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If you choose not to decide, you still have made a choice

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ABSTRACT

When designing stated-choice experiments modellers may consider offering respondents an "indifference" alternative to avoid stochastic choices when utility differences between alternatives are perceived as too small. By doing this, the modeller avoids adding white noise to the data and may gain additional information. This paper proposes a framework to model discrete choices in the presence of indifference alternatives. The approach allows depicting the likelihood function, independent of the number of alternatives in the choice-set and in the subset of indifference alternatives, offering a new approach to existing methods that are only defined for binary choice situations. The method is tested with the help of simulated and real data observing that the proposed framework allows recovering the parameters used in the generation of the synthetic datasets without major difficulties in most cases. Alternative approaches, such as considering the indifference option as an opt-out alternative or ignoring the indifference choices are clearly outperformed by the proposed framework and appear not capable of recovering parameters in the simulated set.

1. Introduction

Discrete choice models rely on the assumption that individuals are rational decision makers that maximize their utility when facing a given choice situation. This way, individuals will opt for a given alternative if and only if it promises them the maximum expected utility among all alternatives in their choice-sets (Thurstone, 1927; McFadden, 1974). Nevertheless, establishing which alternatives should be considered into the individuals' choice-set is not an easy task.

In real situations the modeller will just observe the chosen alternatives and needs to construct the choice-sets of the individuals on the basis of their characteristic and their choices. This involves major difficulties, as it is well established that people tend to narrow their decisions to only a subset of the potentially available options (Roberts and Lattin, 1991; Swait and Erdem, 2007). By contrast, when dealing with stated preference (SP) data the choice-set must be established *a priori*. In this case, it is important that it be carefully defined preserving the realism of the choice situations. Thus, in many cases it might be necessary to consider an opt-out (non-purchase) alternative (Carson et al., 1994; Olsen and Swait, 1998); whether this alternative should be included directly into the choice-set (Louviere et al., 2000) or indirectly via dual response procedures (Dhar and Simonson, 2003) remains a debatable point (see Schlereth and Skiera (2016) for a good discussion), but the necessity of alternatives accounting for a reservation utility level

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higher than the expected utility of all alternatives in the choice-set is well-established (Kontoleon and Yabe, 2003).

A similar but far less analysed problem is the inclusion of indifference alternatives in the choice-set. If the modeller does not allow for respondents to state their indifference among two or more alternatives, they will be forced to opt for one of them in a rather stochastic manner, adding white noise to the experiment. Additionally, doing so would provide less information about the individuals' preferences leading to loss of efficiency. Indeed, Cantillo et al. (2010) used a synthetic dataset to show that assigning the preferences associated with an indifference alternative randomly, diminished significantly the model's capability to recover the input parameters. Furthermore, Cantillo et al. (2010) also considered real databanks, observing than offering the possibility of stating indifference may indeed affect the outcome of the experiment (the estimated parameter values).

Along these lines, empirical evidence (Dhar, 1997; Fenichel et al., 2009) shows that in experiments including non-purchase options, indifference situations may artificially increase the probability of selecting the opt-out[1] alternative, as a kind of cognitive bias. Therefore, it appears advisable to include indifference alternatives when also offering non-purchase options as a way to reduce cognitive biases. Nevertheless, including indifference alternatives should be carefully considered, as it might generate other kind of complications, especially if individuals are overwhelmed by the complexity of the choice experiment.

Both situations (opt-out and indifference alternatives) exhibit, however, substantial differences; while the former suggest the existence of a reservation utility that is higher than the utility provided by the alternatives in the choice set, the latter indicates that individuals ascribe the same utility to two or more alternatives in it (this utility being higher than the reservation utility). Therefore, in the first case an extra alternative accounting for this reservation prize should be considered. Nevertheless, considering an extra alternative to reflect indifference choices does not seem to be appropriate, as it does not reflect the causes leading to the statement of indifference; in fact, by treating indifference as a new (opt-out) alternative, the modeller implicitly assumes that the utility ascribed to this new option would be greater than that of the competing alternatives, which is clearly not the case.

Despite the fact, that according to classical theory indifference situations will only arise if the expected utility of two or more alternatives is the same (curves of indifference), the underlying behavioural theory behind the indifference phenomena suggests the existence of perception thresholds, below which the individuals are not able to perceive differences between two stimuli (Quandt, 1956; Coombs et al., 1970; Cantillo and Ortúzar, 2006).

Krishnan (1977) developed an operational discrete choice model accounting for the existence of indifference thresholds. This approach (Minimum Perceivable Differences model, MPD) allows taking into account the fact that observations falling into the indifference interval would be assigned stochastically to one alternative, in the context of a binary choice situation. Cantillo et al. (2010) expanded the MPD-approach to allow for individuals stating their indifference in stated-choice (SC) experiments. This way, the indifference alternative would be selected if the difference between the utility of both alternatives was smaller than a threshold, to be estimated.

The main limitation of the MPD-approach is that it only allows considering binary choice situations. Thus, the method can neither consider situations where two alternatives exhibit a similar utility (which is superior to all other alternatives in the choice-set), nor cases when three or more choices report an apparently identical utility (which may be of particular interest when considering alternatives to first-choice SP experiments, such as rankings). The same limitation arises, when considering approaches such as an ordered logit framework (with indifference being an intermediate choice between two binary alternatives).

A method that allows accommodating more than two alternatives, consists in assuming that instead of behaving as utility maximizers, the individuals minimize their regret (RRM framework; Chorus, 2012a). Under this assumption, the regret associated with a certain alternative is given by the direct comparison of its attributes with those of all remaining alternatives in the choice set (whereby only a negative performance would generate regret). Thus, including an extra null-alternative (without attributes) into the model cannot longer be associated with a higher reservation utility, but would rather stand for a level of regret, above which none of the alternatives in the choice-set is favoured (i.e. none of the alternatives significantly minimizes the regret in comparison with other options in the choice-set, Chorus, 2012b). Hence, under this assumption an extra alternative would allow to capture indifference (Hess et al., 2014).

Nevertheless, this approach does not appear appropriate to deal with non-binary choice situations, as the extra alternative would be indicative of indifference among the whole choice-set, not allowing to consider indifference among a sub-set of alternatives (e.g. the respondent is indifferent among two alternatives, but both alternatives are preferred over the remaining alternatives in the choice-set). Furthermore, it does not seem appropriate to consider experiments allowing for both the option of stating indifference as well as opting out, because: (i) it would be necessarily a non-binary situation, and (ii) it would imply considering two different null-alternatives, which should account for two completely different phenomena. Finally, the approach would necessarily require the analyst to assume a regret minimization strategy (ideally, the modeller should aim at an approach that allows considering indifference under different assumptions, e.g. regret minimization or utility maximization, and discern between them on an empirical basis).

This paper discusses the implications of indifference choices concerning the utility ascribed to the different alternatives in the choice-set. Along these lines, the paper presents a new approach that allows dealing with indifference choices in multinomial choice situations. This framework allows not only addressing first-choice SP experiments but also rankings, where indifference choices may be expected to appear more often. The approach is tested with the help of simulated and real datasets, observing that it clearly

[1] For the purposes of this paper, it is assumed that opting-out implies that none of the alternatives satisfies the individual's requirements (i.e. a non-purchase option). This is highly recommended in non-pivoted SP experiments, as with totally new options it could well be that none is acceptable and not presenting an opt-out may bias results (Olsen and Swait, 1998).