Modeling Category Effect of Items in Assortment Planning for Large Retail Chains

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Abstract

In this paper, we have developed an analytical model to jointly optimize the assortment and inventory policy for a category in a retail chain. In addition to own sales and cross item effects, we model the category effect of items. Our model is general enough that it allows us to formulate category effects induced due to both the choice of the items included in the assortment and stock outs. To solve the resulting non-linear, stochastic, mixed integer formulation, we develop excellent linear approximations which can be solved using standard optimization codes. We provide a numerical as well as analytical proof for our approximation. Our approximation allows us to solve the assortment planning problem simultaneously for the entire chain, rather than for a single location only. We illustrate our methodology by using data that is based on a large retail chain, and derive important managerial insights about assortment planning. In particular, we show that ignoring the category effect can lower profitability considerably.