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Master Thesis Proposal

Discrete Choice Model estimation for products with network effects

Consumer purchase decision are dependent on different aspects of a product. First, there are functional attributes like color, size or price that are directly influenceable by the firm's decision maker. On the other hand, experiential and social attributes like reputation, recommendations or network effects are much more difficult to influence. The network effect describes a behavior, where people value an item dependent on the products sales. This effect can take different forms and is mainly distinguished into global and local network effect.

Companies can benefit from the network effect to optimize sales by accounting for endogenous network effects in their forecasts. Predictive choice models, like the multinominal choice model (MNL), are often used to describe customer purchase behavior. An underlying assumption of the models is the possible decomposition of the product or service in attributes with different levels, where each attribute level is connected to a particular partial utility. The conjoint method can estimate model parameter like sensitivity to price and other attributes. Wang (2020) showed for the case of an endogenized total market size that it can be beneficial to sell a product below its marginal costs, in order to stimulate other sales of more profitable products. Wang and Wang (2017) consider the assortment planning problem under an MNL choice model with endogenized network externality. Furthermore, the authors propose a method for estimating an endogenized MNL model based on both uncensored and censored data.

The objectives of this thesis are to:
- to review the basic empirical and optimization-related literature on discrete choice models under consideration of network effects. Distinguish between global and local network effect.
- identify and discuss the state-of-the-art approach for estimating choice model with endogenous network effects,
- conduct a discrete choice experiment or empirically analyze an existing dataset that includes sales data of a product exhibiting endogenous network effects, and discuss managerial applications for optimization model design,
- to comment, if companies should incorporate network effects in their decision-making process and what difficulties they may face from an optimization point of view,
- provide open research gaps and future trends.

Recommended basic literature:

Wang, R., & Wang, Z. (2017). Consumer Choice Models with Endogenous Network Effects. *Management Science*, *63*(11), 3944–3960. https://doi.org/10.1287/mnsc.2016.2520

Wang, R. (2020). On the assortment optimization with endogenized market size.
Operations Research Letters, 48(5), 682–686. https://doi.org/10.1016/j.orl.2020.07.011

Qi, W., Liu, X., Luo, X., & Zhang, Z.-L. (2020). Product Line Optimization Considering Network Effects. IEEE Systems Journal, 1–11. https://doi.org/10.1109/JSYST.2020.3035093

Train, K., & Ebrary, Inc. (2009): *Discrete choice methods with simulation* (Second ed.). Cambridge New York Melbourne Madrid Cape Town Singapore São Paulo Delhi Mexico City