Pricing Policies for Perishable Products with Demand Substitution

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Abstract

This paper studies optimal pricing policies for a family of substitute perishable products with demand correlation. Potential buyers arrive according to an exogenous stochastic Poisson process. At each demand epoch, the arriving customer observes the set of substitute products for which there is still inventory available together with their corresponding prices. Based on this information, the customer either buys one of the available products at the posted price, or leaves the system without making any purchase. We propose a simple choice model to capture buyers’ purchasing behavior from which a price-sensitive demand function is derived. In this context, we study the seller’s problem of optimally selecting a pricing policy that maximizes expected cumulative revenues over a finite selling horizon.

Keywords: Pricing, demand substitution, consumer choice model, retail operations, approximations.

1 Introduction

In many retail settings the demand for certain products does not only depend on their own price and stock levels, but also depends on the price and inventory of other products (substitute and complementary products). This occurs, for example, when customers are willing to substitute their favorite quality and style product for a cheaper one they can afford, or when customers prefer buying a similar (but different) product, than leaving the store making no purchase when their initial preference is out of stock. When these kind of behaviors are relevant in a product category, omitting the effects of demand substitution over inventory and pricing decisions can have significant profit implications. Some retailers have realized the importance of this issue, and have been able to compete against big discount stores by offering a one-stop shopping with a wide variety of products (e.g. Smith and Agrawal [20]).

This paper investigates the effects of demand substitution on optimal pricing policies for perishable products in stochastic environments. In the context of this work, we will understand by substitute products a family of products that satisfy (or are perceived to satisfy) the same customers’ needs.

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