Changing Propulsion System and Refuelling Patterns: Company Car Drivers' Preferences for Electric Cars

Alexandros Dimitropoulos*

Piet Rietveld

Jos N. van Ommeren

Department of Spatial Economics,

VU University, Amsterdam, The Netherlands

*Email: a.dimitropoulos@vu.nl

1. Background

Electric vehicles (EVs) have been enjoying the vigorous support of policy makers during the last decades, as their large-scale adoption is considered a means of confronting mounting concerns over environmental degradation, oil dependence and increasing petroleum prices. With the possible exception of hybrid electric vehicles, however, consumer adoption of EVs has long been hampered by relatively high acquisition costs, considerable uncertainty over developments in battery technologies and the fact that it entails notable changes in car refuelling patterns.

Even though consumer preferences for EVs have been studied in the economic literature since the late 1970s (e.g. [1]-[5]), researchers have been disproportionately focussed on the private car market segment, leaving the possible role of the company car market in the diffusion of EVs virtually unexplored. In Europe, around half of new vehicle registrations concern company cars, namely cars offered as fringe benefits to employees, although mainly serving private travel needs [6]. The vast majority of company cars are offered under lease contracts of a predetermined duration which usually cover also car's operating costs. Employees make their vehicle choice on the basis of a maximum monthly lease budget determined by their employer. Nevertheless, they are generally free to select a car whose lease price slightly exceeds their lease budget, provided that they pay the difference between the lease price and the budget allowance themselves. The use of a company car is taxed on the basis of a tax base rate, usually being proportional to the car's purchase price.

Especially at the early adoption phase, the company car market constitutes an important candidate diffusion channel for EVs, as the uncertainty concerning vehicle resale price, battery replacement and maintenance costs is therein shifted from the private user to the car leasing company. Since fuel costs are

explicitly taken into account in the determination of the car leasing price level, the company car market can further ensure that the fuel cost savings provided by EVs are not disregarded.

2. Aim and Methodology

The current study employs a choice experiment approach to investigate the preferences of Dutch company car drivers for battery electric (BEVs), hybrid electric (HEVs) and plug-in hybrid vehicles (PHEVs). An online survey launched in May 2012 invites respondents to engage in eight choice exercises. In each of them they make their choice among three alternative car leasing contracts, differing in terms of: (i) three car attributes (fuel type, purchase price and driving range), (ii) two lease contract attributes (employee's contribution to car's lease price and lease contract duration), (iii) three refuelling activity attributes (station refuelling time, home/workplace charging time and detour time needed to reach the nearest refuelling station), and (iv) a policy intervention attribute (tax base rate). Each choice scenario includes a contract option referring to a car of the same fuel type as the next car the respondent intends to lease, and two contracts concerning EV technologies. Importantly, in addition to HEVs and PHEVs, we consider two types of BEVs; the first one allows for fast-charging, while the second one allows for battery-swapping at specialised stations. Both types allow for home or workplace charging of a several-hour duration.

In contrast to previous research, our analysis deviates from the arguably unwarranted treatment of driving range, refuel time and detour time as three independent elements of consumer's utility function. We instead analyse them from a generalised costs of refuelling perspective, where drivers jointly consider the number of refuelling actions they have to undertake to cover a specific distance and the time and cognitive burden these actions imply. Hence, we specify a utility function where such interdependencies are investigated by means of interaction terms (ratios) between refuelling and detour time and driving range. Company car drivers' preferences are elicited by the use of Nested, Mixed and Latent Class Logit models.

3. Expected insights and results

Our discrete choice analysis aims to shed light on the potential role of the company car market in the early adoption process of EV technologies. In this context, we look into the effects of changes in the examined attribute levels on the probabilities of EV technologies being chosen, and we provide insights into the implied trade-offs among these attributes. Furthermore, we quantify the extent to which: (i) battery-swapping options have the potential to mitigate company car drivers' concerns about the short driving range of BEVs, (ii) the extended range option provided by plug-in hybrids is appreciated by company car drivers, (iii) drivers travelling longer daily and annual distances experience a higher disutility from shorter driving ranges and higher refuel and detour times; (iv) drivers' preferences for

plug-in vehicle technologies are influenced by the availability of a standard parking position at home and workplace; (v) the tax base rate can be a powerful tool for the stimulation of the adoption of EVs in the hands of policy makers; (vi) preferences for EV technologies and valuation of specific attributes vary with the body type and fuel technology of the reference vehicle, i.e. the car that respondents state they wish to lease next. Our analysis further explores the possible impact of the fuel type, body type and brand name of the current company car, as well as of the other vehicle holdings of the household, on consumer preferences for EV technologies.

References

[1] Beggs, S., Cardell, S., and J. Hausman, "Assessing the potential demand for electric cars", Journal of Econometrics 17 (1), 1-19, 1981.

[2] Calfee, J.E., "Estimating the demand for electric automobiles using fully disaggregated probabilistic choice analysis", Transportation Research Part B 19 (4), 287-301, 1985.

[3] Segal, R., "Forecasting the market for electric vehicles in California using conjoint analysis", The Energy Journal 16 (3), 89-112, 1995.

[4] Hidrue, M.K., Parsons, G.R., Kempton, W. and M. Gardner, "Willingness to pay for electric vehicles and their attributes", Resource and Energy Economics 33 (3), 686-705, 2011.

[5] Qian, L. and D. Soopramanien, "Heterogeneous consumer preferences for alternative fuel cars in China", Transportation Research Part D 16 (8), 607-613, 2011.

[6] Gutiérrez-i-Puigarnau, E., and J.N. Van Ommeren, "Welfare effects of distortionary fringe benefits taxation: the case of employer-provided cars", International Economic Review 52 (4), 1105-1122, 2011.

Keywords

Electric vehicle; Company car; Choice experiment; Generalised costs of refuelling.