Abstract:

In choice situations characterized by a large number of alternatives, individuals engage in a two-stage process, consisting of the reduction of the universal realm to a viable choice set followed by a compensatory evaluation. While compensatory models are capable of accommodating taste heterogeneity and substitution patterns among alternatives, they are limited to representing only the second stage of the above process. The first stage is represented by exogenously generating choice sets prior to model estimation, which may result in incorrectly specified choice sets and consequently inconsistent and biased estimates.

Semi-compensatory choice models show great promise in representing choice set formation as an integral part of discrete choice models, thus increasing the accuracy of choice set specification. However, they become intractable in the absence of information regarding the choice set composition, as the number of possible choice sets increases exponentially with the number of available alternatives. Thus, they are seldom applied and the few existing ones rely on simplifying assumptions to maintain tractability. In fact, most semi-compensatory models found in the literature assume a narrow universal realm of three alternatives (e.g., Ben-Akiva and Boccara 1995; Bașar and Bhat 2004; Cantillo et al.
2006). Other models consider slightly larger universal realms but either require cognitively demanding data (Morikawa, 1995) or radically limit the number of choice sets (Zheng and Guo, 2008). Also, all the models rely on simplifying assumptions regarding threshold distribution, in particular on independence among thresholds. Finally, all models represent the compensatory stage with the multinomial logit model (MNL). Thus, the full extent of compensatory models’ capabilities has not been incorporated yet within semi-compensatory model frameworks. Incorporating these capabilities is needed in order to increase the applicability of semi-compensatory models to a wide range of choice situations, and thus to enhance their competitiveness versus compensatory models.

Kaplan et al. (forthcoming) develop and estimate a novel two-stage semi-compensatory model consisting of the sequence of a conjunctive strategy followed by utility maximization. The model relies on explicit choice protocols, which record tolerated search-criteria thresholds in addition to choice outcomes. This framework significantly increases the accuracy of individual choice set representation and model estimation for a large universal realm without the need for simplifying assumptions, by reducing the theoretical number of possible choice sets to the actually chosen ones. However, this framework, as other semi-compensatory models, represents the compensatory stage simply with the MNL model. The present study focuses on extending the aforementioned framework by incorporating flexible error structures into the compensatory stage to account for individual taste variations and substitution patterns among alternatives.

The proposed model is applied to students’ rental apartment choice as an example of a choice situation characterized by many alternatives. Data collection relied on a specifically designed website, including a questionnaire and a choice experiment. During the questionnaire, respondents provided information about socio-economic characteristics, travel and study preferences, and price perceptions. During the experiment, respondents searched a synthetic apartment inventory by a list of threshold values for six pre-defined search-criteria and then ranked their three most preferred apartments from the resulting choice set. The website seamlessly recorded chosen apartments as well as threshold values leading to the observed choice sets from which the choices were made. The synthetic inventory was based on a statistical analysis of existing real-estate websites, and eighteen attributes per apartment were extracted from their observed distribution, including structural features, location amenities and accessibility indicators. The data sample for model estimation consists of 631 respondents, who searched the database by a combination of the three most frequently chosen search-criteria (i.e., apartment sharing, location and price), resulting in 44 actually chosen choice sets. Specifically, the data sample includes a pool of the three ranked choices for each individual, for a total of 1,893 observations of apartments chosen from a universal realm of 200 alternatives.

The proposed framework combines a multidimensional mixed ordered-response model for representing the conjunctive strategy with alternatively: a) a nested logit model for representing substitution patterns in the utility maximization stage; b) a random parameters logit model for representing taste variations in the utility maximization stage. In both cases, the two stages were jointly estimated by a maximum likelihood routine written in GAUSS programming language.

The two suggested versions of the model were compared to their compensatory counterparts: a) a nested logit model, and b) a random parameters logit model. Since the observed choice process is a two-stage process, the estimated parameters of apartment
attributes of the semi-compensatory model are more precise estimates of the “true” parameters than parameters of compensatory models. Thus, the parameter estimates of the proposed semi-compensatory model can be considered as a reference point for comparing performances of compensatory models.

Results demonstrate the applicability and feasibility of representing individual taste variations and flexible substitution patterns by the suggested semi-compensatory model. The comparison between the suggested model and its compensatory counterparts illustrate the competitiveness of the suggested model, and permits evaluating the difference in the estimated parameters between the two approaches.

**Keywords:**

**References:**


Kaplan, S., Bekhor, S., Shiftan, Y., 2009. A two-stage model jointly revealing the determinants of non-compensatory conjunctive choice set formation and compensatory choice. Accepted for publication in the Transportation Research Record: Journal of the Transportation Research Board.
