A semi-compensatory model with cut-offs to account for attributes non-attendance

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Abstract:

Standard discrete choice models assume that individuals exhibit a compensatory behaviour regarding attributes. This means that individuals evaluate all the attributes and trade them off under the assumption of unlimited substitutability. However, there are enough evidences supporting the view that individuals often do not consider all the information available in the decision problem and/or do not value them equally in all their domain of variation.

A growing literature on stated choice experiments has focused on the problem of attribute non-attendance, i.e. when individuals ignore some of the attributes presented (see e.g. Collins and Hensher, 2015). Evidences show that the number of attributes and their levels but also the importance and relevancy of attributes presented potentially determine the attribute processing strategies adopted by a respondent. If one attribute is much less important than the others or its levels do not vary over a range that matters enough to result in a trade-off for the respondent, the attribute can be excluded from the decision process. Campbell et al. (2012) argue that thresholds on specific attributes can also be the cause of attribute non-attendance and showed that individuals can apply different decision strategies depending on the level of the attribute presented and it does not process the attributes only when it takes some values. They focused on the price attribute and used a dummy variable specific for each price level to account for the fact that some respondents may disregard prices that fell below their lower limit or went beyond their upper limit. They account for non-attendance in the price by using constrained latent class model, where coefficients in some classes are constrained to zero to reflect null preference.

In this paper we discuss another decision strategy due to the interaction among attributes. Namely the case when an attribute is not considered when some other attribute (which is probably more relevant or at least more relevant in some range of variation) falls below a lower limit or goes beyond an upper limit. In this case the non-attendance does not depend on the attribute itself, or its levels, but it depends on the values (and cut-offs) of some other attribute in the utility. Moreover, given the relative nature of the discrete choice, we argue that this cut-off is likely not to depend on the value of the specific attribute but to relative difference of the attribute between the discrete alternatives.

To model the semi-compensatory effect due to the due to the interaction among attributes we follow the Constrained Multinomial Logit proposed by Martinez et al. (2008). Differently from Martinez et al. (2008), in our model the cut-offs or penalization functions do not affect the all utility but specific attributes, allowing for non-compensatory effects on the preference for specific attributes. Differently from the previous works (both Martinez et al., 2008 and Campbell et al. 2012) the cut-offs are defined in terms of relative difference between alternatives. Following Castro et al. (2009) different utility functions were defined for the sub-sample of individuals with compensatory behaviour and those with non-compensatory

behaviour. Systematic and random heterogeneity can be accounted in the compensatory part, while the cut-offs in the utility are activated only for the non-compensatory behaviour allowing capturing the mass of coefficient at zero.

The model is applied to the case of a discrete choice between an electric and a conventional vehicle. A customised Stated Choice experiment was built based on information on household vehicle holdings and on the most likely characteristic of the future vehicle purchase. The attribute values shown to the respondents in the experiments were then adjusted accordingly to the desired car class and engine technology. The Stated Choice experiment consisted of binary choices between an electric and a conventional vehicle, but to avoid that the respondent were forced to choose between two evil alternatives, an opt-out option was also included, and explicitly modelled. Attributes include purchase price, driving cost, range, carbon emission and other 2 attributes defining the charging possibilities: the number of battery stations and availability of slow/fast charging station in the city center or in shopping areas. 30 choice tasks were generated and randomly divided in 5 groups, such as 6 choice tasks were presented to each respondent. After a carefully screening of the data collected, a sample of around 18000 observations was used to estimate the models.

Based on the results of this study and other studies on electric vehicles, it is known that purchase price and range are the attributes evaluated as most important by the individuals. We then tested to which extent these attributes and the values presented in the experiments would determine a non-compensatory behaviour in the evaluation of the charging attributes. We found that individuals show a compensatory behaviour, trading off among all attributes (and in particular the recharging options) only when the purchase price of the electric vehicle is higher than that of the conventional car. In particular preference for the slow recharging option increases as the difference between the price of the conventional and electric cars increases. Individuals tend instead to ignore the slow recharging option, when the purchase price of the electric vehicle is lower or equal to that of the conventional car. We also tested if individuals showed non-compensatory behaviour due to upper or lower bounds in the price specifically of the electric vehicles. But we did not find any significant effects, which confirm our assumption that the relative difference of the most attributes (not their absolute values) induce non compensatory behaviours disregarding the attributes less relevant, at least some of their levels.