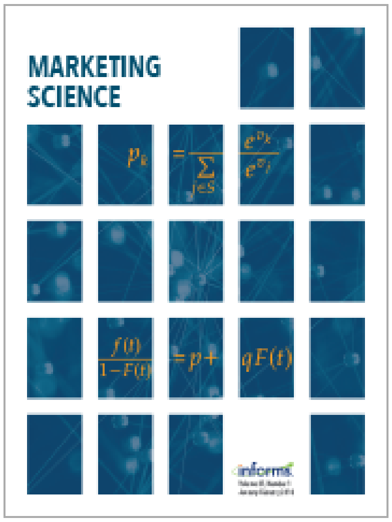


Marketing Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Why Bundle Discounts Can Be a Profitable Alternative to Competing on Price Promotions

Subramanian Balachander, Bikram Ghosh, Axel Stock,

MARKETING SCIENCE
Vol. 29, No. 4, July–August 2010, pp. 624–638
ISSN 0732-2399 | EISSN 1526-548X | 10 | 2904 | 0624
DOI 10.1287/mksc.1090.0540

Why Bundle Discounts Can Be a Profitable Alternative to Competing on Price Promotions

Subramanian Balachander
Krannert School of Management, Purdue University, West Lafayette, Indiana 47906,
sbalacha@mgmt.purdue.edu

Bikram Ghosh
Moore School of Business, University of South Carolina, Columbia, South Carolina 29208,
bghosh@moore.sc.edu

Axel Stock
College of Business Administration, University of Central Florida, Orlando, Florida 32816,
astock@bus.ucf.edu

Price promotions and bundling have been two of the most widely used marketing tools in industry practice. Past literature has assumed that firms respond to price promotions by promoting a product in the same category. In this paper, we extend this literature as well as the bundling literature by considering the possibility that a firm may respond to a competitor's price promotions by also offering a cross-buying or bundling discount. Using a game-theoretic model, we show that bundle discounts can help increase profits in a competitive market by creating endogenous loyalty, thereby reducing the intensity of promotional competition. We also find that bundle discounts can be used as an effective defensive marketing tool to prevent customer defection to the competition.

Key words: bundling; competitive marketing strategy; game theory; price promotions; brand loyalty
History: Received: December 16, 2008; accepted: September 14, 2009; processed by Chakravarthi Narasimhan. Published online in *Articles in Advance* December 2, 2009.

1. Introduction

Many firms use price promotions as part of their marketing mix to appeal to price-sensitive customers. However, competitors may respond with their own price promotions to counteract any advantages that accrue to the firm offering price promotions. Indeed, Blattberg and Neslin (1990, p. 110) suggest that because of competitive reactions, price promotions may result in a prisoners' dilemma in which all competing firms may not see any increase in profits from the price promotions and may likely see lower profits. On the other hand, anecdotal evidence from the industry suggests that a firm may more effectively respond to a competitive price promotion environment by offering price discounts to customers who purchase a bundle of more than one product from the firm. For example, in 2004, Cox Communications Inc. started offering bundle discounts to consumers who purchased phone, cable, and broadband Internet services as a package (*Wall Street Journal* 2004) and so did other telecommunication companies. According to that article, the firms offering such bundle discounts benefit from these deals "because package customers tend to stay longer." The article further reports Cox's vice president of product marketing and management as saying that "customers who sign up for packages defect to competing services at about half the rate of basic cable customers."

Similarly, in the wireless phone industry, when firms competed for subscribers by offering bargain deals, the result was increased customer turnover or "churn," which was costly to firms (Carlton 1997). However, these firms found that offering bundle discounts for the purchase of other services such as discounted long-distance services was an effective deterrent of churn. As another example, banks in the United States increasingly resorted to offering bundle discounts in the late 1980s after years of primarily competing on the basis of interest rates charged for loans and deposits (*Wall Street Journal* 1989). Banks found that consumers purchasing bundles were likely to be more loyal as did CitiCorp with its CitiOne product (Eppen et al. 1991). Bundle discounts in the banking industry have come to stay as banks offer discounts such as free checking or reduced mortgage costs for customers who do more business with them (*Wall Street Journal* 2003).

These examples suggest that firms find bundle discounts to be an effective strategy that reduces customer switching in a competitive environment where firms may offer price promotions to steal competitors' customers. In contrast, a common thread in the literature on competitive bundling is that bundling by all competitors results in lower profits for all. The main result in this area stems from Matutes and Regibeau (1992), who analyze two firms competing in two complementary product categories and show that one or both firms may not offer bundle discounts in equilibrium to avoid intensifying price competition. The intuition is that head-to-head price competition between competing bundles lowers profit. Matutes and Regibeau (1992) also find that when both firms do offer bundle discounts in equilibrium, the equilibrium is a prisoners' dilemma in which both firms make lower profits in comparison to an equilibrium in which neither firm engages in bundle discounts. Recent analysis by Gans and King (2006) of competition between two firms in two independent categories also leads to similar conclusions. An exception to this general notion that bundling by competitors decreases profits is Ghosh and Balachander (2007). However, Ghosh and Balachander (2007) consider a special case in which the competing firms that resort to bundling offer differentiated products in one category and undifferentiated products in another. To summarize, in contrast to the anecdotal evidence presented earlier, the overall theme of the competitive bundling literature is that bundling by competitors decreases profits by intensifying price competition.

It is worth nothing that the analyses in the bundling literature described above do not involve a discussion of competitive price promotions. Indeed, a separate literature has studied price promotions and likened such promotions to mixed strategies on prices (e.g., Shilony 1977, Varian 1980, Narasimhan 1988, Raju et al. 1990). The focus of this literature has been to characterize the mixed strategies used in a product category under various conditions (e.g., varying number of informed consumers or loyal consumers) to provide insight into the depth and frequency of price promotions under these conditions. However, to the best of our knowledge, the effect of bundle discounts on competitive price promotions has not been studied in this literature because the analyses have typically focused on price promotions in a single category. By examining price promotions and bundle discounts in a single framework, our paper bridges the streams of literature on these two subjects. More important, in contrast to the general theme of the bundling literature that bundling reduces profit by intensifying price competition, we establish that bundle discounts can increase profit in comparison to a scenario where firms compete simply on price promotions. Thus, our results help explain the industry evidence that appears to be contrary to findings on bundling in the literature. Our analysis also shows that bundle discounts increase profit by preventing defection of price-sensitive customers, consistent with the anecdotal evidence presented above.

We analyze a game-theoretic model in which two firms sell a product in each of two categories and compete by setting prices for the products and by offering a bundle discount, if any. In each category, there are customers who are loyal to each firm as well as switchers who purchase from the firm offering the lowest price. We analyze two scenarios: (1) a "base game" where firms compete by only setting prices in each category, and (2) a "cross-category game" where firms compete by setting prices as well as by offering a bundle discount, if any, to customers who purchase both products. Whereas firms in the base game are concerned only with the distinction between loyal customers and switchers in a category, decision making for the cross-category game requires firms to consider other possibilities. For example, customers could be partial loyals in the sense of being loyal in one category and a switcher in the second, or be a switcher in both categories ("complete switchers"). It turns out that this fine-grained segmentation that results from taking a cross-category perspective leads to crucial differences in the strategies and profits between the two games. In particular, we show that both firms may enjoy higher profits in equilibrium when offering bundle discounts in contrast to previous results in the bundling literature (cf. Matutes and Regibeau 1992). The intuition is that bundle discounts create "endogenous loyalty" among partial loyals while also leading to better appropriation of the customer surplus by the firms through better customer segmentation. The notion of endogenous loyalty refers to the lower willingness to pay induced in a switcher for a competing product as a result of a bundle discount. This endogenous loyalty makes it difficult for a firm to attract a competitor's partial loyals and, thus, relaxes competition on price promotions in comparison to the base game.

An alternative explanation of the anecdotal evidence presented earlier is that bundle discounts entice customers to purchase multiple products, thereby raising customer switching costs and reducing customer turnover (Eppen et al. 1991, Kamakura et al. 2003). These switching costs may include costs incurred to purchase or to learn to use a competitor's product (Klemperer 1987). However, we assume no such exogenous switching costs and still show that bundling can deter customer switching. Indeed, the "endogenous loyalty" that is instrumental in reducing customer switching and increasing profits in our model results only from the pricing strategy of using bundle discounts and does not rely on exogenously specified switching costs such as learning or transaction costs.[1] Apart from the strategic motivations for bundling discussed above, it is important to note that bundling can also reduce production or selling costs, as is the case for automobile manufacturers who typically offer bundles of accessories (Eppen et al. 1991).

The rest of the paper is organized as follows. Following a literature review in the next section, we outline our modeling framework in §3 and discuss our analytical results in §4. Finally, in §5, we conclude with a summary of our main conclusions and a discussion of areas for further research. All proofs are relegated to an electronic companion to this paper, available as part of the online version that can be found at http://mktsci.pubs.informs.org.

2. Literature Review

Our paper contributes to both the literature on bundling and the one on price promotions, which, as we have noted earlier, have been separate research streams. The early literature on bundling analyzes bundling decisions of a multiproduct monopolist firm. Stigler (1968) shows that a monopolist can gain by bundling because it can help extract additional customer surplus. Adams and Yellen (1976) show that a monopolist can generally do strictly better with mixed bundling (selling the individual products as well as the bundle) than with pure bundling (selling the bundle alone). Schmalensee (1984) and Venkatesh and Kamakura (2003) extend these results to more general settings.

A second stream of literature looks at the competitive aspects of bundling. Whinston (1990) shows that bundling can help a firm leverage its monopoly power in one product market to induce exit and deter entry of competitors in a second product market. The intuition is that bundling makes the firm aggressive in its pricing in the second market (see also Tirole 1988, p. 334). Matutes and Regibeau (1992) consider use of bundling by two firms competing against each other in two product categories that are perfect complements. They show that when the equilibrium entails all competitors using mixed bundling, the firms make lower profits relative to the scenario where no firm offers bundled products—resulting in a prisoners' dilemma. Under other conditions, Matutes and Regibeau (1992) find that one or both firms may refrain from offering bundle discounts to avoid intensifying price competition. Research by Gans and King (2006) also shows similarly that two firms that sell competing products in two independent categories would choose not to offer bundle discounts in equilibrium to avoid intensifying price competition between them. In contrast to Matutes and Regibeau (1992) and Gans and King (2006), we find that competing firms enjoy a higher profit when offering bundle discounts in equilibrium.[2]

As noted in the introduction, Ghosh and Balachander (2007) also find a profitable equilibrium that involves bundling by all competing firms. However, they consider a specialized situation in which firms compete in a differentiated product category and an undifferentiated category. They find that pure bundling can increase profits by avoiding head-to-head competition in the undifferentiated product category. In contrast to Ghosh and Balachander (2007), we consider symmetric categories and the possibility of price promotions, and we find that the higher profit from bundling results from a reduction of price competition for partial loyals in both categories. Moreover, they obtain pure bundling in equilibrium, whereas we obtain mixed bundling similar to Matutes and Regibeau (1992).

An important point of difference between our paper and the rest of the bundling literature is that we consider the effect of bundle discounts in a competitive context where price promotions occur without such discounts. Because the extant literature on competitive price promotions does not consider bundle discounts, we contribute to this stream of literature as well. Interpreting mixed strategies in a static game as price promotions, Varian (1980) shows that firms may use such mixed strategies to price discriminate between uninformed and informed consumers in equilibrium. Narasimhan (1988) and Raju et al. (1990) also interpret mixed strategies as promotions to analyze the effect of brand loyalty on the depth and frequency of price promotions used by firms. Narasimhan (1988) analyzes a model in which two brands compete in a market consisting of brand-loyal consumers and switchers. He shows that firms use price promotions in equilibrium to attract switchers while minimizing losses from brand-loyal consumers. He then characterizes the depth and frequency of price promotions as a function of the sizes of the brand-loyal and switcher segments. Raju et al. (1990) analyze price competition between asymmetric

[1] Note that although Klemperer (1987) analyzes the effect of exogenous switching costs on price competition for a single product, the explanation that bundling reduces price competition by raising exogenous switching costs needs more formal analysis. In particular, it is unclear why inducing purchase of multiple products by individually discounting the separate products cannot have the same effect as offering bundle discounts.

[2] Chen (1997) illustrates a situation where price competition is relaxed when one of two competing firms in a product market bundles its product with a competitively supplied product. However, Chen does not consider firms competing in both markets, unlike the papers discussed here.

brands and show that the brand with the stronger loyalty promotes less frequently but offers deeper promotions than the brand with weaker brand loyalty in equilibrium.

Whereas the aforementioned studies analyze promotional competition between firms in a single product category, we contribute to this literature by taking a multicategory perspective that involves bundle discounts. Dhar and Raju (1998) also take a multicategory perspective but use a reduced-form model of consumer response to coupons to study "cross-ruff" coupons.[3] These coupons are provided with the purchase of a branded product but can only be used to subsidize the purchase of another branded product in a different category. Thus, cross-ruff coupons are similar to bundle discounts for multicategory purchases. Dhar and Raju show that cross-ruff coupons can increase sales and profits in comparison to coupons that induce repurchase of the brand that was originally purchased. They also examine the implications of asymmetry in the strengths of the brand offering the cross-ruff coupon (carrier brand) and the brand for which purchase the coupon can be redeemed (target brand).

3. Model

We consider two firms, A and B, selling one product in each of two product categories. Following the larger bundling literature, we assume that each customer in the market has demand for at most one unit of a product in each category (see Schmalensee 1984, Matutes and Regibeau 1992, Chen 1997). This may be an appropriate assumption for banking and telecommunication services, for example, where consumers typically purchase one unit of the product (checking accounts and mortgages or telephone and broadband connections). Similar to the literature on price promotions (Narasimhan 1988, Raju et al. 1990), we allow for each category discrete segments of customers who differ in their willingness to switch between the firms to get a lower price. More specifically, in each category, there are customers who are "loyal" to firm A, customers who are "loyal" to firm B, and a "switcher" segment that buys the product from the firm with the lower price. If both firms charge the same price, we assume that they share the switchers equally. Unlike switchers, loyals buy a product only from their preferred firm as long as its price is below their reservation price (cf. Narasimhan 1988). We assume that loyals and switchers have reservation prices of R and r, respectively, with $r < R$. The assumption that $r < R$ is consistent with the notion that brand loyals have a higher willingness to pay for a product than switchers (East et al. 1995). Sobel (1984) also makes a similar assumption. As noted in §1, we do not assume any exogenous switching costs for customers who purchase a firm's product. Therefore, a customer's willingness to pay for a firm's product as specified earlier is independent of his previous purchase (no state dependence), and a static model as presented here is sufficient for our analysis.

Following the larger bundling literature (e.g., Stigler 1968, Schmalensee 1984), we assume that the demand (reservation price) for the two product categories are independent (they are neither substitutes nor complements).[4] Demand independence implies that a customer's reservation price for one product is independent of the price of the other product. A further motivation for the independence assumption is to exclude demand correlation between product categories as a driving factor for the results obtained in a bundling context.

Because our analysis considers possible bundle discounts across the two categories, we need to specify how a customer's loyalty varies across the two categories. We assume that there is a segment of customers who are switchers in both categories while customers who are loyal to a firm in one category are equally likely to be one of three types in the other category: loyal to the same firm, loyal to the other firm, or a switcher. Although loyalty to a firm may be positively correlated across categories (e.g., Singh et al. 2005, Hansen et al. 2006), by assuming that loyalty in one category is equally likely to be associated with the three possible preference structures in the second category, we abstract away from correlation issues that may influence the analysis. Our main results are not sensitive to assuming some correlation in loyalty across the categories as we discuss later. However, empirical studies find that the correlation in a consumer's preference for a firm across categories is far from perfect (Singh et al. 2005).

[3] A reduced-form model is typically formulated at the phenomenon level (e.g., purchase probability increases with a price discount) as opposed to a structural model that is built at a more theoretical level of agents (consumers or firms) behaving optimally. This optimal behavior, in turn, leads to predictions at the phenomenon level. An advantage of a reduced-form model is that it is typically simpler to set up and may involve fewer parameters. However, the intuitive insights may be fewer because the optimizing agents' behavior is not fully modeled. Furthermore, the assumptions made at the phenomenon level in the reduced-form model may become less valid for some conditions. For example, a change in the level of price discounts may provoke competitor reaction, which may change the consumer response to the discount at the phenomenon level (see Chintagunta et al. 2006 for further discussion of this issue in an empirical context).

[4] The assumption of independence may also be reasonable for some of the products used in the motivating examples. For example, the opening of a checking account is unlikely to change the value of a mortgage to a consumer. Similarly, the value of Internet services is unlikely to be influenced by whether a consumer has phone services (see Liu et al. 2008 for supporting evidence).

Table 1 Distribution of Customers

	Product category 2		
Product category 1	Loyal to A	Loyal to B	Switchers
Loyal to A	1 (I)	1 (II)	1 (III)
Loyal to B	1 (IV)	1 (V)	1 (VI)
Switchers	1 (VII)	1 (VIII)	K(IX)

Note. In each cell, the first character denotes the segment size followed by the segment label in parentheses.

Given our assumptions on the relationship between customer firm preferences in the two categories, the market consists of nine customer segments as shown in Table 1. We refer to customers who are loyal to the same firm in both categories (segments I and V in Table 1) as complete loyals and customers who are loyal to a different firm in each category (segments II and IV) as split loyals. Furthermore, we denote customers in segments III, VI, VII, and VIII as partial loyals because they are loyal to one firm (A or B) in one product category and are switchers in the other product category. We sometimes refer to segments III and VII as firm A's partial loyals (because they are loyal to firm A in one of the categories) and segments VI and VIII likewise as firm B's partial loyals. Last, we call customers in segment IX, who are switchers in both categories, "complete switchers." Given our assumption that loyalty to a firm in one category is equally likely to be associated with each of the three possible customer types in the other category, the sizes of segments I–VIII are all equal, and we normalize this size to be one without loss of generality (see Table 1). We assume the size of the complete switcher segment to be K, with $K > 0$.[5]

We assume that both firms have identical marginal costs for their products in each category, and we assume these costs to be zero without loss of generality. We denote the price charged by firm i for product c as P_{ic} and use δ_i ($\delta_i \geq 0$) to denote firm i's bundle discount for customers who buy both products from it with $i = A, B$, and $c = 1, 2$. We analyze a game with the following sequence of moves. In the first stage, firms simultaneously choose prices for both of their products and the amount of bundle discount. In the second stage, customers purchase the product(s) that maximize their surplus, and profits are realized. Because the amount of bundle discount can be changed as easily as prices, it is reasonable to assume that firms make both of these decisions simultaneously. In our analysis, we solve for symmetric equilibria in firm strategies. In the following analysis, we only consider equilibria that are symmetric across the two categories for each firm; i.e., those in which the prices or pricing distributions are identical for the two products sold by a firm. In most cases, the equilibrium that we determine is also symmetric across the two firms; i.e., the prices or pricing distributions are identical across firms. Thus, when we state that an equilibrium is symmetric in the ensuing analysis, we imply symmetry across firms because we only consider equilibria that are symmetric across categories for a firm.

[5] Although our model assumes that the sizes of the complete, split, and partial loyal segments are the same, the results qualitatively remain the same if the sizes of the segments are unequal.

Table 2 Firm's Demand in a Category for Base Game

$$Q_{ic} = \begin{cases} 0 & \text{if } P_{ic} > R, \\ 3 & \text{if } r < P_{jc} < P_{ic} \leq R, \\ 4 + \dfrac{K}{2} & \text{if } P_{ic} = P_{jc} \leq r, \\ 5 + K & \text{if } P_{ic} < \min\{r, P_{jc}\} \\ & i, j = \{A, B\}, i \neq j, c = 1, 2. \end{cases}$$

4. Analysis

To understand how a bundle discount may affect the competition between firms in the two categories, it is useful to first consider the base case where firms do not use bundle discounts. In this base case, which we refer to as the base game, each firm competes in each category solely on the basis of the price of its product in that category. This game serves as a benchmark for our subsequent analysis in which firms may also offer bundle discounts. We refer to the latter game as the cross-category game.

4.1. Base Game

Because firms compete by setting prices category by category in this case, the analysis can be done by category and is similar to previous analyses on price promotions (cf. Narasimhan 1988, Raju et al. 1990). Note from Table 1 that, in each category, there are three loyals for each firm and $K + 2$ switchers. Thus, the number of switchers in a category increases as K increases. Table 2 presents the demand Q_{ic} for firm i in category c, $i = A, B$, and $c = 1, 2$. The demand function shows that there is a discontinuity in the demand when firms' prices are equal and below r. This discontinuity can give rise to mixed strategies as is seen from Proposition 1, which summarizes the equilibrium results in the base case.

Proposition 1. *In the base game,*

(i) *When $R/r > 5/3$ and $0 < K < \underline{K} = 3R/r - 5$, the unique equilibrium in each category is a pure-strategy equilibrium in which each firm charges $P^* = R$ for each product making a profit of $3R$ per category and a total profit of $6R$.*

(ii) *When $R/r > 5/3$ and $K > \underline{K}$ or when $1 < R/r < 5/3$, there is no pure-strategy equilibrium. However, there exists a unique symmetric mixed-strategy equilibrium in each category in which both firms randomize prices using the cumulative distribution function $F(p)$ given below and make an expected profit of $3R$ per category resulting in a total profit of $6R$:*

$$F(p) = \begin{cases} 1 & \text{if } P \geq R, \\ \dfrac{3(R-r)}{(2+K)r} & \text{if } r < P < R, \\ \dfrac{(5+K)P - 3R}{(2+K)P} & \text{if } \dfrac{3R}{5+K} \leq P \leq r, \\ 0 & \text{if } P < \dfrac{3R}{5+K}. \end{cases}$$

Consistent with the literature (Narasimhan 1988), we interpret the pure-strategy equilibrium in Proposition 1(i) as an equilibrium without price promotions. Intuitively, when switchers have a low reservation price or the number of switchers in a category is small, firms do not have an incentive to charge a low promotion price to attract switchers because the loss in margin on the products as a result of the lower price cannot be offset by selling enough additional units. Therefore, firms are better off selling only to loyal customers at a high price and offering no price promotions. On the other hand, when the reservation price of switchers is not much lower than R or when it is significantly lower than R but the switching segment is sufficiently numerous ($K > \underline{K}$), firms have an incentive to cut prices to attract switchers to increase profit. In this case, there is no pure-strategy equilibrium because a competing firm can undercut the firm offering a price cut, which can lead to further undercutting, and so on. Nevertheless, there is a unique symmetric mixed-strategy equilibrium as noted in Proposition 1.

In this equilibrium, firms randomize over prices in each product category to attract the switchers in the market. Consistent with past studies (Varian 1980, Narasimhan 1988, Raju et al. 1990), we can interpret such mixed strategies as price promotions. Given our interest in the effect of bundling on price promotions, we are more interested in this particular equilibrium. Some characteristics of the mixed-strategy equilibrium are as follows. First, even though firms sell to switchers with positive probability, note that, in each category, both firms make an expected profit of $3R$, which is the same profit that could be had by selling only to its loyals. Thus, the incremental profit from switchers is competed away in this equilibrium, consistent with the idea that price promotions ultimately may not increase profit because of competitive reaction (Blattberg and Neslin 1990).

Second, similar to the previous literature, we can characterize the frequency and depth of price promotions suggested by the mixed-strategy equilibrium. To do so, we interpret any price that is below the highest possible price in the support of a firm's mixed strategy as a price promotion (cf. Narasimhan 1988, Raju et al. 1990). The highest price charged under the equilibrium mixed-strategy distribution presented in Proposition 1 is R, at which price there is a mass point. Interpreting prices below R as price promotions, we find that the frequency of price promotion in equilibrium increases with K. Furthermore, we can calculate the depth of the price discount as given by the difference between R and the "promotional price." It can be seen by inspection of $F(P)$ that the maximum value of the depth of the promotional discount also increases with K. These results are consistent with intuition that an increase in the number of switchers is likely to increase the frequency of price promotions and the maximum discounts offered.

Third, given the anecdotal evidence that bundle discounts decrease customer loss to competition, it may be useful to compare the calculated probability of serving switchers in the base game with that obtained in the cross-category game. The probability that a firm serves switchers when it charges a price of P is $1 - F(P)$. (Note that a firm always serves its loyals.) With the firm charging P with the probability density function $f(P)$ (corresponding to the cumulative distribution function $F(P)$) in equilibrium, we can compute ϕ_B, the firm's probability of serving switchers in a single category, as follows:

$$\begin{aligned} \varphi_B &= \int_{\underline{P}}^{r} (1 - F(P)) f(P)\, dP \\ &= \frac{(K^2 + 4K - 5)r^2 + 18rR - 9R^2}{2(2+K)^2 r^2}. \end{aligned} \tag{1}$$

We find that the probability of serving switchers increases with K. We saw earlier that both the frequency and maximum depth of promotional discounts offered by a firm increase with K. This increase in a firm's promotional intensity increases the probability of serving switchers even though the promotional intensity of the competing firm also increases. In §4.2, we analyze the scenario where firms can offer a cross-category promotion in the form of a bundle discount.

4.2. Cross-Category Game

In the base game discussed earlier, firms engage in "category-by-category" profit maximization. When a firm considers a single category, the only relevant segmentation is whether customers are switchers or loyal to a firm. In other words, all switchers are the same irrespective of whether customers are switchers in one category (partial loyal) or both categories (complete switcher). However, when a firm takes a cross-category perspective in formulating its pricing strategy, a partial loyal customer is distinct from a complete switcher because the former is willing to pay $(R+r)$ for a bundle of two products compared to a complete switcher who is only willing to pay $2r$. This perspective raises the possibility of firms using bundle discounts to achieve a finer segmentation of the market. However, would competition prevent a firm from achieving higher profits from such bundle discounts, as might be inferred from the bundling literature? Alternatively, even when using bundle discounts, could promotional competition for price-sensitive segments preclude any increase in profit, as was the case in the base game? We address these questions in this section.

A bundle discount is a price reduction to customers who buy both products from the same firm. When a firm offers a bundle discount, a customer's demand for each product category depends not only on the price of the product in that category but also on the price of the product in the other category and the bundle discount. Table 3 presents the demand faced by a firm in a category when using a bundle discount. The electronic companion describes how the demand function is derived. As Table 3 shows, there are principally two cases (Cases I and II) giving rise to different shapes of the demand function. In Case I, unlike Case II, a customer who purchases from firm A in category 1 also purchases from firm A in category 2 because of the bundle discount. Figure 1 shows representative shapes of a firm's (firm A) demand for its product in a category (category 1) for the two cases (the demand curve may vary somewhat from these generalized shapes depending on the prices and the bundle discounts offered by the firms). Of interest are the price points at which firm A's demand expands beyond the loyals (three units) to include switchers. Note that firm A can attract its partial loyals who are switchers in category 1 (segment VII)—and the complete switchers (segment IX) when Case I applies—even when it prices above P_{B1} as long as its price is below $P_{B1}+\delta_A$. Conversely, it attracts firm B's partial loyals who are switchers in category 1 (segment VIII) only when it prices δ_B below firm B's price of P_{B1}. Thus, the firms' bundle discounts provide a cushion against low competitive prices that can potentially steal switchers away from them. We can interpret the bundle discount as an "endogenous loyalty" induced by a firm's strategy as opposed to the exogenous loyalty modeled in Narasimhan (1988) and Raju et al. (1990) wherein a consumer switches to a competitive brand when the latter's price is sufficiently lower than the consumer's exogenously preferred brand. Note that our model also has exogenous loyalty in the form of loyal segments who only buy from their preferred firm in a category.

Table 3 **Firm's Demand in a Category for Cross-Category Game**

***Case* I: $P_{i3-c} \le P_{j3-c} + \delta_i$**

$$Q_{ic}=\begin{cases} 0 & \text{if } P_{ic} > \mathrm{Max}\{R,\, 2R-P_{i3-c}+\delta_i\},\\ 1 & \text{if } R \le P_{ic} \le \mathrm{Max}\{R,\, 2R-P_{i3-c}+\delta_i\},\\ 3 & \text{if } \mathrm{Min}\{P_{jc}+\delta_i,\, R+r-\mathrm{Min}\{P_{i3-c}, R+\delta_i\}+\delta_i,\, r+\delta_i\} < P_{ic} \le R,\\ 4 & \text{if } \mathrm{Min}\{2r-\mathrm{Min}\{P_{i3-c}, r+\delta_i\}+\delta_i,\, r+\delta_i\}\\ & \quad \le P_{ic} \le \mathrm{Min}\{P_{jc}+\delta_i,\, R+r-\mathrm{Min}\{P_{i3-c}, R+\delta_i\}+\delta_i,\, r+\delta_i\},\\ 4+K & \text{if } \mathrm{Min}\{P_{jc}-\delta_{3-i},\, r\} < P_{ic} \le \mathrm{Min}\{2r-\mathrm{Min}\{P_{i3-c}, r+\delta_i\}\\ & \qquad +\delta_i,\, r+\delta_i\},\\ 5+K & \text{if } P_{ic} \le \mathrm{Min}\{P_{jc}-\delta_j,\, r\}. \end{cases}$$

***Case* II: $P_{i3-c} \ge P_{j3-c} + \delta_i$**

$$Q_{ic}=\begin{cases} 0 & \text{if } P_{ic} > \mathrm{Max}\{R,\, 2R-P_{i3-c}+\delta_i\},\\ 1 & \text{if } R \le P_{ic} \le \mathrm{Max}\{R,\, 2R-P_{i3-c}+\delta_i\},\\ 3 & \text{if } \mathrm{Min}\{P_{jc}+\delta_i,\, R+r-\mathrm{Min}\{P_{i3-c}, R+\delta_i\}+\delta_i,\, r+\delta_i\} < P_{ic} \le R,\\ 4 & \text{if } \mathrm{Min}\{P_{jc}-\delta_j,\, r\} < P_{ic} \le \mathrm{Min}\{P_{jc}+\delta_i,\, R+r\\ & \qquad -\mathrm{Min}\{P_{i3-c}, R+\delta_i\}+\delta_i,\, r+\delta_i\},\\ 5+K & \text{if } P_{ic} \le \mathrm{Min}\{P_{jc}-\delta_j,\, r\}. \end{cases}$$

4.2.1. Pure-Strategy Equilibrium. We begin first by characterizing the pure-strategy equilibria of the cross-category game.

Proposition 2. *In the cross-category game,*

(i) *When $7/5 < R/r \le 3$ and $0 < K \le K^*$, there exists a symmetric pure-strategy equilibrium in which both firms charge $P^* = R$ in both categories and offer a bundle discount of $\delta^* = R - r$, making a total profit of $5R + 3r$, with $K^* = \min[(1/2)(5R/r - 7),\, (3/2)(R/r - 1)]$ implying that*

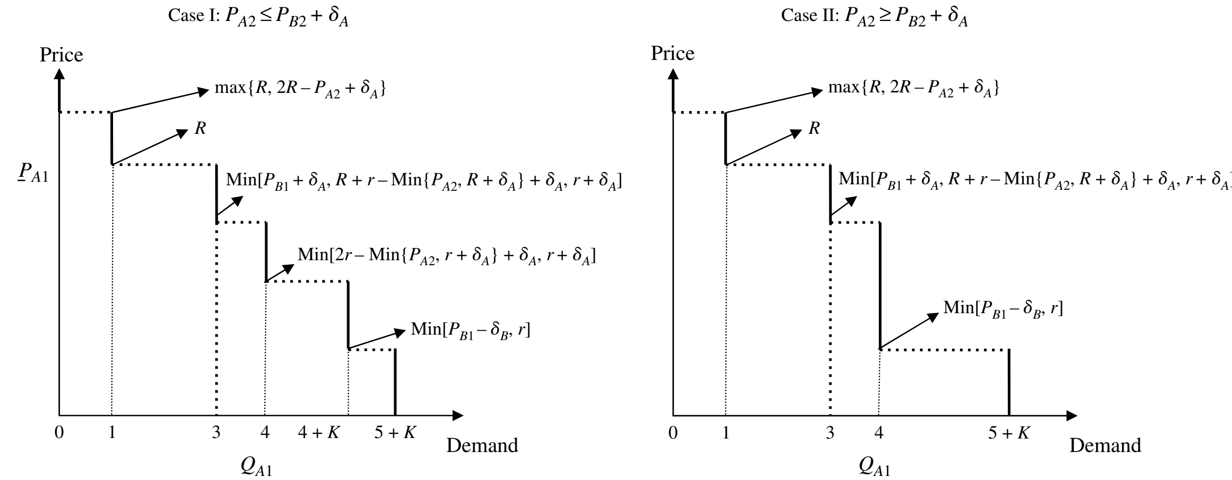
$$K^* = \begin{cases} (3/2)(R/r-1) & \text{if } 2 \le R/r \le 3,\\ (1/2)(5R/r-7) & \text{if } 7/5 < R/r \le 2. \end{cases}$$

(ii) *If $K \le 2R/r - 3$ and $R/r \ge 3$, there exists a symmetric pure-strategy equilibrium in which both firms charge $P^* = R$ in both categories and offer a bundle discount of $\delta^* = 0$, making a total profit of $6R$.*

(iii) *There are no other symmetric pure-strategy equilibria.*

Part (i) of Proposition 2 represents the more interesting result in that both firms make a higher profit when they adopt a cross-category perspective and offer a bundle discount. This result is surprising, given the prior results in the literature that

Figure 1 Demand Function for Firm *A* in Cross-Category Game



bundling by competitive firms leads to lower profit (as noted in §1). The intuition for this result has two parts, one of which is a familiar intuition from the mixed bundling literature involving monopolist firms (Adams and Yellen 1976) and a second, more novel, intuition when considering the competitive aspects and contrasting with prior bundling literature (Matutes and Regibeau 1992). The familiar intuition is that, similar to the monopolist case, mixed bundling leads to better appropriation of customer surplus through more effective customer segmentation. Table 4 describes this equilibrium segmentation for one of the symmetric firms, namely, firm A. The dark gray segments buy the bundle from firm A and the light gray segments representing split loyals buy one product from each of the two competitive firms at the full price of R. Mixed bundling allows firm A to extract all the surplus from partial loyals, who pay the discounted price of $R + r$ for the bundle, while simultaneously extracting all the surplus from split loyals who buy only one product. The trade-off in such a strategy is the surplus of $R - r$ given to complete loyals. This trade-off is profitable if and only if $5R + 3r \ge 6R$, which gives rise to the condition $(R/r) \le 3$ in Proposition 2(i).[6] Note that the profit advantage of mixed bundling increases as r approaches R. Thus, better appropriation of customer surplus through mixed bundling is a contributory factor to the increase in profit observed in Proposition 2(i).

Nevertheless, past work by Matutes and Regibeau (1992) has shown that this increase in profit from mixed bundling does not carry over to a competitive setting. Specifically, they show that mixed bundling by both competitors in equilibrium may result in lower profit or may not constitute an equilibrium for some parameters because of lower profit. In contrast, our results are new in the sense that both competitors enjoy a higher profit in equilibrium when they adopt mixed bundling (Proposition 2(i)). The intuition for our results is that when a firm (say, firm A) offers a bundle discount of δ, it creates an "endogenous loyalty"[7] that makes it harder for the competing firm B to peel away certain switcher segments. Although firm B can gain complete switchers by beating firm A's bundle discount (assuming no difference in individual product prices between the firms), it can gain switchers who are firm A's partial loyals only by reducing its individual product prices to a level that is δ below firm A's product prices. Because a reduction in price by δ is more costly in comparison to a marginal increase in bundle discount, firm B may find it more difficult to steal firm A's partial loyals when firm A offers a bundle discount. Thus, when both firms offer bundle discounts, price competition for the individual products becomes less intense, which allows firms to charge the full price of R and leads to higher profit.[8] In contrast, overall firm profits decrease in Matutes and Regibeau (1992), even though individual product prices increase with bundle discount in their model as well.

In explaining the difference between our results and those of Matutes and Regibeau (1992), we note that our model differs from theirs in two respects. First, we

[6] Note that if firm A, for example, is the only firm in the market as a monopolist, it would adopt a similar mixed bundling strategy when $r \ge R/3$ and when K is sufficiently small, namely, $K \le (1/2)(R/r - 1)$.

[7] Unlike exogenous loyalty, the loyalty because of bundle discounts results from bundling decisions of the firms; hence, the adjective "endogenous."

[8] The condition $K \le (1/2)(5R/r - 7)$ in Proposition 2(i) ensures that a firm does not gain by deviating from its equilibrium strategy and stealing its rival's partial loyals.

Table 4 Customers Served—Proposition 2(i)

	Product category 2		
Product category 1	Loyal to A	Loyal to B	Switchers
Loyal to A	1 (I)	1 (II)	1 (III)
Loyal to B	1 (IV)	1 (V)	1 (VI)
Switchers	1 (VII)	1 (VIII)	K (IX)

consider two independent product categories while Matutes and Regibeau (1992) consider two perfectly complementary categories. Second, we consider competition using price promotions (mixed strategies), and they do not. However, further analysis of the model in Matutes and Regibeau (1992) reveals that their results carry over to independent product categories as well. Therefore, we can attribute the difference between our results and theirs to the fact that we consider competitive price promotions using discrete customer segments that include partial loyals, whereas they use a continuous distribution for customer preference. This conclusion underlines the importance of considering promotional competition when studying the efficacy of bundle discounts as a profit-enhancing competitive strategy. We may also infer that the relaxation of price competition because of bundle discounts is more potent in the presence of discrete customer segments and allows individual product prices to rise to R.

It may also be useful to compare the intuition of our results with Ghosh and Balachander (2007), who also find that competitive bundling can increase profits. As noted earlier, Ghosh and Balachander (2007) consider firms competing in a differentiated category and in an undifferentiated category. In their model, any relaxation of price competition as a result of bundle discounts occurs because pure bundling avoids head-to-head price competition in the undifferentiated category. In contrast, reduced price competition in our model stems from lower intensity of competition in both categories for switchers who are partial loyals.

Note that firms do not serve complete switchers in the equilibrium of Proposition 2(i) because K is small ($K \leq (3/2)(R/r - 1)$ as stated in the proposition). Thus, in this case, the bundle discounts crucially target the "cross-selling" at partial loyals to increase firm profit. In sum, our results show that bundle discounts can increase profit for competitive firms by creating endogenous loyalty among partial loyals, thereby helping to relax intense competition on price promotions of individual products.

Figure 2 maps the equilibria identified in Propositions 1 and 2 (and subsequent propositions) as a function of K and R/r. Note that K increases both to the left and right of the origin along the x-axis in Figure 2, allowing us to present the equilibria in the base game and cross-category game side by side. Figure 2 shows that, under conditions that support the higher profit identified in Proposition 2(i), there may exist either a pure-strategy equilibrium or a promotional (mixed-strategy) equilibrium in the base game.[9] Thus, Figure 2 demonstrates that the endogenous loyalty created by cross-category bundle discounts relaxes the promotional price competition that may occur when firms compete category by category to yield a promotion-free (pure-strategy) equilibrium that nets a higher profit for both firms. Note that for parameter values that correspond to the promotional equilibrium in the base game and the pure-strategy equilibrium of Proposition 2(i), the probability of partial loyal customers buying both products has increased from less than 100% to 100% with the help of bundle discounts. This result is consistent with the anecdotal evidence that bundle discounts prevent loss of potential customers to competitors. Of course, in the case of Proposition 2(i), the increased likelihood of serving partial loyals is also accompanied by the firing of "bad" customers, namely, the complete switchers (Zeithaml et al. 2001).

As noted in §1, there is also anecdotal evidence attributing the reduction in customer defection with bundle discounts to an increase in transactional switching costs created when customers develop multiple buying relationships (Eppen et al. 1991, Kamakura et al. 2003). In contrast, our results show that bundle discounts can reduce customer defection even in the absence of such transactional switching costs.

We also find that each firm has higher expected sales units with bundle discounts (in the equilibrium of Proposition 2(i)) in comparison to the base game. Thus, bundle discounts help expand the market (cf. Adams and Yellen 1976).

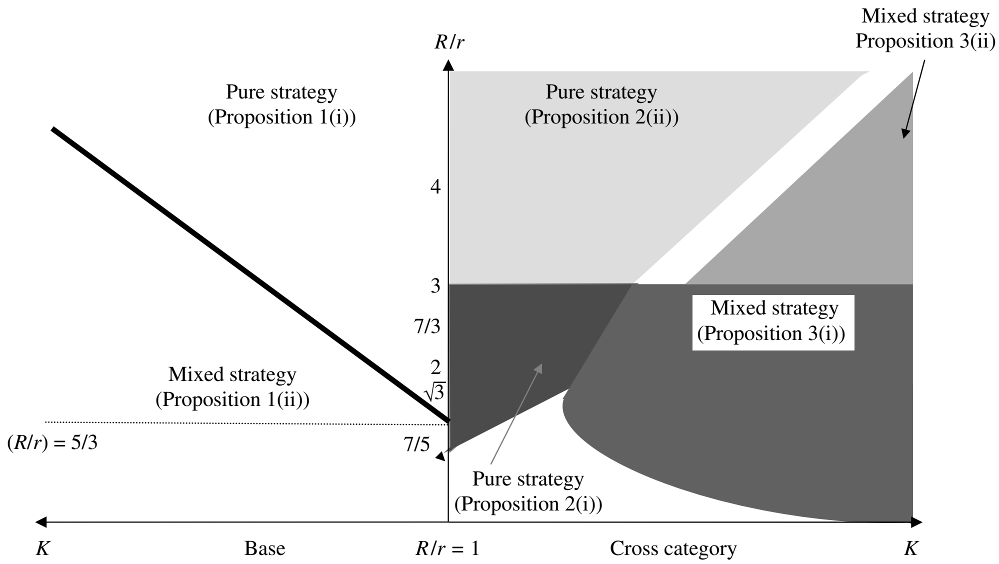
Proposition 2(ii) shows that for $R/r \geq 3$ and K sufficiently small, there exists a less interesting pure-strategy equilibrium in which both firms offer no bundle discounts and make the same profit as in the base game.[10] As can be inferred from our earlier discussion, when $(R/r) \geq 3$ and K is small, mixed bundling is unprofitable (even for a monopolist) as switchers who are partial loyals are willing to pay too low a price in one of the categories.[11] Last,

[9] Of the two regions of R/r identified for existence of the equilibrium in Proposition 2(i), when $2 \leq R/r \leq 3$, we note that there can be no mixed (pure) strategy equilibrium in the base game as long as $K < 1 (K > 4)$. Conversely, in the region $7/5 < R/r \leq 2$, there can be no pure-strategy equilibrium in the base game when $R/r \leq 5/3$ or when $K > 1$.

[10] For $R/r \geq 3$, a pure-strategy equilibrium always exists in the cross-category game when $K < 6$, whereas there is only a pure-strategy equilibrium in the base game when $K < 4$ (see Figure 2).

[11] The condition for a monopolist firm A to not use mixed bundling is identical to that presented in Proposition 2(i).

Figure 2 Equilibrium Regions in Base and Cross-Category Games



Proposition 2(iii) shows that there are no other pure-strategy equilibria.

4.2.2. Mixed-Strategy Equilibrium. We now consider mixed-strategy equilibria in the cross-category game. Proposition 3 characterizes the symmetric mixed strategy equilibrium in which firms use mixed-strategies on the bundle discounts alone. Consistent with our interpretation of mixed strategies on prices as price promotions, we interpret mixed strategies on bundle discounts as *bundle promotions*. Examples of bundle promotions can be observed for telephone, Internet services, and other telecommunication products (Young 2004), for computers and printers, and in other industries. We explore mixed-strategy equilibria in the cross-category game to more completely characterize the possible equilibria as well as illustrate that higher equilibrium profits with bundling need not be inconsistent with promotions, albeit bundle promotions, as in the case of Proposition 3.

Proposition 3. (i) *When $R/r \le 3$ and $K > K^{**}$ as given below, there exists a symmetric mixed-strategy equilibrium in which both firms charge $P^* = R$ in both categories and randomize on the bundle discount δ using the following cumulative distribution function $G_1(\delta)$, with $\bar{\delta} = [R(3+2K) - 3r]/(3+K)$. Both firms make a profit of $5R + 3r$ in this equilibrium*:

$$G_1(\delta) = \begin{cases} 1 & \text{if } \delta > \bar{\delta}, \\ \dfrac{3(r+\delta-R)}{K(2R-\delta)} & \text{if } 2(R-r) \le \delta \le \bar{\delta}, \\ \dfrac{3(R-r)}{2Kr} & \text{if } R-r \le \delta \le 2(R-r), \\ 0 & \text{if } \delta < R-r; \end{cases}$$

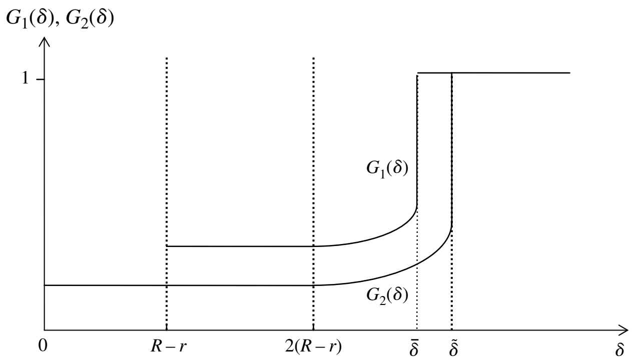
$$K^{**} = \text{Max}\{3r/(R+r), (3/2)(R/r-1)\}$$
$$= \begin{cases} (3/2)(R/r-1) & \text{if } \sqrt{3} \le R/r \le 3, \\ 3r/(R+r) & \text{if } 1 < R/r \le \sqrt{3}. \end{cases}$$

(ii) *If $R/r \ge 3$ and $K > 2R/r - 1$, there exists a symmetric mixed-strategy equilibrium in which both firms charge $P^* = R$ in both categories and randomize on the bundle discount δ using the following cumulative distribution function $G_2(\delta)$, with $\tilde{\delta} = [2R(1+K)]/(3+K)$. Both firms make a profit of $6R$ in this equilibrium*:

$$G_2(\delta) = \begin{cases} 1 & \text{if } \delta > \tilde{\delta}, \\ (3\delta - 2R)/[K(2R-\delta)] & \text{if } 2(R-r) \le \delta \le \bar{\tilde{\delta}}, \\ (2R-3r)]/Kr & \text{if } 0 \le \delta \le 2(R-r), \\ 0 & \text{if } \delta < 0. \end{cases}$$

Proposition 3(i) shows that bundle discounts can enable competitive firms to make a higher profit in comparison to the base game even when they use randomized strategies to set the bundle discounts. In this equilibrium, both firms charge a pure-strategy price of R for both its products (i.e., no price promotions) while randomizing on the bundle discounts. As discussed earlier, we interpret mixed strategies on bundle discounts as bundle promotions. Figure 3 shows the cumulative distribution functions $G_1(\delta)$ and $G_2(\delta)$ of the bundle promotions for both parts of the proposition. The graph of $G_1(\delta)$ shows that there is a mass point at the minimum discount point of $R - r$, whereas $G_1(\delta)$ is flat in the region $(R-r, 2(R-r))$ where there is zero probability density. The minimum

Figure 3 **Cross-Category Game: Mixed-Strategy Cumulative Distribution Function**



discount of $R-r$ ensures that each firm serves its partial loyals in equilibrium with probability one, as this segment is willing to pay utmost $R+r$ for the bundle.

The equilibrium segmentation of the market is similar to Table 4 except that each firm serves complete switchers with some probability through bundle promotions while serving its complete loyals, split loyals, and partial loyals with probability one. Once again, the intuition for the higher profit depends on the two factors discussed earlier: better appropriation of customer surplus with mixed bundling and the relaxation of price promotion competition because of the endogenous loyalty created by the bundle discounts. The first factor is supported when $R/r \leq 3$ because, as seen earlier, this condition allows greater profit from the segmented pricing that results from mixed bundling (cf. Table 4). The second factor of endogenous loyalty stemming from bundle discounts allows the firms to charge the full price of R for its individual products while defending its partial loyals with the help of the bundle discount. Recall that a firm can steal a rival's partial loyals only by lowering the price of its individual products and not by simply increasing its bundle discounts. In particular, a firm has to set the price of its individual product to be below its rival's price by at least the amount of the rival's bundle discount to steal the rival's partial loyals. Given that firms' bundle discounts are at least $R-r$, a firm has to price its individual products at or below r to attract its rival's partial loyals. If $K > 3r/(R+r)$, a firm does not find it advantageous to attract a rival's partial loyals in equilibrium. The intuition for this condition is better understood after we discuss firms' bundle promotions in the coming paragraphs.

Bundle discounts make it unattractive for a firm to steal partial loyals from its rival, but they also help a firm attract and defend complete switchers when a firm's bundle discount is higher than $2(R-r)$. Bundle discounts between $(R-r)$ and $2(R-r)$ do not attract incremental switchers and, therefore, are not offered with positive density, which accounts for the flat portion of $G_1(\delta)$ (see Figure 3). It can be shown that the mass point of $G_1(\delta)$ at $R-r$ diminishes with K and that the maximum bundle discount increases with K. Both these results are fairly intuitive, suggesting that increasing intensity of bundle promotions as K increases is the explanation why a firm finds it unattractive to steal its rival's partial loyals when K is sufficiently high ($K > 3r/(R+r)$). Note that this condition on K is a sufficient rather than a necessary condition. (The necessary condition is quite complicated.) The other condition, $K \geq (3/2)(R/r-1)$, for the equilibrium in Proposition 3(i) ensures that the mixed-strategy distribution is nondegenerate. Figure 2 shows the parameter regions that support the mixed-strategy equilibrium of Proposition 3(i). For these parameter values, there can be either a pure-strategy or a mixed-strategy equilibrium in the base game.[12] A point of interest is that although promotions on bundle discounts occur in the cross-category game in this equilibrium, these promotions do not drive down the profit to the levels in the base game. The reason is that bundle promotions primarily target the complete switcher segment, whereas price promotions in the base game target all switchers. However, bundle promotions do compete away the profits from complete switchers, leaving firms with the profit they derive from the other segments.

It is interesting to compare the probability of serving switchers in the base and cross-category games. First, we compute the probability of serving switchers in the case of Proposition 3(i). In this case, the probability that a firm serves "complete switcher" customers when it offers a bundle discount δ is $G_1(\delta)$. As noted earlier, firms serve switchers who are partially loyal with probability one in equilibrium. In computing the overall probability of serving a switcher, we need to suitably weight the probability of serving each of these two segments. Because we compute only the probability of serving switchers, serving a partial loyal should carry one-half the weight of a complete switcher because the former type of customer is a switcher in only one of the categories. Using this weighting scheme, we can see that the maximum number of switchers that a firm can serve in this equilibrium is $K+1$. We compute the overall probability of serving these $K+1$ switchers by weighting the probabilities of serving each of the two switcher segments by their respective proportions: $1/(K+1)$ for partial

[12] For R/r such that we have the equilibrium in Proposition 3(i), when $\sqrt{3} \leq R/r \leq 3$, there can be no mixed (pure) strategy equilibrium in the base game as long as $K < 3\sqrt{3}-5$ $(K > 4)$. Conversely, in the region $1 < R/r \leq \sqrt{3}$, there can be no pure-strategy equilibrium in the base game when $R/r \leq 5/3$ or when $K > 3\sqrt{3}-5$.

loyals and $K/K+1$ for complete switchers.[13] Thus, the overall probability of serving switchers φ_c is given by the following expression in which $g_1(\delta)$ is the probability density function corresponding to $G_1(\delta)$:

$$\varphi_C = \frac{1}{K+1} + \frac{K}{K+1}\int_{2(R-r)}^{\bar{\delta}} G_1(\delta) g_1(\delta)\, d\delta = \frac{8+4K-9(r-R)^2/(Kr^2)}{8(1+K)}. \tag{2}$$

It can be shown (see the electronic companion) that φ_C initially increases with K before decreasing with K at high values of K, except when R/r is small. As noted earlier, the intensity of bundle promotions, as indicated by its frequency and the maximum bundle discount, increases with K. However, because the competing firm also intensifies its bundle promotions with an increase in K, a firm's probability of serving switchers eventually decreases with K after initially increasing with K. When R/r is small, the equilibrium exists only at high values of K so that φ_C always declines with K.

We now compare φ_C with the probability ϕ_B of serving switchers computed earlier for the base game when there are price promotions (Equation (1)). An issue in comparing the two probabilities is that φ_C denotes the probability of serving a switcher who purchases both products from a firm, whereas ϕ_B represents the same entity for a switcher who purchases only one product for a firm. We address this issue by weighting the probabilities in each category in the base game. Specifically, if we assign each product a weight equal to one-half in computing the probability of serving switchers when considering two products in the base game, we can see that the weighted probability of serving switchers is still ϕ_B, and this quantity can then be compared directly with φ_C.[14] This comparison shows that the probability of serving switchers in the cross-category game is higher than in the base game, consistent with the anecdotal evidence that bundle discounts prevent customer defection (see the electronic companion).

Proposition 3(ii) presents the result that when $R/r \geq 3$, firms offer bundle discounts using mixed strategies in equilibrium but make the same profit as in the base game. As discussed earlier, when $R/r \geq 3$, partial loyals are not an economically attractive segment, precluding profit gains from offering bundle discounts to this segment. However, this equilibrium presents an interesting contrast to the previous equilibria that involve bundle discounts (Propositions 3(i) and 2(i)). First, this equilibrium shows that bundle discounts need not always result in a higher profit in comparison to the base game. The key to profit improvement is whether bundle discounts target and help retain partial loyals. Figure 3 shows the probability function $G_2(\delta)$ used by the firms for randomizing bundle discounts in the mixed-strategy equilibrium of Proposition 3(ii). $G_2(\delta)$ has a mass point at $\delta = 0$ but otherwise puts positive density only for bundle discounts greater than $2(R-r)$. Thus, when firms offer positive bundle discounts, they are targeted at complete switchers. However, profits from this extreme switching segment are competed away because this segment, unlike the partial loyals, is willing to switch to a competitor for a slightly higher discount. Second, this equilibrium also shows a situation where profit gains realized by a monopolist through the use of mixed bundling may not be realized by competing firms. For example, a monopolist can gain a profit higher than $6R$ when K is sufficiently high ($K \geq 2R/r - 3$) by pricing its products at R and offering a bundle discount of $2(R-r)$. However, competitive firms do not realize a profit higher than $6R$ because profits from bundle discounts are competed away. This point again highlights the importance of partial loyals and the role of endogenous loyalty created for this segment by bundle discounts. Third, we compute the probability of serving switchers in this equilibrium and find that it exceeds the corresponding probability ϕ_B in the base game even though the profits are identical in both equilibria. Thus, this case shows that an increased ability in preventing customer losses to competition through bundle discounts can also be accompanied by no increase in profit. We also find that the bundle discounts in Proposition 3 help to expand expected sales in comparison to the base game, irrespective of whether such discounts are more profitable (see the electronic companion).

4.2.3. Discussion. In Proposition 3, we characterize a symmetric mixed-strategy equilibrium in which firms randomize only on the bundle discounts. More generally, there may be a mixed-strategy equilibrium in which a firm may randomize both on prices and on bundle discounts. However, we find such an equilibrium to be complicated and difficult to characterize. Unlike bundle discounts that can be used to attract complete switchers, lower prices are required for a firm to steal a rival's partial loyals. Therefore, we conjecture that an equilibrium where both prices and bundle discounts are randomized may exist for

[13] Note that a firm serves either all of the complete switchers or none of them depending on whether its bundle discount is sufficiently high and beats that of its competitor.

[14] Assuming independence in the probabilities of serving switchers across the two categories in the base game, we can calculate the components of the weighted probability as follows: with probability equal to ϕ_B^2, "one" product is sold to switchers; with probability equal to $2\phi_B\,(1-\phi_B)$, only one-half product is sold. The weighted sum of these probabilities is ϕ_B.

intermediate values of K when the number of partial loyals (two for each firm) is more significant in comparison to K. Thus, the white areas in the right panel of Figure 2 may represent possible parameter regions that support such a mixed-strategy equilibrium. Although we are unable to derive such an equilibrium for tractability reasons, we believe that characterizing it is unlikely to yield substantially new insights.

An important insight from our analysis is the crucial role of partial loyals in rendering competitive bundle discounts profitable. Thus, our results require a significant and economically attractive ($R/r \leq 3$) partial loyal segment. In our model, we assume no correlation between loyalty in one category and loyalty or switcher behavior in a second category for a customer. If loyalty behavior in the two categories were highly positively correlated, there would not be a significant number of partial loyals for bundle discounts to be profitable in a competitive setting.[15] However, except for this extreme setting, competitive bundle discounts would result in higher profits in general. The profitability of competitive bundle discounts would, however, decline as the correlation between loyalty in the two categories increases. As noted in §3, Singh et al. (2005) find empirically that the correlation in consumer preference for a firm across categories is not high.

5. Numerical Example

Assume $R = \$40$ and $r = \$25$ in each of two categories. These reservation prices correspond roughly to the regular and promotional prices in the United States for telecommunication products such as video (cable), broadband, or wireless services (Grant 2004, Iyengar et al. 2008). Consider the situation when $K = 2$, which would put the proportion of switchers in each category at 40%. Using the framework of Colombo and Morrison (1989), this proportion of switchers would be roughly consistent with an annual churn rate of 21.6% reported in Neslin et al. (2006).[16] For these parameters, we have only a mixed-strategy equilibrium in the base game in which each firm makes a profit of \$240 across both categories. In this mixed-strategy equilibrium, each firm charges a regular price of \$40 in each category with probability 0.45, and a promotional price in the interval [\$17.14, \$25] with a probability of 0.55. The expected sales of each firm is 4.6 units and the probability ϕ_B of a firm serving switchers in a period is approximately 0.40. When firms can offer bundle discounts, we have a mixed-strategy equilibrium in which both firms still sell each product at a price of \$40 but offer a minimum bundle discount of \$15 with a probability of 0.55 and bundle promotions. These bundle promotions take the form of temporarily higher bundle discounts in the interval [\$30, \$41] with a probability of 0.45. In this equilibrium, each firm makes a profit of \$275, which is a 14.58% increase over the profit in the base game. The probability that a firm serves switchers is approximately 0.60, which is higher than in the base game (0.40). Each firm's average sales per product category increases to 4.8 units when offering bundle discounts and bundle promotions, thereby expanding product category sales.

When the number of complete switchers is lower at $K = 0.4$, for the base game, we still have a mixed-strategy equilibrium in which each firm makes a profit of \$240. However, each firm charges the regular price of \$40 with a higher probability (0.75) and obtains lower expected sales (3.5 units) in comparison to the above base-game equilibrium with $K = 2$. With $K = 0.4$, we have a pure-strategy equilibrium in the cross-category game in which each firm's profit is \$275. In this equilibrium, firms sell each product for \$40 and offer a bundle discount of \$15. The probability of selling to partial loyals is 100% although complete switchers are not served. Finally, each firm's sales per product category is four units.

6. Conclusion

Price promotions can be an effective way for marketing managers to appeal to price-sensitive customers while preserving their profit margins on sales to less price-sensitive customers (Narasimhan 1984). However, in today's intensely competitive marketing environment, price promotions can be quickly matched by competitors erasing any profit gains from such promotions (Blattberg and Neslin 1990). In this paper, we show that firms that sell products in multiple categories can benefit from taking a cross-category perspective, using bundle discounts to counter an intense promotional environment. In particular, we show that all competitors may benefit by offering bundle discounts as opposed to competing simply on price promotions of individual products. This

[15] We analyzed a model in which consumers who are loyal to one firm in a category are also loyal to one firm or the other in the second category. This assumption resulted in five consumer segments: two who are completely loyal to one or the other firm, two who are split loyal consumers, and one segment of complete switching consumers. However, the equilibrium profit with bundle discounts in any pure- or mixed-strategy equilibrium in this game is $6R$, which is the same as in the base game. Details are available from the authors on request.

[16] We use Equation (2) in Colombo and Morrison (1989) in which we set $p_{ij} = 0.216$ and $\pi_j = 0.5$ (assuming switchers are indifferent between the two firms) to obtain the proportion of loyal customers α_i for each firm as 0.568. With symmetric firms that split all customers equally between themselves on average, we would expect the loyal customers of each firm to account for roughly 28% ($0.5 * 0.568$) of the market and the switchers to account for 44% of the market.

result is interesting because it is unlike the previous results in the bundling literature that suggest that profits decline when all firms offer bundle discounts (Matutes and Regibeau 1992, Gans and King 2006). Moreover, the result is consistent with anecdotal evidence (see §1) that suggests that bundle discounts can be a profitable strategy in a competitive promotional environment. By combining bundle discounts and price promotions, we also contribute to the literature on competitive price promotions, which has largely focused on analyzing promotions in a single category.

The intuition for our results shows that the efficacy of bundle discounts depends on two factors. First, as a baseline, the customer behavior that favors segmented pricing induced by bundle discounts should exist for profitable bundling. In other words, the mixed bundling created using bundle discounts should be able to appropriate more customer surplus by profitably segmenting the market into those who buy the bundle at a discount and those who choose to buy the separate products (Adams and Yellen 1976). The second factor that drives our results is more interesting as it relates to the competitive effect of bundle discounts. We find that bundle discounts create an endogenous loyalty, particularly among partial loyals, i.e., those who are loyal to a firm in one category but are more sensitive to competitive price differences in a second category. This endogenous loyalty is generated because a firm has to price its product below the level of the discount savings offered by a rival firm to steal partial loyals in the one category in which these customers are willing to consider substitutes. Because of this endogenous loyalty stemming from bundle discounts, competition on price promotions is relaxed, allowing firms to make a higher profit.

Naturally, we find that the increased profit from bundle discounts is also accompanied by better coverage of customers prone to switching, implying that bundle discounts can be an effective defensive marketing tool. This finding is consistent with the comment of a senior executive of BellSouth who contends that bundle purchases make consumers less inclined to switch (Wilson 2006). Eppen et al. (1991) suggest that the multicategory purchase stimulated by bundle discounts may reduce customer turnover by increasing the level of switching costs. Our analysis shows that bundle discounts can help a firm defend its customer base and improve profits even when there are no switching costs.

Our analysis also shows the important role of partial loyals in making bundle discounts a competitively profitable strategy. Indeed, we show that if the segment of partial loyals is not economically meaningful, bundle discounts may not increase profit because such discounts would target very price-sensitive segments, namely, complete switchers, who do not have loyalty to either firm in both categories. Unlike for partial loyals, endogenous loyalty created by bundle discounts is not effective for complete switchers because these customers can be induced to switch if a competitor simply beats a rival's bundle discount. Conversely, even if the partial-loyal segment is economically attractive to firms, we show that promotions may still be offered in the form of time-varying bundle discounts (bundle promotions), and these promotions would target complete switchers instead of partial loyals. In this case, care should be taken to offer a minimum level of bundle discounts to retain partial loyals and thereby maintain higher profit levels. These results point to the importance of carefully thinking about and separating target segments (partial loyals and complete switchers) when designing bundle discount levels and bundle promotions.

We now summarize the managerial implications of these results. Our findings point to the importance of managers taking a cross-category perspective in pricing and promotion decisions rather than making such decisions category by category (see also Dhar and Raju 1998 on this point). Carefully designed cross-category bundle discounts can help managers increase profit in a promotion-intensive environment. Our analysis shows that bundle discounts could be profitably designed to appeal to customers who are loyal users of some of the firm's products but who do not purchase other products from the firm consistently. On the other hand, additional bundle promotions could be designed, if profitable, for customers who may not have much loyalty to the firm on any of the products. Firms such as banks and telecommunication companies usually have access to customer databases from which these behavioral tendencies of customers can be inferred in designing bundle discounts (Kamakura et al. 2003). Furthermore, cross-selling efforts can become more fruitful when these bundle discounts are pitched to the appropriate target customers in the database (Balachander and Ghosh 2009). These principles are equally applicable in nonservice contexts such as packaged goods marketing, where cross-ruff coupons are a form of bundle discounts (Dhar and Raju 1998). An implication of our research for this industry is that firms need to go beyond category management to cross-category management to improve profits (Bezawada et al. 2009).

We conclude with a discussion of some limitations of our paper that lead to avenues for further research. First, although we consider symmetric firms and categories, it would be interesting to explore the effect of firm and category asymmetry on cross-category bundle discounts (cf. Narasimhan 1988, Raju et al. 1990, Dhar and Raju 1998). Second, we assume that a customer purchases only one unit of the product in each category. It may be useful to explore the effect of making bundle discounts contingent on buying multiple units from a firm both within a category and across categories (Foubert and Gijsbrechts 2007). Third, we analyze two product categories whose valuations are independent for customers. It may be useful to extend this analysis to consider categories that are substitutes or complements. Fourth, as noted earlier, it may be insightful to formally analyze the effect of bundle discounts in the presence of exogenous switching costs, and this would entail a multiperiod model (cf. Klemperer 1987). Last, given that the competitors are symmetric, we solve for symmetric equilibria in firms' strategies in this paper. It may be interesting to explore whether asymmetric equilibria can exist where only one firm offers bundle discounts. Although no such asymmetric equilibrium in pure strategies is possible in our model, the characterization of asymmetric equilibria in mixed strategies is complicated and is left for future research.

7. Electronic Companion

An electronic companion to this paper is available as part of the online version that can be found at http://mktsci.pubs.informs.org.

Acknowledgments

The authors thank the editor, area editor, and two anonymous reviewers for several comments that helped us improve the paper. The authors also thank attendees at the Marketing Science Conference 2007 in Singapore for comments on an earlier version of the paper.

References

Adams, W. J., J. L. Yellen. 1976. Commodity bundling and the burden of monopoly. *Quart. J. Econom.* **90**(3) 475–498.

Balachander, S., B. Ghosh. 2009. Multiple product buying and customer churn behavior. Working paper, Krannert School of Management, Purdue University, West Lafayette, IN.

Bezawada, R., S. Balachander, P. K. Kannan, V. Shankar. 2009. Cross-category effects of aisle and display placements: A spatial modeling approach and insights. *J. Marketing* **73**(3) 99–117.

Blattberg, R. C., S. A. Neslin. 1990. *Sales Promotion: Concepts, Methods and Strategies*. Prentice Hall, Upper Saddle River, NJ.

Carlton, J. 1997. Don't hang up: Cellular companies take aim at their no. 1 marketing problem: Churn. *Wall Street Journal* (September 11) R12.

Chen, Y. 1997. Equilibrium product bundling. *J. Bus.* **70**(1) 85–103.

Chintagunta, P., T. Erdem, P. E. Rossi, M. Wedel. 2006. Structural modeling in marketing: Review and assessment. *Marketing Sci.* **25**(6) 604–616.

Colombo, R. A., D. G. Morrison. 1989. A brand switching model with implications for marketing strategies. *Marketing Sci.* **8**(1) 89–99.

Dhar, S. K., J. S. Raju. 1998. The effect of cross-ruff coupons on sales and profits. *Management Sci.* **44**(11, Part 1) 1501–1516.

East, R., P. Harris, G. Wilson, K. Hammond. 1995. Correlates of first-brand loyalty. *J. Marketing Management* **11**(5) 487–497.

Eppen, G. D., W. A. Hanson, R. K. Martin. 1991. Bundling—New product, new markets, low risk. *Sloan Management Rev.* **32**(4) 7–14.

Foubert, B., E. Gijsbrechts. 2007. Shopper response to bundle promotions for packaged goods. *J. Marketing Res.* **44**(4) 647–662.

Gans, J. S., S. P. King. 2006. Paying for loyalty: Product bundling in oligopoly. *J. Indust. Econom.* **54**(1) 43–62.

Ghosh, B., S. Balachander. 2007. Competitive bundling and counterbundling with generalist and specialist firms. *Management Sci.* **53**(1) 159–168.

Grant, P. 2004. Here comes cable and it wants a big piece of the residential phone market. *Wall Street Journal* (September 13) R4.

Hansen, K., V. Singh, P. Chintagunta. 2006. Understanding store-brand purchase behavior across categories. *Marketing Sci.* **25**(1) 75–90.

Iyengar, R., K. Jedidi, R. Kohli. 2008. A conjoint approach to multipart pricing. *J. Marketing Res.* **45**(2) 195–210.

Kamakura, W. A., M. Wedel, F. de Rosa, J. A. Mazzon. 2003. Cross-selling through database marketing: A mixed data factor analyzer for data augmentation and prediction. *Internat. J. Res. Marketing* **20**(1) 45–65.

Klemperer, P. 1987. The competitiveness of markets with switching costs. *RAND J. Econom.* **18**(1) 138–150.

Liu, H., P. K. Chintagunta, T. Zhu. 2008. Complementarities and the demand for home broadband Internet services. Working Paper 08-30, Booth School of Business, University of Chicago, Chicago.

Matutes, C., P. Regibeau. 1992. Compatibility and bundling of complementary goods in a duopoly. *J. Indust. Econom.* **40**(1) 37–53.

Narasimhan, C. 1984. A price discrimination theory of coupons. *Marketing Sci.* **3**(2) 128–147.

Narasimhan, C. 1988. Competitive promotional strategies. *J. Bus.* **61**(4) 427–449.

Neslin, S. A., S. Gupta, W. Kamakura, J. Liu, C. H. Mason. 2006. Defection detection: Improving predictive accuracy of customer churn models. *J. Marketing Res.* **43**(2) 204–211.

Raju, J. S., V. Srinivasan, R. Lal. 1990. The effects of brand loyalty on competitive price promotional strategies. *Management Sci.* **36**(3) 276–304.

Schmalensee, R. 1984. Gaussian demand and commodity bundling. *J. Bus.* **57**(1) S211–S230.

Shilony, Y. 1977. Mixed pricing in oligopoly. *J. Econom. Theory* **14**(2) 373–388.

Singh, V. P., K. T. Hansen, S. Gupta. 2005. Modeling preferences for common attributes in multicategory brand choice. *J. Marketing Res.* **42**(2) 195–209.

Sobel, J. 1984. The timing of sales. *Rev. Econom. Stud.* **51**(3) 353–368.

Stigler, G. J. 1968. A note on block booking. *The Organization of Industry*. Irwin, Homewood, IL, 165–170.

Tirole, J. 1988. *The Theory of Industrial Organization*. MIT Press, Cambridge, MA.

Varian, H. R. 1980. A model of sales. *Amer. Econom. Rev.* **70**(4) 651–659.

Venkatesh, R., W. Kamakura. 2003. Optimal bundling and pricing under a monopoly: Contrasting complements and substitutes from independently valued products. *J. Bus.* **76**(2) 211–231.

Wall Street Journal. 1989. Making change for a segmented market—Banks package services to woo target groups. (November 2) R12.

Wall Street Journal. 2003. Bigger banks; better deals?—Huge merger could signal improved service, lower fees as banks compete for consumers. (October 28) D1.

Wall Street Journal. 2004. Bells fight cable with satellite-TV deals. (February 9) B1.

Whinston, M. D. 1990. Tying, foreclosure, and exclusion. *Amer. Econom. Rev.* **80**(4) 837–860.

Wilson, C. 2006. Pricing of bundles: More art than science. *Telephony* **247**(10) 54–62.

Young, S. 2004. All in one: Buying bundles of telecom services can make things easier—and cheaper—for consumers. *Wall Street Journal* (September 13) R6.

Zeithaml, V. A., R. Rust, K. T. Lemon. 2001. The customer pyramid: Creating and serving profitable customers. *California Management Rev.* **43**(4) 118–142.