

Essays on Multinomial Choice Models & Its Application in Business Analytics

In this work, I aim to explore and extend the existing multinomial logit models that handle dynamic choice behavior, zero-inflated responses, multivariate responses and heterogeneity in choice models. In particular, I will discuss two distinct applications where innovative extensions of multinomial logit (ML) models are being explored. In the first work, I extend the existing ML models to capture dynamic evolution of consumer's choice over time using time-varying regression coefficients. This work has been analyzed in context of UK 2010 general election and specific questions like, how the preferences of voters evolve over a very short duration of political campaigns, why voters swing etc. are addressed by dynamically updating the model parameters. Commonly used methods, for evaluating communications in this scenario, ignore both earned media and the consumer's individual perceptual response to exposures. To address these shortcomings, this work adopts an emerging data collection technique based on text messaging called real-time experience tracking (RET). In addition one specific application, among many, from consumer product category choice problem is also discussed.

My second work concentrates on exploring the behavior of physicians prescribing a certain drug to the patient community and the propensity of an educated patient's (through advertisement, campaign etc.) of asking for a certain type of drug to the physician for his/her disease. This is a common scenario in US and New Zealand. Modeling and understanding these interrelated behaviors of physicians and patients are very important for the successful marketing of the drug. In the usual scenario, a physician may prescribe one of the several available drugs to the patient and a patient may ask for a particular drug out of many available to the physician to prescribe. Conceptually a typical multinomial choice model would have sufficed to model each of the above scenario. However, modeling challenges arise not only because the above two scenarios are correlated, but also because of the presence of informative zero observations, since a lot of the times there is no request from the patient and a zero response can also happen due to the physician not reporting the patient's request. Since, none of the two types of zero's can be discarded as they are informative of the market choice behavior, a good model should be able to identify and distinguish these two types of zeros. In this work, I extend multinomial logit model to capture these scenarios. Particularly, patients' drug choices are modeled using a zero-zero-inflated multinomial (ZZiMNL) choice model. Physicians' prescription choices, which depend on patient's request, detailing visits etc., are further modeled as standard multinomial logit (MNL) model. Additionally, instead of estimating these models separately, a joint modeling structure is put forth, accommodating the correlation among the models. Further, the dynamics of competitive drugs detailing and direct-to-consumer-advertisements (DTCA), in the pharmaceutical market, is also analyzed.