ELECTRIC VEHICLES AND CONSUMER CHOICES

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Overview

Electric vehicles (EVs) have many attractive features when compared to conventional vehicles (CVs). Their main advantage lies in their significant economic benefits due to the much higher fuel efficiency, and substantial environmental benefit of lower greenhouse gas (GHG) emissions. However, the market share of EVs in the UK remains low and their benefits will not be realized unless the government and the manufacturers can gain crucial information, necessary to effectively support and speed up the adoption of EVs. To provide such information, this study uses a stated preferences dataset from a UK national survey, conducted in 2014 and 2015. The main goals include finding: the characteristics of potential early adopters of EVs in the UK, the vehicle attributes that they consider important in their purchase decision making, and the key barriers to EV adoption.

Methods

The survey yielded 1996 responses, 1347 of which were used in the main analysis. A discrete choice model is applied, using an adaptive Lasso methodology, binomial logit and ordered logit regressions. Due to the large number of variables, the analysis could suffer from a number of problems, such as overfitting. To improve the estimation containing a large number of promising consumer profile and vehicle attributes, an important step is to build a model that only includes important attributes. For this purpose, I use the adaptive Lasso methodology:

$$\hat{\beta}_n^{AL} = \arg\min_u \sum_{j=1}^{n} \left(y_j - u' x_j\right)^2 + \lambda_n \sum_{i=1}^{p} \lambda_{n,i} |u_i|$$

where $\lambda_{n,i} = \frac{1}{(|\hat{\beta}_{n,i}|)^{\gamma}}$ *is the adaptive weights vector,*
$\hat{\beta}_{n,i}$ *is an initial estimate of the coefficients,*
γ *is a positive constant for adjustment of the adaptive weights vector, set between* $\frac{1}{3}$ *and* $\frac{10}{3}$.

Once the key variables are identified, binomial and ordered logit regressions can be applied in order to answer the main goals of the study, as specified in the overview section of this abstract. An example of the binomial logit regression used can be expressed as the following:

$$y_j = \beta_0 + \sum_{l=1}^{L} \beta_l z_{j,l} + \sum_{k=1}^{K} \alpha_k w_{j,k} + \sum_{r=1}^{R} \gamma_r c_{j,r} + \epsilon_j, \qquad j = 1,2,\dots n$$

where y_j *is the dependent variable of interest,*
$z_{j,l}$ *are the consumer profile attribute variables from adaptive Lasso,*
$w_{j,k}$ *are the vehicle aspect and design attribute variables from adaptive Lasso,*
$c_{j,r}$ *are the control variables, considered important in comparable studies,*
β_l *are the coefficients of the consumer profile variables,*
α_k *are the coefficients of the vehicle variables,*
γ_r *are the coefficients of the control variables,*
ϵ_j *is the error term,*
n *is the number of observations (1347),*
L *is the number of consumer profile variables,*
K *is the number of vehicle attributes variables,*
R *is the number of control variables.*

Results

The results suggest that the propensity of being a potential EV early adopter increases with youth, education, being a student, living in the more southern parts of UK, being married and, to a lesser extent, income. Consistently with previous papers, vehicle purchase cost, performance and maximum range are found to be important vehicle attributes for potential early adopters of EVs, along with vehicle's positive impact on the environment. Additionally, two key barriers to wide EV adoption are identified – high purchase cost and low maximum range of the vehicle.

Conclusions

A possible policy recommendation for the government and the marketers is to support and target younger, highly educated consumer groups, which are more environmentally focused at the same time. A strategy of manufacturers to focus their research and development on improvements in batteries is also advisable, as these could lower the purchase price and increase maximum range – both of which are major adoption barriers and represent important attributes in the eyes of potential EV adopters. The results also suggest that the government should focus on educating those individuals who never thought of EV purchase, as for these people, the lack of knowledge about EV technology is a major barrier to them also becoming potential EV adopters.

References

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