



The profit benefits of bundle pricing of complementary products

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ABSTRACT

In an attempt to provide a framework that can help firms find optimum bundling product categories and pricing strategies that maximize their profits, this study develops a profit-maximization model. The results indicate that optimum bundles and price strategies exist; specifically, if a firm uses a bundling strategy to sell its products, it should combine highly complementary products and charge a relatively lower price. The value of a bundling strategy always increases with the size of market and price sensitivity. Managers can use the provided model framework and related advice and examples to plan their bundling strategies.

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1. Introduction

A common marketing strategy bundles complementary products and services, though the pricing of these bundles remains an extremely challenging task. Firms must consider various issues, including segmented customer demand, product-specific costs, and consumers' multiple options. Furthermore, bundling decisions have significant implications for monopoly power, level of welfare, and marketing strategies especially as integrated, unique solutions become more common as firms' central market offering. Finally, bundling can minimize consumer costs from 18% to 57%, depending on the number of items bundled, the value of those items, and the level of the variations (Estelami, 1999).

Because complementary product bundling can offer economies of scale, bundle choices and sizes are significant for both consumers and suppliers. Moreover, because the cross-elasticity of demand for complementary goods is negative – that is, demand for one complementary good creates demand for the other – firms can gain additional marketing power through bundling, and vendors can obtain optimal prices. For example, if they price the base good at a relatively low price, consumers are more likely to consider the secondary product.

Various examples of complementary product bundling describe the different approaches that firms have taken to this strategy. Michelin may be the pioneer of bundling; when it started publishing the Michelin guide, it provided tourists with information about gas stations, hotels, and restaurants, as well as maps and driving directions. But it also encouraged the use of automobiles, which boosted its tire business, making tourist

guides and automobile tires seemingly strange complements. More conventionally, DVD players and disks clearly are complementary and function as a system, just as computer hardware and software or season tickets and sporting events are. A perfect complement must be consumed with its complement; for example, demand for hot dogs creates parallel demand for buns, as well as for ketchup, mustard, and other related items.

These widespread actual examples have prompted various research models, though none of these models addresses optimal pricing and profit maximization for complementary products. We therefore propose a model in which the optimal price for complementary products depends on the degree of complementarity between the two products. A higher degree of complementarity produces a unique symmetric equilibrium, such that all consumers simultaneously buy both products. When the degree of complementarity is lower, asymmetric equilibrium exists, the firm behaves as a monopolist, and some consumers buy only the monopoly product while others always buy both. At intermediate complementarity levels, both types of equilibria exist.

In this context, the degree of complementarity should influence the advantages of bundling products and thus the optimum bundling that allows the firm to maximize its profit. According to Cournot (1938), if joint consumption is mandatory, firms should set a price based on the value of the joint consumption. Economides (1996) confirms this view by showing that a firm can charge higher prices by selling complementary products to customers who prefer the composite goods. The firm's sale therefore depends on the price of the bundle and the degree of product complementarity.

We propose a profit-maximization model to address three main research questions: What is the optimal pricing strategy when there is no bundling? What is the optimum product and pricing strategy when the firm uses bundling? What is the value of a bundling strategy to the firm if the market is large and consumers are sensitive to price?

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In the next section, we summarize relevant literature before we present our profit-maximization model with two different scenarios, depending on whether the firm uses or does not use a bundling strategy. The main results pertain to optimal policies and a sensitivity analysis; we also present the results of a numerical analysis that we conducted to provide further insights for firms. We end with some conclusions and managerial implications.

2. Literature review

In Table 1, we summarize prior studies of complementary product bundling and pricing. Despite the significant number of studies available, they do not confirm a single strategy that would always be best. Moreover, little research considers the optimal pricing of complementary products according to the degree of their complementarity.

Historically speaking, the rationales for bundling have included price segmentation (Stigler, 1968), price discrimination (Adams and Yellen, 1976), product range restrictions (Eppen et al., 1991), retail agglomeration (Oppewal and Holyoake, 2004), reduced classification or processing costs (Kenney and Klein, 1983), scope economies (Baumol et al., 1982), and risk reduction. Guiltinan (1987) provides a normative framework that integrates most of these rationales, and McAfee et al. (1989) propose a model based on this framework that indicates mixed bundling is the optimal strategy. The reservation

prices for the various products or services are independently distributed across the population of the consumers, and thus, as Schmalensee (1984) observes, the mixed bundling strategy generally yields higher profits than either pure bundling or a pure component strategy.

Venkatesh and Mahajan (1993) also propose a probabilistic model that a seller can use to determine the optimal price of a bundle with pure components, pure bundling, and mixed bundling strategies. This model estimates the maximum level of profits for each category and includes time and money as independent variables. However, their model is limited to a monopolistic environment; it cannot function in a competitive environment with multiple sellers and buyers, who influence both products that appear in the bundle and the prices. Nor does the model treat costs as a variable of the number of units sold, which creates a limitation in terms of economies of scale.

Venkatesh and Kamakura (2003) suggest an analytical model for optimal bundling strategies and price patterns in a monopolistic environment, which demonstrates the optimal solutions for complements and substitutes differ from those of independently valued products; marginal costs play a critical role in determining the optimal strategy. Consumers are willing to pay more for the bundle of complements than for standalone products. However, in this model, profit maximization is static and based on a bivariate uniform reservation price distribution system, with the assumption that the reservation prices for the

Table 1
Studies of complementary product bundling.

Types of complementary bundling strategies	Types of complements	Author	Type of study	Research focus
Price segmentation	Movie bundles	Stigler (1968)	Theoretical	Developed a theory for package bundling.
Price discrimination	Variety of goods in package	Adams and Yellen (1976)	Theoretical	Developed the concept of commodity bundling or package selling.
Price bundling	Movie bundles	Tellis (1986)	Theoretical	Introduced the concept of price bundling.
Price bundling	Banks, health clubs, hotels	Guiltinan (1987)	Theoretical	Proposed a framework for determining the optimal conditions for mixed bundling strategies.
Price optimization	Variety of goods in package	Rosenthal et al. (1995)	Theoretical	Developed a linear programming model that minimizes the total purchasing costs.
Product optimization	Variety of goods in package	Van Buer et al. (1997)	Theoretical	Developed a model that minimizes the purchasing costs of buying multiple bundles from multiple vendors.
Product optimization	Variety of goods in package	Sarkis and Semple (1999)	Theoretical	Developed a model that minimizes the purchasing costs of buying a product from multiple vendors.
Optimal bundle pricing	Multiple software modules	Hanson and Martin (1990)	Empirical	Proposed a model for calculating the optimal price based on the products in the bundle.
Bundle pricing	Retail	Mulhern and Leone (1991)	Empirical	Demonstrated that interdependencies in demand for items in a bundle can be incorporated into the retail industry.
Bundle pricing	Season tickets	Venkatesh and Mahajan (1993)	Empirical	Proposed a probabilistic model for bundle packaging under pure components, pure bundling, and mixed bundling strategies.
Optimal number of items in the bundle	Season tickets for events	Ansari et al. (1996)	Empirical	Proposed a model in which the optimal number of items in the bundle is determined endogenously for pure and mixed bundling strategies.
Commodity bundling	Variety of goods in package	Foster (1991)	Theoretical	Introduced the concept of bundling for promotions.
Optimal bundling services	Variety of goods in package	Bennett and Robson (2001)	Theoretical	Demonstrated that business associates prefer bundled service combinations rather than separate services.
Bundle options for multicomponent system	Industrial systems	Wilson et al. (1990)	Theoretical	Studied the risk and benefit of selling in a bundled system, unbundle and sell components individually, or sell some of the components individually and withdraw from selling other components of the system.
Price and product bundling	Luggage sets	Yadav and Monroe (1993)	Empirical	Developed and tested two models: one for the bundle's acquisition value and the other for the transaction value.
Bundling of focal and ancillary products	Variety of goods in package	Puri (1998)	Empirical	Observed that consumers evaluate an ancillary product as having greater value when it is bundled with a focal product.
Multiple product bundling	Variety of goods in package	Mazumdar and Jun (1993)	Empirical	Observed that the consumers respond more favorably to multiple price decreases of a bundle than a single price discount.
Multiple product bundling	Subscription to journals over the Internet	Chuang and Sirbu (1999)	Empirical	Proposed a bundling model with multidimensional consumer preference in a multiproduct monopolistic environment.
Multiple product bundling	Bundling in the automobile, travel and banking industries	Wappling, Strugnell and Farley (2010)	Descriptive	Explored the reasons for bundling, the influence of bundling strategies on consumers, and consumers' ability to influence product bundles in the automobile, travel and banking industries.
Multiple services bundling	Bundling in the tourism sector	Oppewal and Holyoake (2004)	Empirical	Explored the effect of bundling on shopper behavior under increased competition.

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