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Author: Marshall Fisher - Kumar Rajaram

Accurate Retail Testing of Fashion Merchandise: Methodology and Application

Marshall Fisher • Kumar Rajaram
Operations and Information Management Department, The Wharton School, The University of Pennsylvania Philadelphia, Pennsylvania 19104-6366, fisher@wharton.upenn.edu
Operations and Technology Management Area, The John E. Anderson Graduate School of Management The University of California at Los Angeles, Los Angeles, California 90095-1481, kumar.rajaram@anderson.ucla.edu

Abstract

In a merchandise depth test, a retail chain introduces new products at a small sample of selected stores for a short period prior to the primary selling season and uses the observed sales to forecast demand for the entire chain. We describe a method for resolving two key questions in merchandise testing: (1) which stores to use for the test and (2) how to extrapolate from test sales to create a forecast of total season demand for each product for the chain. Our method uses sales history of products sold in a prior season, similar to those to be tested, to devise a testing program that would have been optimal if it had been applied to this historical sample. *Optimality* is defined as minimizing the cost of conducting the test, plus the cost of over- and understocking of the products whose supply is to be guided by the test.

To determine the best set of test stores, we apply a k-median model to cluster the stores of the chain based on a store similarity measure defined by sales history, and then choose one test store from each cluster. A linear programming model is used to fit a formula that is then used to predict total sales from test sales.

We applied our method at a large retailer that specializes in women's apparel and at two major shoe retailers, comparing results in each case to the existing process used by the apparel retailer and to some standard statistical approaches such as forward selection and backward elimination. We also tested a version of our method in which clustering was based on a combination of several store descriptors such as location, type of store, ethnicity of the neighborhood of location, total store sales, and average temperature of the store location. We found that relative to these other methods, our approach could significantly improve forecasts and reduce markdowns that result from excessive inventory, and lost margins resulting from stockouts. At the apparel retailer the improvement was enough to increase profits by more than 100%.

We believe that one reason our method outperforms the forward selection and backward elimination methods is that these methods seek to minimize squared errors, while our method optimizes the true cost of forecast errors. In addition, our approach, which is based purely on sales, outperforms descriptor variables because it is not always clear which are the best store descriptors and how best to combine them. However, the sales-based process is completely objective and directly corresponds to the retailer's objective of minimizing the understock and overstock costs of forecast error.

We examined the stores within each of the clusters formed by our method to identify common factors that might explain their similar sales patterns. The main factor was the similarity in climate within a cluster. This was followed by the ethnicity of the neighborhood where the store is located, and the type of store. We also found that, contrary to popular belief, store size and location had little impact on sales patterns.

In addition, this technique could also be used to determine the inventory allocation to individual stores within a cluster and to minimize lost demand resulting from inaccurate distribution across size. Finally, our method provides a logical framework for implementing micromerchandising, a practice followed by a significant number of retailers in which a unique assortment of merchandise is offered in each store (or a group of similar stores) tuned to maximize the appeal to customers of that store. Each cluster formed by our algorithm could be treated as a "virtual chain" within the larger chain, which is managed separately and in a consistent manner in terms of product mix, timing of delivery, advertising message, and store layout.
(*Merchandise Testing*; *Retailing*; *Mathematical Programming*)

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