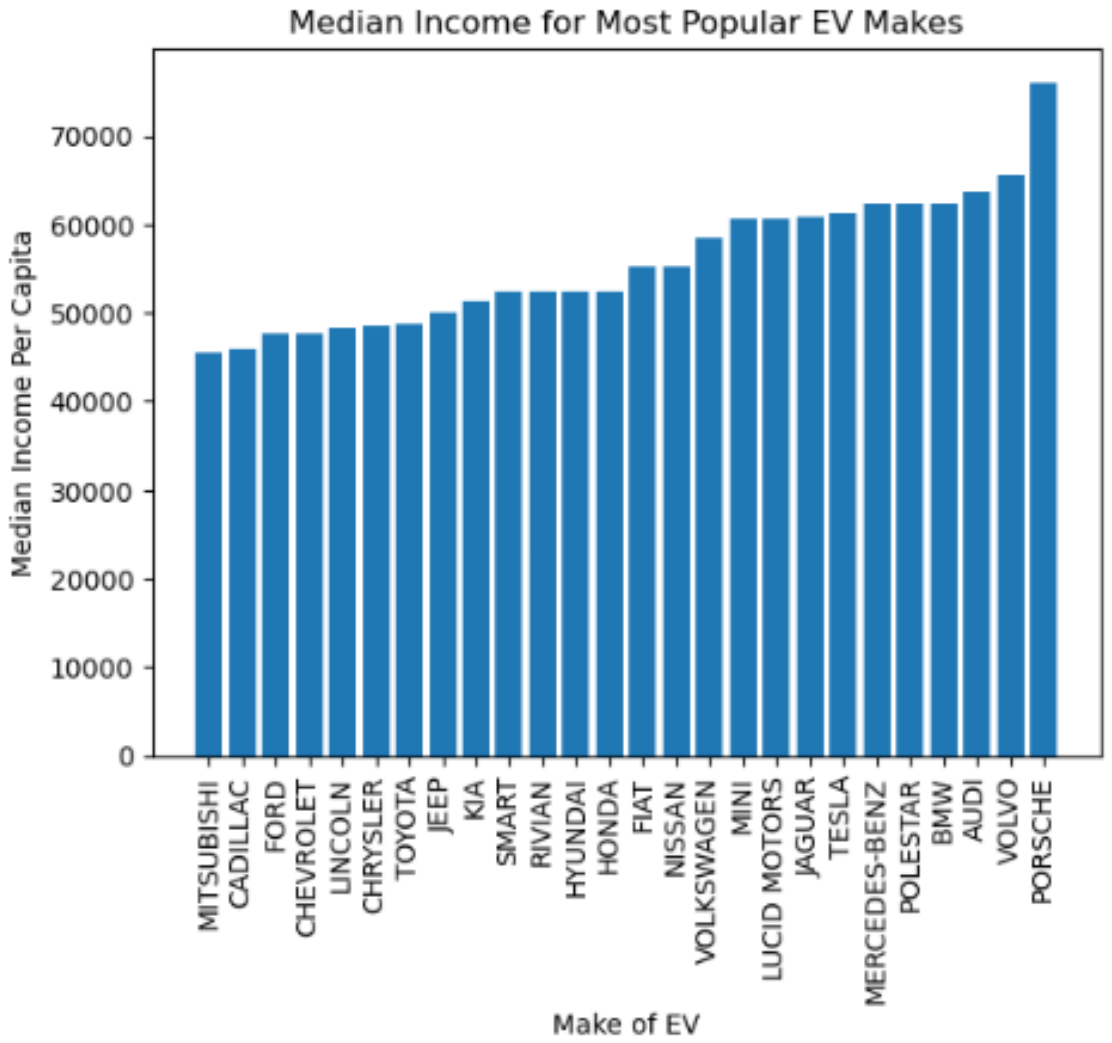
EV Make by Median Per Capita Income



NOTE

- There is a negative correlation between per capita median income and EV ownership by make with r = -0.26

Make by Median Income (cont.)



NOTE

- We can see a relationship between ownership of luxury EV brands, and high income per capita

Make and Type - Notes

Method

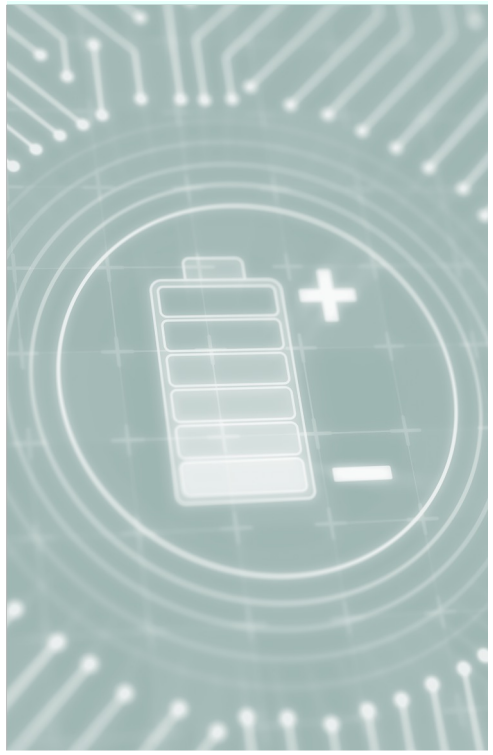
All data pulled from the Census API and the cleaned Kaggle EV dataset were grouped by the make and type (PHEV/BEV) of EV. After filtering the data to only show the makes of EV that shows up in more than 10 zip codes we manipulated the data frame into a variety of visualizations.

Results

While the large majority of the total sample appeared to own BEV vehicles as opposed to PHEV, ownership by income showed that the majority of lower income individuals owned PHEV, while higher income individuals are more likely to own BEV. We did find a negative correlation between per capita median income and EV ownership by make with r = -0.26

Section Three

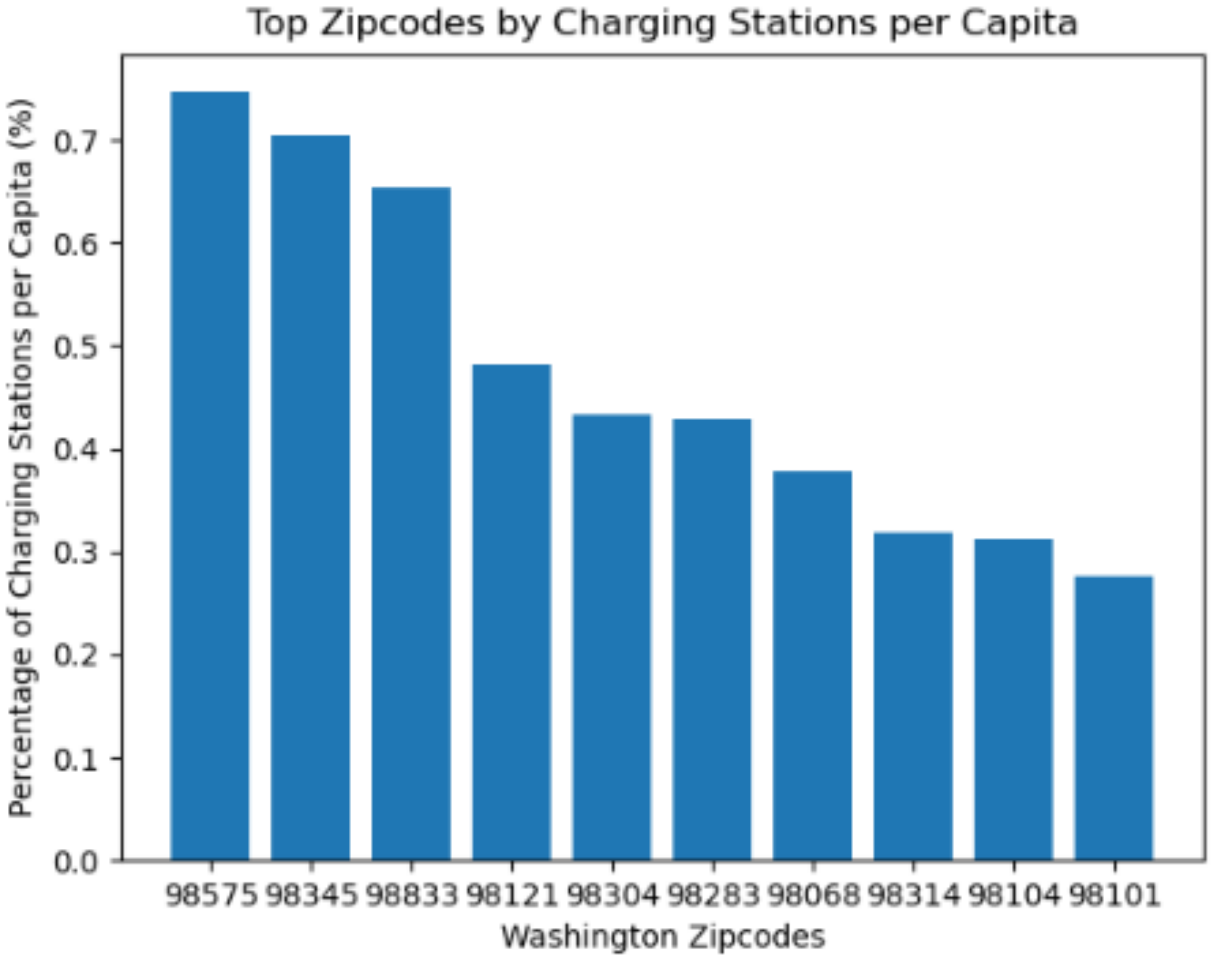
Income



Make and Type

Charging Stations

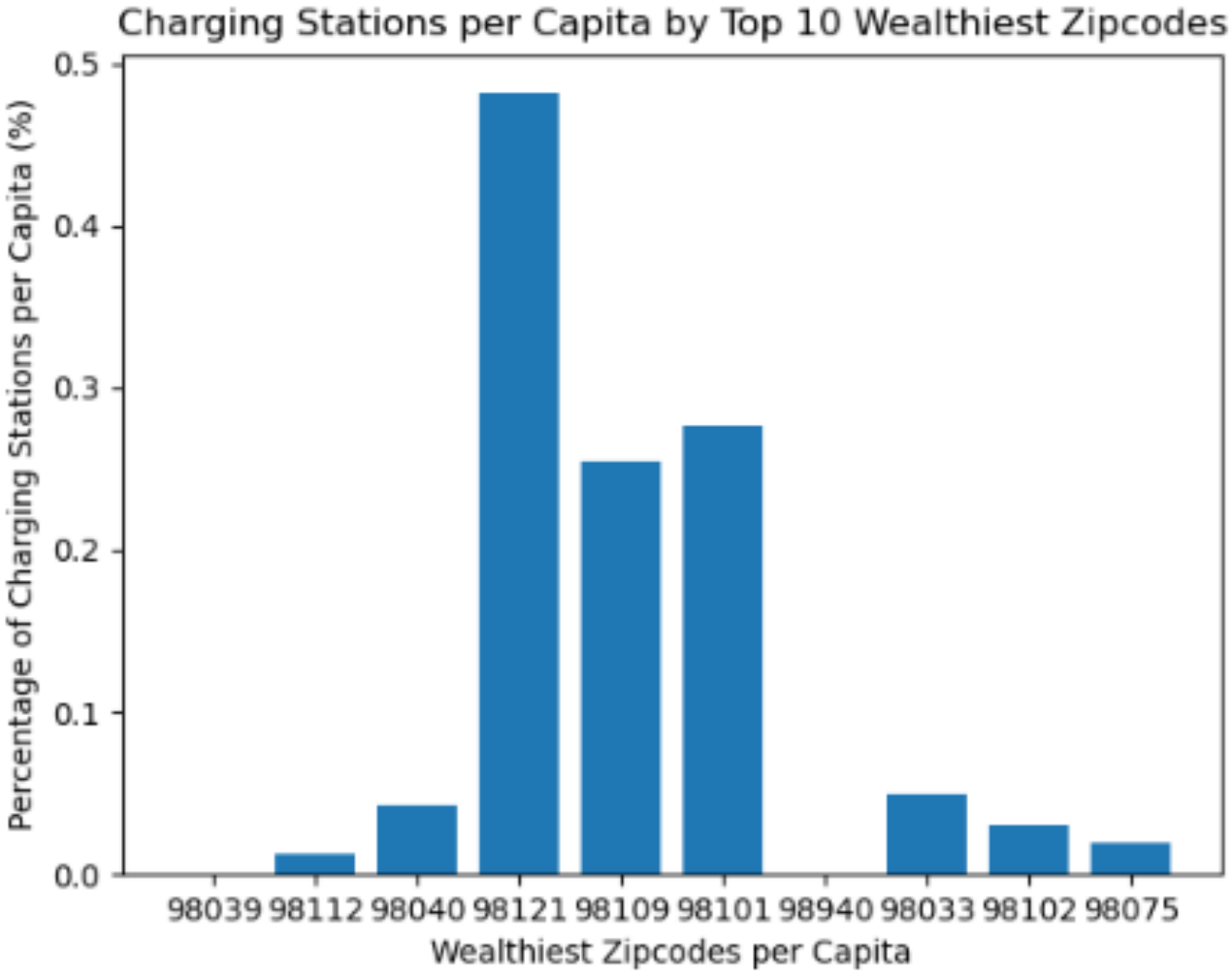
Charging Stations by Zip Code



NOTE

- There is no recognizable correlation between income and number of charging stations.

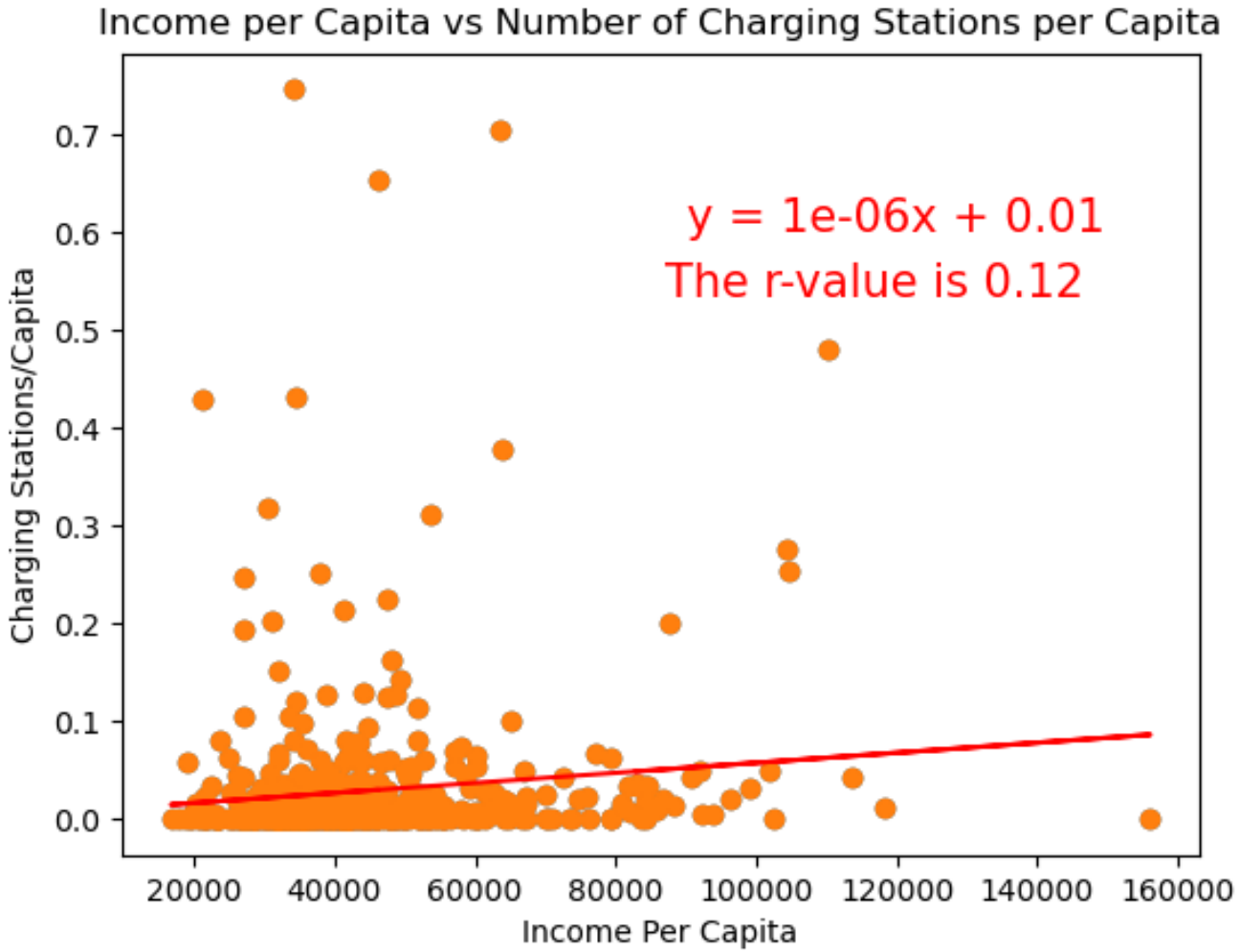
Charging Stations by Wealthy Zip Codes



NOTE

- There is no obvious correlation between wealthier zip codes and the number of EV charging stations

Income vs. Charging Stations Per Capita



NOTE

- When we conducted linear regression of number of charging stations vs. income per capita there was a very weak positive correlation of r = 0.12

Charging Station - Notes

Method

To determine if there is a correlation between these two factors, our group first obtained a dataset from Transportation.gov listing all public charging EV charging stations in the state of Washington. Next, we ranked the top 10 zip codes according to their population of charging stations and compared those to the top 10 zip codes by EV ownership.

Result

Surprisingly, of our top 10 zip codes with the most EV ownership, not many also appeared on the list of zip codes with the most charging stations. Upon graphing this data in a scatterplot and calculating a linear regression we get a R-Value of 0.12. This supports that there is not a strong correlation between the charging stations available in an area and per capita income.

Thank you

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