IDENTIFYING POTENTIAL EARLY ADOPTERS OF ELECTRIC VEHICLES IN EUROPE: THE COMPANY CAR MARKET CASE

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(1) Overview

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 [1]. As company car drivers do not have to incur any upfront costs for the use of the car, and the uncertainty concerning vehicle resale price, battery replacement and maintenance costs is shifted from the car user to the car leasing company, the company car market is actually a prominent diffusion channel for alternative fuel vehicles. For instance, it constitutes the cornerstone of the successful diffusion of hybrid electric vehicles (HEVs) in the Netherlands. We examine its potential role in the early adoption process of electric vehicles (EVs), by drawing on the stated preferences of Dutch company car drivers for a number of EV technologies.

Even though consumer preferences for EVs have been studied in the economic literature since the late 1970s (e.g. [2]-[5]), researchers have disproportionately focussed on the private car market segment, leaving the possible role of the company car market in the diffusion of EVs virtually unexplored. Company cars might not comprise the majority of cars driven in Europe, but the company car market is the driving force of changes in the car fleet of many European countries, such as Belgium, Germany, the Netherlands, Sweden and the UK. The vast majority of company cars are offered under lease contracts of a predetermined duration which usually also cover car's operating costs. The private use of a company car is taxed on the basis of a tax base rate, commonly being proportional to the car's purchase or list price [6].

In view of the contribution that EVs can potentially make to the pursuit of environmental and energy security goals, European governments have attempted to stimulate their diffusion in the company car market through the provision of generous tax incentives for drivers, firms and car leasing companies. However, little is so far known about company car drivers' preferences for various types of EVs and their attributes, as well as about their likely response to the implemented tax policies. In this context, the current study makes a key contribution by providing insights into the preferences of company car drivers for EV technologies and the associated refuelling infrastructure and by informing policy makers about the potential success of various measures used for the stimulation of their adoption.

(2) Methods

We employ a discrete choice experiment approach to investigate the preferences of Dutch company car drivers for battery electric (BEVs) and plug-in hybrid vehicles (PHEVs). Our findings draw on the outcome of more than 950 responses to an online survey carried out between November 2012 and January 2013. During the survey, respondents were invited to engage in eight hypothetical choice exercises. In each of them they made a choice among four alternative propulsion systems, a system propelled by an internal combustion engine (ICE) and driver's preferred fuel type, a PHEV, and two types of electric cars, a fixed-battery EV (FBEV) allowing for fast-charging, and a swappable-battery one (SBEV) providing the option of battery-swapping at specialised stations. Both types allowed for home or workplace charging of several-hour duration. The alternatives differed in terms of: (i) two monetary attributes (purchase price and employee's contribution to car's lease price), (ii) a policy intervention attribute (tax base rate), (iii) driving range, and (iv) three refuelling activity attributes (station refuelling time, home/workplace charging time and extra detour time required to reach the nearest refuelling station). Drivers' annual monetary costs consist of the sum of their contribution to car's lease price and the product of the tax base rate and the purchase price of the car. Company car drivers' preferences are elicited by the use of Nested, Mixed and Latent Class Logit models.

(3) Results

We find that ICE technologies rank first in drivers' preferences, followed by their closest alternative in terms of performance and refuelling behaviour, PHEVs. The disutility derived from BEVs is around twofold the one derived by PHEVs. Interestingly, swappable-battery EVs are slightly preferred to fixed-battery ones, verifying that company car drivers derive utility from having the option to replace the EV battery at the same amount of time that they need to refuel an ICE car. Drivers are very sensitive to changes in the tax base rate they are presented with, thereby confirming that tax incentives are a powerful tool for the stimulation of the demand for electric vehicles in the hands of policy makers.

Drivers value increases in driving range and reductions of fast-charging and detour time rather highly, whereas reductions of home charging time are not equally appreciated. The opportunity costs of detouring, fast-charging and charging at home are substantially different from each other, as the range of other activities that drivers can perform while engaging in each of these refuelling-related actions varies widely. In line with our expectations, drivers' value of detour time is higher than (about twofold) the value of fast-charging time, while their value of home-charging time is considerably lower. We further show that drivers' utility is not linear in the attribute levels considered. Drivers' willingness to pay (WTP) for increases in range and reductions in fast-charging time diminishes as driving range and fast-charging time increase. Their WTP for reductions in detour time exhibit a different pattern for FBEVs and SBEVs. Drivers value reductions in the extra detour time required to reach the nearest battery-swapping station substantially, while they do not show much appreciation for reductions in the detour time required to reach a fast-charging facility unless they result in trivial detours. This provides some evidence for the complementarity of the disutility derived from detour time and station charging time.

In addition, we examine whether drivers travelling longer daily and annual distances experience a higher disutility from shorter driving ranges and higher refuel and detour times, as well as how drivers' preferences vary with the fuel type and intensity of use of the current household vehicle holdings and with their access to a standard parking spot at home and workplace. We further investigate the role that drivers' environmental concerns, attitudes towards innovative products, and personal experiences with driving and boarding EVs and HEVs, play in the formulation of their preferences.

(4) Conclusions

In light of the vital role that the company car market plays in the diffusion of alternative fuel vehicles in Europe, the elicitation of company car drivers' preferences for EV technologies becomes particularly relevant for the study of their early adoption process. We find that the recently introduced plug-in hybrid and extended-range EVs have considerable potential to mitigate company car drivers' concerns over short driving ranges and long charging times. Although the provision of a battery swapping option is valued by drivers, the vast majority of them still prefer EV alternatives with similar performance and refuelling activity requirements to their status quo. Until technological breakthroughs in battery development allow the achievement of driving ranges comparable to the ones of ICE cars, it seems that early company EV adopters will primarily opt for plug-in hybrid and extended-range EVs. At the early stage of adoption, governmental intervention through tax base changes emerges as a very effective strategy for the stimulation of EV demand in the company car market. In view of PHEVs' popularity among EV alternatives, however, the provision of similar tax advantages for the adoption of PHEVs and BEVs can potentially distort the early adoption of EV technologies, as it appears to largely work for the benefit of the first and at the expense of the latter.

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