

Dynamic Marketing Mix Allocation for Long-Term Profitability

Abstract

To optimally allocate their marketing mix across customers, firms need to consider the evolution of their customers over time. Changes in the marketing environment, as well as intrinsic changes in preferences or needs, may discretely shift customers into different buying-behavior states. The ability to identify the dynamics in customer behavior, and its drivers, present an opportunity for firms to influence the movement of customers to more favorable states of buying behavior. Accordingly, we address the following managerial questions in this research: (1) how can firms dynamically segment their customer base? (2) what are the short- and long-term effects of marketing activities? and (3) how should firms allocate and target their marketing resources to maximize long-term profitability?

To address these questions we propose a non-homogeneous hidden Markov model that accounts for dynamics in customer behavior, the long-term impact of marketing actions, and customer heterogeneity. We capture dynamics by allowing customers to transition over time among a set of latent states of buying behavior. We develop a unique and flexible approach to capture the enduring effect of marketing actions by incorporating a non-stationary transition matrix that is dynamically affected by these actions. To optimally allocate marketing activities, we formulate a dynamic programming approach which takes into account the evolution of customers' behavior.

We apply the model in the context of direct-to-physicians marketing in a major pharmaceutical company. The results suggest that physicians transition among three behavioral states over time, showing a high degree of dynamics. Furthermore, the marketing activities have varying degrees of short- and long-term effects that depend on the physician's prescription-behavior state. Specifically, we find that (i) both detailing and sampling have mostly long-term effects; (ii) detailing and sampling have a total duration impact of approximately 10 and 5 months, respectively; (iii) detailing is most effective as an acquisition marketing tool, whereas sampling is most effective as a retention tool. Using a counterfactual analysis, the optimization results show that the firm could increase prescriptions and profit by as much as 51% and 80%, respectively. Moreover, our analysis suggests that the firm should decrease its current detailing and sampling efforts by 30% and 20%, respectively. The integrative framework we propose provides important marketing implications for managing customers and maximizing long-run profitability.

Keywords: *marketing mix allocation, long-term effect of marketing activities, hidden Markov model, Bayesian estimation, dynamic programming, pharmaceutical marketing.*