



Household Demand for Clean Vehicles in California: Individual Attitudes, Current Car Ownership, and Future Car Ownership

Konstadinos G. Goulias
Hui Shi

University of California Santa Barbara
kgoulias@UCSB.EDU

Project Objective

Understand the determinants of intentions and recommendations for clean (hybrid and electric) vehicles, vehicle miles travelled and willingness to pay by households for vehicle attributes.

Problem Statement

Using a three parts analysis to identify attitudes, beliefs, and propensity to purchase and recommend clean vehicles by households who have had experience with these technologies, investigate vehicle characteristics that influence annual vehicle miles travelled, and explore values of willingness to pay for vehicle attributes in household fleets.

Research Methodology

Market segmentation using mixed data cluster analysis and factor analytic techniques. Multilevel data analysis to identify determinants of vehicle annual vehicle travelled in single vehicle and multiple vehicle fleets. Discrete choice models on hypothetical choice scenarios to derive willingness to pay for vehicle attributes based on stated choice data.

Results

In this project an investigation of the key factors (such as attitudes towards electric vehicles, household characteristics, and past experiences) of vehicle purchase intention (future car ownership) by household is the core subject. Using observed data we determine whether eco-friendly vehicles (e.g., battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs)) have the potential in California based on a *three part analysis*. The data used here are the 2017 and 2019 California Energy Commission (CEC) vehicle surveys and the National Household Travel Surveys (NHTS). The objective of *the first part* is to explore behavioral attitudes, including both positive and negative attitudes toward battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). *The second part* explores if ZEVs lead to a higher number of Vehicle Miles Travelled (VMT) through an analysis of reported VMT of household fleet utilization in different years in the United States. *The third part* is a pilot study of willingness to pay for specific attributes of ZEVs mirroring a previous research project on Commercial Fleets.

In the first part, clustering of respondents is first done based on vehicle attributes to group users' future vehicle intentions. Then a weighted multinomial logistic model (MNL) is developed to study the impact factors of people's future vehicle demand. Following that, three distinct models are evaluated to identify factors influencing consumer willingness to recommend three different zero-emission vehicles and potentially zero emission vehicles (ZEVs), namely plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and hydrogen fuel cell electric vehicles (FCEVs), with past experiences (reflected by post-purchase satisfaction in this study) serving as mediators. Finally, the relationship between past experiences and future vehicle demand is discussed. Future vehicle choices are classified into four groups that based on fuel type, body size, vehicle addition or replacement, and desire for new or used automobiles. The results show that consumers who have experienced sustainable vehicles are more likely to continue to select them in the future. In terms of the impact factors of ZEV satisfaction and recommendation, PHEV owners are concerned about the costs associated with gasoline and electricity

Pacific Southwest Region UTC Research Brief

consumption at home. BEV users consider not just all of the aforementioned but also battery range and the availability of public charging stations. FCEV users value the convenience of refueling their vehicles. Figure 1 and Figure 2 provide a summary of the Path analysis recommendations for PHEV and BEV.

In the second part data from NHTS 2017 and 2022 are used to discern differences in annual reported VMT for vehicles of household fleets distinguishing between single vehicle fleets from multiple vehicle fleets and their correlation with vehicle types, fuel type, household composition and residential location. We find significant differences across the two cross sections of 2017 and 2022 and across household vehicle fleet sizes. Most important vehicles in multivehicle fleets are used by far less, fuel types play different in fleets of different sizes, and household structure is an important determinant of annual VMT. Moreover between 2017 and 2022 we see a variety of complex trends that support the need to continue tracking annual VMT in regular intervals and continue exploring its correlation with fueled used.

In the third part we explore the answers to hypothetical scenarios designed by a contractor for CEC, find significant factors of the propensity to use clean vehicles by households and then estimate their willingness to pay for specific vehicle attributes. The overall finding is that households appear to be willing to pay higher vehicle purchase price for attributes such as range and efficiency than the market offers.

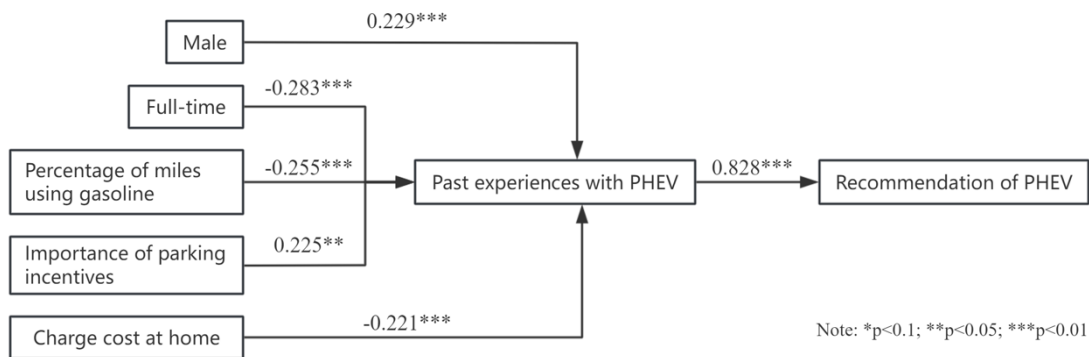


Figure 1 Path analysis results of PHEV recommendation

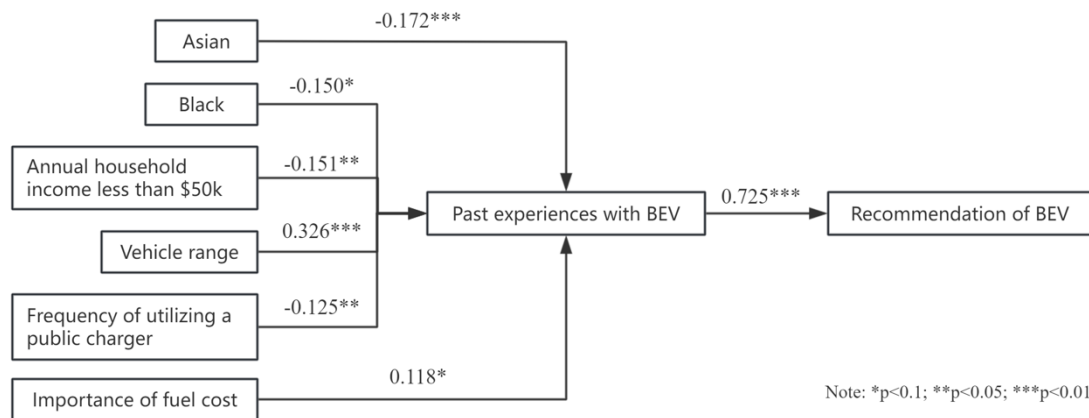


Figure 2 Path analysis results of BEV recommendation