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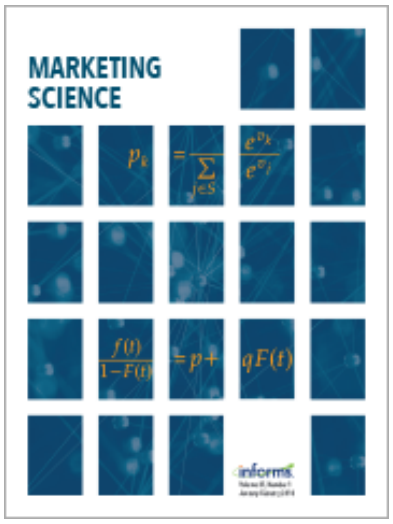

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Commentary

Optimal Pricing and Return Policies for Perishable Commodities

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The paper discusses the genesis of the 1985 paper "Optimal Pricing and Return Policies for Perishable Commodities," as well as the critical ideas presented in that research. A brief review of the literature that cited and expanded the results of the paper is also presented.

Key words: channel coordination; single-period inventory model; newsboy problem; revenue sharing; supply chain; perishable commodities

The Genesis of "Optimal Pricing and Return Policies for Perishable Commodities"

I became interested in the field of operations research because I saw it was a way of using mathematics to improve an organization's performance. It was with this perspective that I read an article in the February 18, 1982 issue of the *Wall Street Journal*, which reported that record manufacturers, seeing a decline in their profits, were moving from a policy that allowed record stores full credit for unlimited returns to a policy that only about 20% of the records purchased by the store could be returned for full credit. In reading this article I wondered where the figure of 20% came from. After calling a number of record manufacturers it became clear to me that the decision was based solely on an accounting perspective relative to profitability. I decided to see if 20% was the optimal return allowance and, more importantly, if one could determine a policy for returns of commodities like records that could optimize the channel profit. My approach for studying this problem was to use the single-period inventory model (newsboy problem) to model operations, hence, the inclusion of the words "perishable commodities" in the paper's title.

The decision to use the single-period inventory model was influenced by a consulting assignment I had a few years earlier in which I was hired to investigate the operations of a California donut chain to see if improvements in operations were possible. This business was interesting because, although the company owned the stores in which the donuts were sold, the store managers kept all of the operational "profits" earned by their stores. When I asked management how the parent company earned its money, I was told that some of the profits came from marking up the ingredients sold to the store managers (managers had to purchase ingredients from the parent company) and some of the profit came from the company charging each store an administrative fee based on a percentage of sales. Management indicated that approximately one-half of the profits were earned from the ingredient mark-up and one-half were earned from the administrative fees charged.

When I asked management why that was the case, the response was "that was how it had evolved over time." Not finding that explanation very satisfying, I decided to see whether such a strategy could be optimal. Given the shelf-life of donuts, it seemed natural to model the situation using the single-period inventory model. Using this approach, I was able to show that the optimal strategy would be for the company to sell the ingredients to the stores at cost and to compensate by increasing the administrative fee. Using such a strategy, if the store managers acted optimally, both the managers' and the parent company's profits would increase. The result of this work was published in *Interfaces* (see Pasternak 1980).

The Critical Ideas

Perhaps the key ideas of the paper were the inclusion of stochastic demand and the modeling of the channel using the single-period inventory model. While there had been previous work done on strategies that could achieve channel coordination (see, for example, McGuire and Staelin 1983, Jeuland and Shugan 1983, and Monahan 1984), these approaches had assumed that demand occurred on a deterministic

basis. The use of the single-period inventory model, a fairly simple and straightforward model to analyze, opened the way to analyzing many different supply chain problems.

The critical finding of the paper was that a policy that limited returns to a fixed percentage of the purchase amount could not optimize channel profits in a multiretailer environment, whereas a return policy that allowed for unlimited returns for a partial credit could. Over the past 22 years, this strategy has gained traction in a variety of industries. For example, the concept of revenue sharing (a mechanism equivalent to the full buy back at partial credit) has been embraced widely in the video rental industry. In revenue sharing, the retailer pays the manufacturer a lower amount for the good, but agrees to share any revenues collected from the sale or rental of the item with the manufacturer.

To illustrate that the full buy back for partial credit is equivalent to a revenue sharing model, consider the following example. A manufacturer sells a good to the retailer for \$6, which in turn the retailer sells for \$10. The manufacturer agrees to buy back all unsold items for \$4. This scheme is equivalent to the following revenue-sharing system. A manufacturer sells the item to the retailer for \$2, and the retailer sells it for \$10. The retailer agrees to remit a further \$4 to the manufacturer for each item sold.

Academic Literature

It is gratifying that "Optimal Pricing and Return Policies for Perishable Commodities" has led to such a large amount of subsequent research. The 1985 paper assumed that the manufacturer is the Stackelberg leader and that the per unit retail selling price, manufacturing cost, and salvage value are fixed exogenous values. There have been numerous papers that extend the model presented in the 1985 paper in which one or more of these assumptions have been relaxed. See, for example, Taylor (2001), Zhao and Wang (2002), Grannot and Yin (2005), Grannot and Yin (2007), and Lee and Rhee (2007). Other extensions of the research have dealt with such issues as sharing of information, rebate policies, revenue sharing policies, e-commerce, price protection/rebates, and competition in the supply chain. Among the papers that cite this research are: Tsay (1990), Donohue (2000), and Cachon and Lariviere (2001)—dealing with information sharing; Taylor (2002) and Lee et al. (2000)—dealing with rebate policies; Dana and Spier (2001), Pasternack (2002), and Cachon and Lariviere (2005)—dealing with revenue-sharing policies; Choi et al. (2004)—dealing with e-commerce; Lee et al. (2000), Taylor (2001), and Taylor (2002)—dealing with price protection/rebates; Padmanabhan and Png (1997), Cachon and Zipkin (1999), and Mantrala and Raman (1999)—dealing with competition in the supply chain.

While numerous papers have extended the results of "Optimal Pricing and Return Policies for Perishable Commodities," it is personally rewarding that work in the area of channel coordination continues some 20-plus years after its publication date. I expect that there will continue to be research done in this exciting area.

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