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A system for pricing the sales distribution from blockbusters to the long tail

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ABSTRACT

The long tail of retailing has been both a challenge and an opportunity for online retailers. This article provides guidelines for enhanced decision making strategies in pricing dependent on popularity, cross-sales quantity and reservation prices. Our model shows that if customer willingness to pay, or reservation price, is higher for less popular items in a category, a unique optimal price path exists which requires deep discounts on popular items. However, if the reservation price is lower for less popular items, the optimal price path is conditional on the profitability of cross-selling and the potential loss from the business of loyal customers. Analyzing data on books, songs and movies from Amazon.com, we provide empirical support for our model findings. An analysis of the same set of movies available both as instant videos and DVDs allow us control for unobserved product characteristics and yields contradictory price paths along the sales rank distribution with increasing prices for DVDs and decreasing prices for streaming movies, as predicted by our model.

1. Introduction

A peculiarity in pricing strategies of Apple and Amazon.com marks apparent divergent strategies. Apple prices its songs sold at iTunes store at three fixed prices, such that the more popular songs are the most expensive ($1.29), the majority moderately expensive ($0.99) and obscure songs least expensive ($0.69), whereas Amazon.com offers its best seller books at considerable discounts and niche books at no discount. A survey of Amazon.com's top 100 best-selling books on October 18, 2011, reveals an average discount of 47.8% off the list price.

Should any online retailer price its more popular items, that is, its superstars, at a discount or at a premium in a given category? How should an online retailer price its niche products, which make up the long tail of sales distribution? Should the retailer follow Apple's song pricing strategy and sell its superstar products at 46% premium over its cheapest offerings, or should it follow Amazon.com's book pricing strategy and offer a 50% discount off regular price on its superstar products in any given product category (e.g., movies, games, applications)? Is the pricing strategy dependent on certain category characteristics, such that both Apple's and Amazon.com's strategies are relevant given category characteristics? In this research, we provide a competitive model of pricing for multi-product retailers that accounts for sales rank-dependent reservation prices for products and sales rank-dependent sales and cross-sales of products to answer these questions.

Every retailer manages a sales distribution that contains a few hit (superstar, blockbuster, or best seller) products that make up the majority of sales and many niche or long tail products that can also have substantial effects on sales [1,7,9]. In the cardinal sales to ordinal sales rank distribution, which takes the form of a power law distribution, the fat head consists of the superstar products; the blockbusters. The niche products make up the long tail of the sales distribution. In between the fat head and the long tail is a chunky middle, with characteristics of both ends but extremities of neither. In today's online markets, customers empowered by search capabilities and guided by recommender systems can easily navigate to all product pages [6,19,34,38]. How can retailers enhance their DSS and maximize their profits by determining the relative prices of the fat head, chunky middle and long tail products?

We consider an oligopolistic market of complete information in which multi-product retailers compete in the sales of homogeneous goods of varying popularity. We use the term “popularity” to capture the sales rank of a product. A product's popularity has three potential influences in our model. First, the perceived value, or the customer valuation of an item may be a function of the item's popularity, i.e., its sales rank. For example, popularity can have a positive effect on the perceived value of the product and can increase the reservation price an average customer would be willing to pay for the product [18]. Second, the position of the product on the best seller list directly influences the sales quantity [7,9]. According to the power law shape, popular items sell disproportionately more and long tail items sell disproportionately less. Third, popular items not only sell more copies

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but also help sell other items because of their traffic-generating capabilities [13,25]. Therefore, popularity pays in both sales and cross-sales.

Following Varian [42], we model these three influences and their interactions in a competitive price promotions setting and describe the conditions that a DSS should account for. Our model findings reveal that the optimal prices of popular versus niche products depend on both the sales potential and the perceived value of products, both of which depend on the sales rank. The sales potential determines not only the profit potential from a product but also the profit potential from the cross-sales of other merchandise. Therefore, a superstar with a high perceived value and corresponding reservation price should be sold at a higher price than an average product, but it should be sold at a lower price than an average product in a competitive environment if the high price risks its own and cross-sales profit potential. Thus, different categories can require different pricing strategies along the sales distribution. For example, books, as a category, may call for discounted bestsellers, while music, as a category, may benefit from discounting the long tail, as our model and empirical analysis demonstrate. Note that a decision support system for relative prices generates suggestions on percentage discounts across the sales distribution where premium prices correspond to no discounts and the lowest prices correspond to deepest discounts.

2. Literature review

The Internet has created a landslide in terms of products available to consumers [1,8,12], and recommendation engines and search tools can be fine-tuned to direct customers' attention to any product [6,19,38,39]. What remains unanswered is how decision making can be improved to manage the products in the fat head, the chunky middle or the long tail of the sales distribution [26,28]. Although pricing online, in which DSS plays an influential role, remains an important topic [32,33,43], pricing online as it applies to this sales distribution has received scant attention (see [39] for an exception). Brynjolfsson [5] calls for research that would examine how retailers should price niche products versus superstars.

The economics of superstars and the potential of the long tail have been two widely discussed and contrasted theories. Research on the economics of superstars and the long tail has treated them as contrasting theories rather than as complementary. Rather than seeing them as two competing theories, we join Brynjolfsson [5] and contend that the economics of superstars and the potential of the long tail should be analyzed as part of an integrated research agenda.

The superstar phenomenon was first introduced to describe the few top performers that reach a majority of the audience and achieve the most profits [40]. Superstars are the few products that emerge mainly from blockbuster strategies of suppliers [18] and create the so-called winner-take-all markets [21] in which blockbuster products dominate sales. On the other side of sales rankings are niche products. Anderson [1] was the first to introduce the notion of the long tail, in which niche products are found more easily with the help of recommendation engines and search capabilities and thus selling less of more niches may be as viable as selling more of a few superstars. All other products reside in-between the superstars and the niche products; these products are modestly popular and modestly obscure at the same time and make up a significant proportion of sales.

Significant evidence indicates that the relationship between a product's sales rank and sales quantity can be represented by a power law (i.e., Pareto law) [7,9]. The sales of both superstars and niche products may also influence the sales of one another. The purchase of a single product can lead to additional purchases as a result of economies of scale, such as traveling, shipping or handling costs [31,38], or psychological factors, such as the shopping momentum effect [16] or a windfall effect [24]. This cross-selling potential leads to loss-leader pricing [31]. Thus, if customers buy superstars and long tail products in the same transaction, their prices should be linked [5]. In the context of the sales distribution, it is also suggested that long tail products may offer higher profit margins than superstars, which are often used as loss leaders [18].

Online sales are also greatly shaped by the customer reviews on products. It is widely accepted that online customer reviews are a good overall proxy of word-of-mouth communication [45]. Prevalent research in marketing, economics and information systems has assessed the correlation between consumer reviews and sales [2,10,11,14,17,22,23,36]. We assume that customers use review and rating information on products to reach a customer valuation of the item considered. In our model and empirical analysis, we link the average customer rating and reservation price (customer valuation), where a customer can infer the product's relative value on viewing consumer reviews and average customer ratings which in turn may influence his or her reservation price [30,35,44]. We consequently refer to a customer's valuation for a product as the reservation price he or she is willing to pay for the product. Hence, we assume that the customer valuation and reservation price for a product with high rating is higher compared to a product with lower rating. In this article, we examine how decision support systems could improve pricing for products of various sales ranks as the shape of the reservation price curve (as a function of the sales rank R) changes.

In the next section, we develop a model with the aim to answer the following research questions: (i) Should a retailer charge a premium for, or offer a discount on the niche products in the long tail? (ii) How should the blockbusters be priced? (iii) How does customer valuation of products combined with sales as well as cross-sales of products affect prices? (iv) How does this influence evolve along the sales distribution?

3. Model

The model we use is an extension of Varian's model [42], and we consider an oligopoly with three retailers. An oligopolistic model captures the severity of competition more robustly than a duopolistic model and is therefore preferred. Table 1 provides a list of variables. Each retailer sells a focal product P to two segments of customers, one that price compares and the other that is loyal to the retailer. Price-comparing customers buy product P from the retailer that lists it for less as long as the price is below their reservation price r. Loyal customers buy the focal product P from the retailer to which they are loyal. Following Varian, we assume a one-shot game of complete information where retailers choose prices of product P to maximize profits.

We introduce three extensions to Varian's [45] market structure. First, we assume that an α proportion of price-comparing buyers of product P also immediately buy the common outside product O from the same retailer. Note that the results of the model hold for all $\alpha\epsilon(0,1]$ and we set $\alpha = 1$ for brevity. We introduce this extension to capture the cross-selling effect of popularity, in which traffic generation is the key factor. The price of product O is exogenous to the model and the same across retailers. We assume no fixed costs and zero marginal cost, so that both p, the price of focal product P, and o, the price of outside product O, also represent profit margins for the respective products.

Second, we allow the sales quantity to be a function of sales rank. This extension is a result of popularity and the resulting traffic, reasons which are external to the model. We use a simplified version of Brynjolfsson, Hu and Smith [7] and Chevalier and Goolsbee [9] models and assume that sales rank R is linked to sales quantity due to customers who price compare for the focal product P as $Q = \frac{1}{R}$.[3]

In the third extension, we allow the reservation price r for product P to vary with the sales rank R (i.e., we treat the reservation price as r[R]). By making no a priori assumptions but allowing for a decreasing, constant and increasing reservation price r[R], we can capture the

[3] The relationship is originally given by $\text{Log}[Q] = \beta_1 + \beta_2 \text{Log}[R] + \varepsilon$, where $\beta_1 > 0$, and $\beta_2 < 0$. Brynjolfsson et al. (2003) estimate $\beta_1 = 10.526$ and $\beta_2 = -0.87$. In our model, we assume $\beta_1 = 0$ and $\beta_2 = -1$ for simplicity. The choice of these values allows for expositional simplicity while ensuring the generalizability of the model.