

Factors Affecting Electric Vehicle Adoption at the ZIP Code Level

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Abstract

It is widely recognized that a requisite aspect of addressing climate goals is to develop a more sustainable transportation sector. One initiative towards this is the federal administration's stated goal that 50% of all new vehicle sales will be electric by the year 2030. However, it is a common consensus that this will not occur without significant changes in electric vehicle (EV) adoption trends. In order to meet this goal and significantly diminish transportation greenhouse gas emissions, it is critical to better understand EV adoption at scale. To do this, we must understand at the system level what the progression of adoption will look like and what factors influence that adoption.

This problem requires a more granular analysis than has been previously performed. We analyze adoption at the ZIP code level in four US states (CA, CO, NY, WA) with historical data dating to 2011. To understand the progression of adoption, we consider two adoption models (the logistic model and the Bass model) to forecast future EV levels in ZIP codes. We find that the logistic is better for the data that is currently publicly available.

We additionally find that EV forecasts must be decomposed into both battery electric vehicle (BEV) and plug-in hybrid electric vehicle (PHEV) forecasts. There is sufficient evidence that the adoption processes for these two types of EVs differ.

Critically, we extend this analysis to consider the factors influencing adoption. Utilizing the adoption forecasts, we perform spatial regression analyses on the parameters that define the forecast shapes. We examine how multiple sociodemographic, land use, and charging measures correlate with the rate of EV adoption and the lateral shift of early EV adoption.

Crucially, we find that multiple measures of charging infrastructure availability correspond with increased adoption; of these, a variation on the distance to fast-charging stations is the most consistent metric across final models. We additionally find that land use type is indeed relevant to adoption. Finally, we are able to corroborate at a granular spatial level numerous sociodemographic variables from the literature.

Ultimately, this research can provide valuable insights into adoption trends at a local level and what factors may be best leveraged to promote adoption.