Welfare effects of distortionary tax incentives under preference heterogeneity: An application to employer-provided electric cars

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In Europe, around half of new vehicle registrations concern company cars, namely passenger cars offered as benefits in kind from employers to employees and serving both business and private travel needs (Gutiérrez-i-Puigarnau and van Ommeren, 2011). The company car market plays a vital role in the diffusion of alternative fuel vehicle technologies, like plug-in and hybrid electric cars, as companies are more likely than households to be able to incur the high upfront costs of these vehicles, as well as to handle the uncertainty about their resale price and operating costs.

In view of the contribution that *plug-in electric vehicles* (PEVs) can potentially make to the pursuit of environmental and energy security goals, several European governments stimulate their diffusion in the company car market through the provision of tax incentives. Company car drivers, for example, are motivated to opt for PEVs in two ways: first, lease prices of PEVs are reduced due to their exemption from registration and road taxes and the possible granting of purchase price subsidies; and second, increases to drivers' taxable income due to the private use of company PEVs are lower as a result of the reduction of their list prices and the tax base rates applicable to them.

Little is so far known, however, about company car drivers' preferences for PEVs, as well as about their response to tax policies. In this context, the contribution of this study is twofold. First, we develop a discrete choice experiment to elicit company car drivers' preferences for the attributes of three different types of PEVs: (i) plug-in hybrids, (ii) full electric cars with fixed battery and (iii) full electric cars with swappable battery. We analyse the choice data with a latent class model which enables us to identify groups of potential early adopters of PEVs and pinpoint the sociodemographic and car use factors contributing to the likelihood that a driver will fall within these groups. The model also addresses the behaviour of individuals who make lexicographic choices by deterministically allocating them in a specific group (see also Hess et al., 2012). Second, we perform a welfare analysis of recent tax policies targeted to company PEVs in the Netherlands and provide estimates of the welfare gains that can be achieved by marginal increases in the zero company tax base rates applicable to PEVs in 2013.

The choice experiment was part of an online questionnaire launched at the end of 2012. The questionnaire invited Dutch company car drivers to make hypothetical choices among conventional cars and the three types of PEVs. The alternatives differed in terms of car list price, tax base rate,

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annual monetary contribution required by the driver, driving range, refuelling time at home or workplace and at the station, and time required to reach the nearest fast-charging or battery-swapping station on top of the detour time spent now by the respondent to reach its nearest petrol station. For the econometric analysis, we formulate a discrete choice model in willingness to pay (WTP) space (Train and Weeks, 2005) and find that a three latent class specification best describes the choice behaviour of the 845 drivers comprising our sample.

The results of our model reveal high sensitivities of company car drivers to changes in the monetary attributes employed in the experiment. They further show that drivers derive relatively small welfare losses from plug-in hybrids and high losses from full electric cars. We also find that increases in the driving range of full electric cars and reductions in the extra detour time to reach the nearest fast-charging or battery-swapping facility are highly valued by drivers and that this valuation exhibits strong non-linearities. Reductions of fast-charging time for full electric cars are appreciated to a lesser extent, whereas relatively little can be gained from reductions of charging time at home or workplace, at least at the early adoption stage.

Around a quarter of our sample are *potential early adopters* of PEVs, especially of plug-in hybrids. The class membership module of our model indicates that these drivers are less likely to belong to high-income groups and more likely to be travelling relatively short annual distances (cf. Hidrue et al., 2011; Koetse and Hoen, 2014). This group of drivers has a relatively high WTP for increases in the driving range of full electric cars and a high sensitivity to reductions in the extra detour time required to reach a fast-charging facility. The latter implies that policies directed to the expansion of the network of fast-charging facilities can be an effective stimulus for the early adoption of fixed battery electric cars.

Drivers' strong responsiveness to reductions in company car tax base rates also suggests that the latter may have substantial social welfare effects. These are assessed under the assumptions that the company car market is perfectly competitive, the supply of all types of PEVs and conventional cars is fully elastic, and the optimal tax base rate is the one most commonly applied to conventional cars, i.e. 20%. We estimate that the annual welfare gains from an increase in the tax rate for plug-in hybrids from 0 to 1% are around €26 per company car, or €16 million for the whole Dutch economy. On the contrary, welfare gains from marginal increases in the rates applicable to full electric cars are substantially lower, about €1 million. The estimates of our analysis imply that the increase of PEV tax base rates implemented by the Dutch government in 2014 is welfare-improving. Our findings further support the implementation of policies providing a clear differentiation in the tax base rates applied to plug-in hybrids and full electric cars.

Key references

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