Optimizing Bundling Policy of Single-Period Products: Perspectives of Producers and Retailers

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ABSTRACT

Combining different product types into standard discount bundles is a common strategy used by producers and wholesalers to increase overall sales profitability. While markets consist of many producers and retailers, a deal is typically made between a single producer and a single retailer. This paper deals with a producer who sells items separately, and considers setting and selling standard discount bundles. The purchased wholesale bundles are unpacked by the retailer and the items are sold to the end-users one by one. Thus, the end-user demand distribution is unchanged, but the retailer’s order quantity grows with the magnitude of the discount. The paper explores the effect of bundle price and content on the profits of both the producer/wholesaler and the retailer, and derives a general objective function composed of a linear combination of these profits. Moreover, the paper establishes the conditions for bundling profitability and presents a way to optimize the profit of each party (producer, or retailer) without reducing the other party’s profit. A real-world case study and sensitivity analysis demonstrate the solution’s applicability. The results indicate that bundling can be a coordination tool for increasing expected profit for both the producer and the retailer.

Keywords: Bundling, Inventory, Newsvendor, Supply Chain Coordination, Supply Chain Management

1. INTRODUCTION

Selling discount bundles is a common strategy for increasing the sales and profitability of producers, wholesalers and retailers. Bundling means selling two or more products, of different types, as a single item, typically with a discount. Examples of bundling can be found across a wide range of products from various industries including food, clothing, cosmetics and electronics, (Stremersch & Tellis, 2002; McCardle et al. 2007). Bundling can also be found in financial product-offerings such as portfolios of shares, options, warrants, and bonds. For example, in order to increase the attractiveness of an “Initial Public Offering”...
(IPO), it is common to bundle the shares with some options (warrants) that can be exchanged for shares during a limited period of time by paying a known conversion fee (Chemmanur & Fulghieri, 1997).

There are several reasons why retailers and producers bundle products, such as reducing logistical costs, increasing market shares and sales, improving customer service, and increasing profitability. For the producer, it is critical to determine optimal bundle prices, optimal bundle content, and optimal production quantities, so as to maximize the its profit. The buyer (in our case, a retailer) strives to optimize his profit by selling the purchased goods whether as bundles, or as separate products. While the bundling literature has mainly analyzed infinite horizon inventory models, very scant work has been done on bundling for single-period purchase decisions, which is the subject of this paper. This paper is confined to single period items (items are either sold, or perished, or salvaged between any two replenishments.) Single-period bundle purchase decisions are frequently encountered in the supply chain. For example, retailers served by delivery truck-lines of perishable goods face these decisions daily. Thus, retailers face on-going single-period purchase decisions, in addition to the decisions that arise before holidays and special events. The bundling option makes these decisions different from those concerning the well-known newsvendor problem. In particular, the paper shows that the differences are related to the optimal bundle prices, bundle content, bundle order quantities, and profits.

The problem of optimizing the bundling policy is studied within the framework of a two-tier supply chain with one producer/wholesaler, and one retailer. In the case of brand-name products there is typically only one producer. In such a case, each retailer knows the demand distribution, and each deal is made between a single retailer and a producer. The pairwise relationship is valid also for deals of non-brand name products (a deal must have a selling and buying parties).

The producer has to decide whether to sell the separate products, or to bundle them. If bundling is chosen, the bundling content and the pricing strategy must be decided. In our scenario, the retailer buys the bundled goods, separates the content into its items, and sells them one by one to the end users (the final customers). Such a setting has the advantage of unchanged demand distribution of the end users for each product. Thus, the retailer has to decide how many products from each type to buy (whether bundled or unbundled.) Our analysis compares a pure bundling policy to a no bundle policy and shows that bundling may be an effective and profitable policy for both the producer/wholesaler and the retailer.

The article proceeds as follows: the next section reviews the related literature; the subsequent section presents definitions and basic results; then the succeeding section presents an example of uniformly distributed demands; and last section concludes the paper.

2. LITERATURE REVIEW

The relevant literature mainly relates to the newsvendor problem, and to bundling and packaging analyses. Hence, this review is divided into three parts: bundling analysis (the next sub-section), the newsvendor problem (the second sub-section) and bundling in the context of the newsvendor problem (third sub-section). Retailers’ inventory purchase decisions when discounts are offered but without bundling is presented by Li & Feng (2010).

2.1. Bundling Analysis

Burnstein (1960) and Stigler (1963) were the first to articulate the idea that bundling commodities could be profitable because it allows manipulation of the prices that affect customer demand. Afterwards, in an important and widely cited essay, Adams and Yellen (1976) considered two products, and the use of discount bundles. They showed that, under certain conditions, selling both the bundle and the separate prod-
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