Customized Service Bundles in a Competitive Context: Integrating Consumers' Bundling, Brand and Quantity Decisions

Manoj K. Agarwal & Ruud T. Frambach

Ruud T. Frambach is professor of marketing and Manoj K. Agarwal is associate professor of marketing at Binghamton University, State University of New York (SUNY), United States. The authors contributed equally to the research.

Correspondence: Ruud T. Frambach, Vrije Universiteit Amsterdam, Faculty of Economics and Business Administration (2E-33), De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands.
Phone +31 20 5986002; Fax +31 20 5986005; Email rframbach@feweb.vu.nl

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Abstract

The widespread use of bundling enables consumers to increasingly choose between different bundles from different firms. Therefore, while previous research has primarily examined fixed bundles in monopoly situations, we propose and estimate a latent class joint conditional model of bundling decisions in a competitive customizable bundle context. Using individual choice data, we examine the impact of promotions and brand preference on bundling, brand choice, and bundle size decisions. We find promotions to primarily influence brand choice and secondarily bundling preference, but to have little impact on bundle size. The results confirm the importance of studying bundling in competitive contexts.

Key words: bundling, customizable bundles, customization, promotions, services.

Introduction

Increasingly, marketers aim to meet the needs of the *individual* customer. Starting from mass production with almost no customization, firms moved to segmentation that provides an intermediate level of customization, to providing individualized products and communications following recent calls for mass customization (Lavidge 1999). The availability of new technologies is allowing firms to customize products while still reaping economies of scale of mass production. For example, Lands' End (landsend.com) and American Fit (americanfit.com) provide custom made jeans. Dell computer has revolutionized the PC industry by letting consumers customize their computers on line. While personally delivered individual services like financial consulting and haircuts have tended to be generally customized due to the nature of the co-production (Zeithaml and Bitner 2002), standardized services like telephone services have had low levels of customization. With the use of bundling as customization strategy, this situation seems to have changed.

Some firms now offer customized bundles of services. For example, Qwest Communications (www.qwest.com 2002), allows customers to choose from a menu of 33 custom calling features like 'anywhere voice mail', 'call waiting', and 'do not disturb'. Customizable bundles of services offer more flexibility to consumers, and thus provide them with higher value and can help in a firm's customer retention and acquisition efforts in a highly competitive arena. Recent research suggests that customization of products and services also lead to higher customer satisfaction (Anderson, Fornell and Rust 1997, Johnson and Nilsson 2003) and higher profits through customized prices (Simon and Dolan 1998, Simon and Butscher 2001).

Despite the importance of customization and the increasing availability of customizable bundles, academic research in the bundling area has been limited (for a comprehensive review see Stremersch and Tellis 2002) and suffers from two main weaknesses. Firstly, with few exceptions (Ben-Akiva and Gershenfeld 1998, Liechty, Ramaswamy and Cohen 2001), researchers primarily considered fixed bundles, in that consumers only react to pre-determined bundles and are not allowed to make their own bundles. Secondly, both the normative and empirical bundling models are typically framed in a monopolistic (e.g. Venkatesh and Kamakura 2003) or a duopolistic context (e.g. Anderson and Leruth 1993) rather than in a multiple competitor context. However, consumers frequently make choices not only between different bundles and products from the same firm, but also increasingly between *different* bundles from *different* firms. Given this consumer choice situation, firms face some important questions, such as (1) How many and which services will consumers buy? (2) Should the firm offer customized bundles? (3) If the firm offers custom bundles and their competitors do not, will they gain market share? (4) What kind of promotions and price incentives will need to be offered to motivate consumers to bundle and will these programs be profitable?

The objective of our study is to provide answers to these questions by investigating how consumers respond to customizable bundles in a competitive environment. Specifically, we explore three different decisions. First, do consumers buy a bundle from one firm or are they inclined to continue to buy the products/services separately from multiple firms? We call this the *bundling decision*. Second, which brand or vendor do consumers decide to buy the bundle from? We call this the *brand choice decision*. Third, how many services do consumers include in their customized bundle? We term this the *bundle size decision*. The main contribution of our research is that we address all three decisions interdependently within the context of multiple competing suppliers, thus enhancing our insight into the factors that drive consumers' preferences for customizable bundles in a competitive context. The few studies that investigate customized bundles (Ben-Akiva and Gershenfeld 1998, Liechty, Ramaswamy and Cohen 2001) are not embedded in a competitive context. We propose a joint conditional model to simultaneously estimate the bundling, brand choice and bundle quantity decisions using the nested logit, multinomial logit and ordered logit frameworks. We allow for unobserved heterogeneity using a latent class approach, and estimate the models using maximum likelihood methods.

In the next section we provide a brief literature review. We then describe the model, the setting of the empirical study focusing on the telecommunications market, and the model estimation, followed by a discussion of the results and their implications for theory and management.

Literature Review

One of the important ways that firms encourage consumers to bundle is through offering a discount on the bundle components compared to the components being bought separately. In the case of price bundling, "a discount must be offered to motivate at least some consumers to buy the bundle" (Stremersch and Tellis 2002, p. 56). This discount could be a monetary discount (e.g. 10% off) or a non-monetary one (e.g. one service free). These discounts can either be front-loaded or rear-loaded (Quelch 1989). Front-loaded discounts offer the discounts immediately on purchase, while rear-loaded ones give the discount some time after the purchase. Dhar, Morrison and Raju (1996) find that rear-loaded offers (on-pack coupons) lead to higher profit than front-loaded offers (peel-off coupons). In a later paper, Zhang, Krishna and Dhar (2000) show that in markets with high variety seeking it is better to use front-loaded discounts, while in markets with high inertia rear-loaded discounts are more profitable.

A number of studies have examined the impact of framing and price discounts on bundle evaluations. Harlam et al. (1995) studied bundle composition, price discount level and bundle presentation impact on purchase intentions. Among their findings is that presentation format of the price change information can affect purchase intent; they find that presenting the "total" bundle price results in higher purchase intent than presenting the separate component prices when the price of the bundle decreases. Johnson, Herrmann and Bauer (1999) report that bundle evaluations increase when price information is bundled and price discount information is unbundled. Thus previous research confirms that price discounts and the framing of the bundle discounts impact bundle evaluations and purchase intentions. While this bundling research is valuable, it is unable to shed light on the impact of price discounts on brand choice and quantity decisions in the customized service bundling context.

Some of these issues have been investigated in the literature on consumer-packaged-goods. Price promotions are found to affect brand choice (Guadagni and Little 1983), category buying (Nijs et al. 2001) and quantity (Krishanamurthi and Raj 1991, Wansink, Kent and Hoch 1998) decisions. The impact of promotions on quantity can be twofold. For items with flexible consumption, like yogurt, both the inventory and usage rate can increase; while for items with inflexible consumption rate, like ketchup, only the inventory levels increase (Ailwadi and Neslin 1998, Chandon and Wansink 2002).

Thus, based on the previous research, both in bundling and the packaged-goods literature, we expect price promotions to impact the brand choice decision in customizable bundles. We expect front loaded promotions to be more effective. Just as promotions impact category buying in packaged goods, we expect that consumers will be motivated to bundle due to promotions. Would we expect promotion to increase the number of services that consumers include in a customizable bundle? Since services cannot be inventoried, we expect the impact of discounts on bundle size to be low or non-existent, although it is possible that some consumers may be motivated to buy new services due to discounts available through bundling (Simonin and Ruth 1995).

Consumer heterogeneity. There is considerable heterogeneity in consumer evaluation of items in fixed bundles (Yadav and Monroe 1993, Yadav 1994, Yadav 1995). Asymmetry and variations in conditional consumer reservation prices determine the optimum bundling strategy from a firm's perspective (Stremersch and Tellis 2002); they show that in the presence of these conditions, pure or mixed price bundling[1] is optimum. Jedidi, Jagpal and Manchanda (2003) investigate the optimal bundling strategy for both durable and non-durable products. They estimate reservation prices for each individual, and find quite high levels of heterogeneity in the reservation prices, and find mixed bundling to be optimal. The importance of asymmetry in the conditional reservation prices suggests that any empirical estimation method must be able to capture consumer heterogeneity.

Conceptual and Modeling Approach

In a customizable bundle, a consumer can choose how many and which services to include in the bundle. Moreover, in a competitive context—which will be the most likely situation to occur—consumers can choose to bundle from different suppliers. Previous bundling models, however, primarily investigate monopoly (e.g. Adams and Yellen 1976, Venkatesh and Kamakura 2002) and duopoly situations (e.g. Koppale, Krishna and Assuncao 1999). In terms of the number of products analyzed, theoretical models have generally dealt with a two-product case. A recent model by Bakos and Brynjolfsson (2000) allows for unlimited number of products, but applies only to information goods where the marginal production costs are zero. Since optimal strategies are primarily impacted by the level of marginal costs of production (Venkatesh and Kamakura 2002), the Bakos and Brynjolfsson (2000) model is limiting. Jedidi, Jagpal and Manchanda (2003) recently propose a more general model for multiple products. Their model allows for marginal production costs to vary across products and bundles. However, they only consider individual products and fixed bundles in a product line; thus they do not model the bundle size decision. In sum, there is a need for incorporating a multiple supplier, multiple product context within theoretical bundling models.

We therefore consider a situation where a number of firms are offering a variety of services, both individually and in customizable bundles. Accordingly, we decompose a consumer's choice with respect to bundling into three related decisions: whether to buy the services separately or in a bundle, which brand (or firm) to buy from, and how many of the services to include in the bundle[2]. These three consumer decisions will be affected by a number of factors. While our model is quite general and can include different variables of interest, in this study we include the following: promotions being offered by various brands, intrinsic consumer preferences for various brands, and the need for the services being offered in the bundle. These variables reflect the main determinants of the bundling decisions addressed in this study based on prior research relating to both bundling and promotions (see the previous section). If we assume that the observed choice is the result of a utility maximizing framework, then the three decisions have to be analyzed simultaneously (Chintagunta 1993). The joint estimation allows for any

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[1] Pure bundling is a strategy in which the firm sells only the bundle and not (all) the products separately; in the case of mixed bundling a firm sells both the bundle and (all) the products separately (Stremersch and Tellis 2002).
[2] Note that we focus on the number of services that consumers are buying rather than which particular ones; the model can be adapted if the interest is in modeling which particular services are included in the bundle.

sequence of decisions being followed by consumers, with the observed choices being the ones that maximizes utility. For example, some consumers might decide on the brand first and then decide which services to buy. Other consumers could first decide which services they want in a bundle, and then choose the brand which gives them the most utility. The joint estimation can handle both situations.

Our goal is to understand the impact of different promotional schemes—both front-loaded and rear-loaded and monetary and non-monetary—given the consumer's preferences, and other variables on the bundling, brand choice and bundle size decisions. For exposition, let us assume that consumers follow the bundling choice → brand choice → bundle size sequence. They decide whether to bundle or not, and if they decide to bundle then they decide on the brand followed by the choice of services. We formulate a conditional model for each of these choices. We model the decision whether to bundle or not as a nested logit, with the brand choice decision (conditional on bundling) as a multinomial logit. A consumer will buy a bundle if the expected utility of a bundle from any of the competing firms (offering a particular promotion plan) is higher than the expected utility of buying those services separately. This is reflected in the nested logit structure of the bundling choice. The attractiveness of the bundle in the decision whether to bundle or not is reflected by the category value (also called the inclusive value) of the brand choice model (Ben-Akiva and Lerman 1985). The coefficient of the category value should be between 0 and 1 to be consistent with utility maximization. Conditional on a bundling decision, the consumer chooses the firm (offering a particular promotion plan) that maximizes his utility; this is modeled as a multinomial logit. Conditional on these two choices, the consumer decides how many services to include in the bundle (the bundle size decision). This decision is modeled as an ordered logit, implying that there is an unobserved continuous preference function for number of services, which results in the observed ordinal choice of the number of services they choose. While a different model could be chosen for the quantity decision, in our case the high truncation to only three possible values makes this model appropriate[3]. We use maximum likelihood methods to jointly estimate all the three model parameters.

The modeling approach has to also account for both observed and unobserved heterogeneity across households (Guadagni and Little 1983, Chintagunta 1993). We capture observed heterogeneity in the bundling model by including in the utility function three household variables that reflect the consumer need for the services and for bundling. These include the total amount spent on telecommunication services; whether the household already subscribes to some of the services being offered in the bundle, and whether they would like to bundle services that are now obtained from a single source. We expect that heavier users will be more likely to bundle as these consumers will be more sensitive to discounts being offered in the bundles. We also expect that current users of more advanced services and thus early adopters, will be more likely to adopt bundles that are quite new in concept in the market[4]. In the brand choice model, we include a measure for consumers' preference for buying a bundle of services from particular firms in the utility equation. We expect that they will be more likely to choose the firm with higher preference. In the quantity model we include the total bill and the current services that they subscribe to in the utility function. We expect the heavier users to choose a larger number of services. While the variables above can be expected to explain the heterogeneity to a large extent, there may still be unobserved heterogeneity. We capture the unobserved heterogeneity in responses by allowing for multiple segments using a latent class approach (Wedel and Kamakura

[3] In our study, as discussed later, the respondent could choose between 3 and 5 services in the bundle.
[4] At the time of the study, telecom firms could not offer bundled services due to regulatory constraints. The landline, cellular and paging firms were distinct in each market. Internet service was also offered by non-telecom firms and

1999). The details of the models are provided in the Appendix. The latent segment approach allows us to identify segments with different response patterns. For example, there may be some segments of consumers for whom both the bundling and brand choices are affected by promotions, while other segments may not be motivated to buy bundles at all by the promotions. We do not have to pre-specify these segments; the latent class approach allows us to determine both how many distinct segments exist, and also the membership of the consumers in each of the segments.

Empirical bundling studies have followed two different methods to estimate the reservation prices for bundles – directly elicited self-stated reservation prices or an implicit approach using conjoint type choice experiments. The self-stated reservation prices approach (Hanson and Martin 1990, Venkatesh and Mahajan 1993) can have significant measurement error (Gabor and Granger 1965) and be biased downwards (Monroe 1990). The choice experiments approach (Wuebecker and Mahajan 1999, Chung and Rao 2003, Jedidi, Jagpal and Manchanda 2003) observes the choices of respondents from a choice set, and infers the reservation prices and does not suffer from the self-stated reservation price approach weakness. We therefore use this approach in our data collection.

Empirical Application

Data

The study was done at the behest of a client firm that wanted to test the effectiveness of various price promotion programs to attract customers from competition in the telecommunications industry. We included five telecommunication services in this study. The five services are: (1)

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was in the early stages of its diffusion. Thus the notion of one firm offering a bundle comprising paging, Internet or local telephony, (2) interstate long distance, (3) cellular telephony, (4) local paging, and (5) unlimited Internet access. These services represent the core telecommunication services available to US consumers (Carroll 2000). Respondents could choose between three major national competitors (N1, N2 and N3) and one local telephone service provider (L1) to buy these services. We do not reveal their names here for confidentiality reasons.

We varied seven bundle plans across each of the competing firms. These bundle plans varied on two dimensions viz. bundle presentation and discount level. We included three different bundle presentations, namely cash back (rear-loaded promotion), discount off total bill (front-loaded promotion) and free services (non-monetary promotion). We varied the level of the bundle discount over two levels, high and low. This resulted in six bundle plans. A seventh plan was a null plan (no discount for bundling). Since bundled services could offer convenience value to some consumers, they may bundle even without any price incentives. The null plan allowed us to examine this effect. The sponsoring firm decided the plans and their discount levels. In addition, as the bundles were customizable, each bundle plan offered three levels of discounts based on how many services (between three and five) the consumer chose. For example in one of the two cash back plans (level: high), the consumer could get back 15%, 20% or 25% of the total bill depending on whether they subscribed to three, four or five services in the bundle, respectively. We present the details of the bundle plans in Table 1.

[Insert Table 1 here]

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cellular service was quite novel.

We used an orthogonal main effect master design in 49 treatments to form the choice cards using the Addelman and Kempthorne (1961) design catalog. We split these 49 cards randomly into seven subsets of seven choice cards each. We showed each respondent seven choice cards from one of the randomly assigned subsets.

Respondents made two choices on a choice card as shown in Figure 1. The top of the choice card showed the four firms, each offering one promotional plan. A fifth choice of "will not bundle" was also available. After reviewing the promotional offers, respondents first decided whether they wanted to bundle. If they decided to bundle, they chose one of the four firms. On the lower half of the choice card they indicated which specific services (between three and five) they wanted to include in the bundle. The respondent was capable of customizing the bundle by choosing the desired type and number of services. Since almost all customers subscribe to local and long distance services, a minimum of three services had to be subscribed to for obtaining the discount.

[Insert Figure 1 here]

A professional marketing research firm collected the data, in 1996, in a three-phase phone-mail-phone sequence. Random digit dialing was used to call residential telephone customers in a western state in the US. The firm told respondents that this was a research study dealing with current and new telecommunications services, and solicited their participation. Then a "homework" task was mailed to those that agreed to participate, using priority mail, which included the discrete choice cards, along with instructions on filling out the responses. In these instructions respondents were asked to examine the choices on each of the cards, and indicate which options they would pick if the services were available immediately. The firm called the participants after a few days to obtain their responses to the discrete choice cards, as well as other questions. It made three callbacks, which resulted in a sample of 517 respondents. Respondents typically referred to a lack of time or interest as reasons for not participating in the study. After eliminating cases due to missing values, 482 respondents remained, which resulted in an overall response rate of 37%.

The sample has the following characteristics. About 55% of the respondents are between 30 and 49 years of age, and two thirds of the households have three members or less. The average monthly bill is $137 with the median being $108. 55% of the respondents have an annual income above $50,000. While all respondents subscribe to local and long distance service, only 32% subscribe to cellular, 29% to paging and 27% to Internet access. On the choice cards, one third of the respondents picked no bundle at all, 47% of the respondents picked a bundle consisting of three services, 13% picked a bundle of four services and 7% picked a bundle of all five services.

Model Estimation and Validation

We formulated three main models that we estimate jointly: bundling, brand choice and bundle size models. The *brand choice model* is a multinomial logit model and we include six dummy variables as independent variables to represent the six promotional plans with the base case being no special promotion. We also include brand dummies to capture the brand equity or strength of the brands and a variable that reflects the consumer preference for buying a bundle from each of the brands. The *bundling model* is a nested logit model wherein the probability of bundling depends on the maximum expected utility derived from buying one of the brands in the brand choice model; the impact of the promotions is thus incorporated through this category value term (see Appendix for details). In addition we include the total telecommunications bill and whether the respondents presently subscribe to cellular, paging or Internet services as additional independent variables. These terms are akin to using average consumption rates and inventory in modeling the category-buying incidence (Bucklin, Gupta and Siddarth 1998). We also include a variable reflecting the consumer's general preference for bundling. The *bundle size model* is an ordered logit model and the independent variables include both the promotion dummy variables as well as the total bill and currently subscribed services.

Each of the 482 respondents made choices on seven different choice situations. We randomly removed one of the choices for each respondent and used it for model validation. This resulted in an estimation data set of 2892 (= 482*6) choices and a validation data set of 482 choices. We estimated both a one-segment and a multi-segment model that allows us to account for unobserved heterogeneity.

We used SAS to estimate the model. We used the AIC3 as the in-sample fit criterion and the hit rate as a predictive validity criterion. AIC3 has been recently shown to be the best criterion for determining the number of segments (Andrews and Currim 2003). The models were estimated for one, two and three segments. The value of AIC3 [one segment: 10118, two segments: 8430.7, three segments: 8505.1] indicated that the two-segment results (with the lowest AIC3 value) were the best[5]. However, the predictive validity rates show that compared to the one-segment model, the two-segment model does a worse job in correct prediction of the bundling choice, but does better in the brand choice and number of services prediction. Overall the out-of sample prediction rates are better for the one-segment model (68 %) versus for the two-segment model (64 %, see second column in Table 2a). We first discuss the one-segment

[5] Alternatively the CAIC criterion can be used; this showed a similar pattern.

results and then highlight the main findings of the two-segment solution. We do so for each bundling related decision subsequently.

[Insert Table 2a here]

Results

Bundling Model: The *category value* coefficient in Table 2b (first column) is positive (0.58) and significant (t=32.4) for the one-segment model. This suggests that when the utility of a bundle is higher, the consumers are more likely to bundle than not. Since the utility of a bundle depends on the price promotion being offered and promotion is found to be significant (as discussed in the next section), promotions also impact the likelihood of bundling. We also find that subscribers having either cellular, paging or Internet service have a higher probability of buying bundled services. Those who prefer bundling are also more likely to opt for bundles.

[Insert Table 2b here]

Brand Choice Model: All the brand dummies (with L1 being the highest) and the brand specific bundling preferences are significant. The brand specific bundling preference variable captures the effect of the individual's inclination to *bundle* from each brand, while the brand dummy captures the average preference for the brand due to other unmeasured brand factors. Even after accounting for individual preferences to bundle from specific brands, there is still some residual significant brand preference.

All the price promotions are significant in affecting brand choice. The best discount is cash-back-yearend-high while the least effective is the cash-back-monthly-low. Comparing the coefficients of cash-back-monthly-high with cash-back-yearend-low which offer the same discounts (10%, 15% or 20% depending on the number of services) allows us to compare rear and front loaded discounts. Consumers prefer front-loaded discount. But when the rear-loaded promotion offers higher discount (cash-back-yearend-high offers an additional 5%), they prefer the higher discount. These results are somewhat different from Zhang, Krishna and Dhar (2000), in that they found that front-loaded promotions resulted in higher market share. However they did not vary the amount of discount, and thus did not have any tradeoff between when the benefit is obtained and the amount of the benefit.

The non-monetary freebies fall between the monetary discounts in terms of effectiveness. Interestingly, freebie-high-level is actually less effective than freebie-low-level, suggesting that consumers value the free call waiting and local service (offered in freebie-low-level) more than free paging and Internet (offered in freebie-high-level), in contrast to the a-priori expectations of the sponsor.

Bundle Size Model: All the independent variables are significant, except for total bill. The freebie-high has the highest impact. We also find that current subscribers to cellular, paging and Internet services opt for a higher number of services. This is plausible as they have a need for these services and are likely to include them in their bundle. Unexpectedly, the one-segment results show that heavy users are not more likely to bundle more services. Rather, the type of services used seems to affect the bundle size decision.

Two-Segment Results: We estimated the posterior probabilities of a respondent being in one of the two segments, and then assigned them to the segment with the higher probability. Segment 1 comprises about 34% of the respondents and segment 2 the remaining 66%. Segment 1 is slightly older and has a somewhat lower total telephone bill. The estimated coefficients for the bundling, brand choice, and bundle size model variables are different between the two segments. Examining the *bundling model*, segment 1 is less likely to bundle (given the non-significant category value) and this likelihood is not affected by promotions. Only the Internet users in this segment have a somewhat higher likelihood of bundling. Segment 2 has a higher tendency to bundle (category value is significant), and promotions as well as bill size positively impact this tendency. Interestingly, the bundling decision for both segments is not affected by consumers' general desire to bundle. In the *brand choice model*, the impact of promotion is quite different between both segments. In segment 1, the promotions generally do not impact brand choice. Only the N2 brand constant is significantly different from 0 (-.33), suggesting that this segment is less likely to choose this brand. In segment 2, while none of the brand constants are significant, the preference to bundle from particular brands is significant, suggesting that it captures all the effect of brand preferences. All the promotion coefficients are also significant, implying that customers in this segment are likely to make their brand choices based on the promotions being offered and their brand specific bundling preference. In the *bundle size model*, none of the variables are significant for segment 1, while all of them are for segment 2.

In sum, one-third of the respondents are not likely to bundle services (segment 1), whereas two-thirds are (segment 2). Consumers who prefer to bundle are responsive to the promotions in all the three choices. In line with our initial expectations (but contrary to the one-segment results), heavier users of telecom services are also more likely to include a higher number of services in the bundle.

The Impact of Promotion on Bundling Decisions: A Simulation

In the introduction of this paper, we raised several questions managers might face with respect to the bundling issue. The results of our study suggest that a marketing manager can use bundling to attract customers from competitors, increase the penetration of services among consumers who at the moment buy their services unbundled, and/or increase sales of services to consumers who already buy their services bundled. Thus, offering customizable bundles may indeed be beneficial to the firm. In order to explore its potential effects, we analyze how different promotional strategies may affect firm performance using the methodology proposed in this paper. We do so by performing simulations for the one-segment results[6]. The simulations will also help in assessing the relative impact of promotions on the bundling, brand choice and bundle size decisions. We use the sample enumeration method to estimate the percentage of consumers making various choices. We show two illustrative calculations; one where only N1 offers the promotion and one where both N1 and N2 offer the same plan simultaneously. We simulate the relative impact on market share and number of services bought for the various promotions. Results are shown in Table 3.

[Insert Table 3 here]

[6] We use the one-segment results for simulation as they make it easier to see the impacts of promotions on the three choices. We also chose it as the predictive validity is somewhat better than for the two-segment solution.

Impact on bundling decision: The base bundling probability is about 53% if there is no promotion. This suggests that bundling inherently provides convenience to some consumers, and that the telecom bundles are perceived in part like *product bundles*, wherein just offering them on one bill provides additional utility.[7] Any price promotion offering by N1 increases the bundling probability to between 60% and 67%. Thus between 7% and 14% new customers can be attracted to bundle; the impact of promotion is quite substantial. When both N1 and N2 offer the same promotion, the bundling proportion increases to between 9% and 18%, depending on the promotion. Cash-back-high appears to be the most effective discount.

Impact on brand choice: The base N1 market share for bundled services is around 14% if no promotions are offered. It can substantially improve its market share to 100% if it is the only brand offering discounts. This is of course unlikely to happen. If both N1 and N2 offer the same discounts, N1 market share could still increase to about 50%, suggesting that the consumers roughly split between the firms offering discounts.

Impact on number of services: In the absence of discounts, 86% of the consumers who bundle choose 3 services, the remaining choosing 4 services. When a discount is offered, there is only a small increase in the number of consumers buying four services (from 36 to 38 out of 482 respondents). Thus promotions do not appear to substantially impact the number of services that are bought.

In sum, the impact of promotions is primarily on market shares, secondarily on motivating consumers to bundle instead of buying the services separately, and there is little

[7] Stremersch and Tellis (2002) differentiate between *price bundling,* where two or more products are sold at a discount and *product bundling,* where the integration of two or more products provide additional value to the customer.

impact on the number of services that are bought. Thus the increase in market share of a firm offering customizable bundles comes primarily from consumers switching from other firms.

Profitability analysis. Using this study, a marketing manager can conduct analyses to assess the potential profitability of different discount plans. In deciding on which plan is the most profitable, s/he needs to:

1. Build a scenario assuming what kind of discount plans competitors will be offering. We show two previously mentioned illustrative calculations in Table 4; one where only N1 offers the promotion and one where both N1 and N2 offer the same plan simultaneously.
2. Calculate the bundling probability as well as own brand choice probability. This is done for each consumer based on his or her current profile.
3. Estimate the number of services each consumer will buy and the revenue per customer. As discussed earlier, the discounts seem to have a minimal impact on number of services that consumers buy. Most consumers who bundle buy only three services, while the number who buys four is almost constant. We assume that the major impact on revenue comes from either attracting a consumer into the market and/or to the brand, and not from an increase in the number of services. We assume average monthly revenue per consumer of $137.
4. Estimate the cost of promotions. We assume that promotional costs are a directly variable cost based on monthly revenue from the customers. This makes sense for the discount and cash-back promotions. The freebie promotion probably has a fixed direct marginal cost per subscriber. We assume a low directly variable cost of 1% and 2% for the two levels of freebie promotion.

Given these estimates, the net profit of any plan can be calculated (see Table 4). We estimate the total annual revenue based on the bundling percentage, choice probability, and assumed monthly revenue. The net profit is obtained after subtracting the assumed promotion costs. Under the first scenario, with only N1 promoting, the cash-back-high is the best promotion to offer, giving the highest net profit of almost $468,000. In the second scenario, we find that the freebie-low promotion is the most profitable. On the other hand, for N2, the cash-back-year-end-high promotion appears to be the best. Other similar analyses under various competitive scenarios could be performed.

[Insert Table 4 here]

We raised several managerial questions a manager may have about offering customized bundles in a competitive context. By using our methodology managers should be able to answer most of them – impact on the firm's market shares, number of services and profitability of various price promotions. They can also identify various segments in the marketplace. The methodology proposed in this research can help managers to identify the optimal bundling strategy to employ under the presumed competitive situation faced by them.

Discussion

Ours is the first study to examine the bundling, brand choice and quantity decisions in a competitive customizable bundling context. We proposed a model and a methodology to simultaneously estimate parameters of these three decisions. Our results show that price promotion does impact the *bundling* decision as well as the *brand choice* and that the level of discount and framing do have differential impact, confirming previous findings from non-competitive contexts (Harlam et al. 1995, Johnson, Herrmann and Bauer 1999). Consumers prefer higher discounts to front-loaded promotions. We also find that price promotion significantly, but not substantially influences the bundle size decision. Research in the consumer-packaged-goods also shows a small but significant impact of promotion on quantity (Bell, Chiang and Padmanabhan 1999, Nijs et. al. 2001). We conjecture that the lack of any substantial influence may be due to consumers not being able to inventory services for later use. In addition, due to the nature of the telecom services tested here, they are only bought if there is a real need.

Hence promotions are not able to make consumers buy additional services. This may, however, be idiosyncratic for the services used in the present study.

As the consumer specific variables used in this study like total bill size and services subscribed to seem to capture most of the heterogeneity across respondents, the one-segment model was found to perform better in predictive tests. We did find some heterogeneity among respondents, however. Consumers varied with respect to their responsiveness to promotions and, consequently, to their bundling propensity. This lends credence to the observed mixed bundling strategies being followed by firms in the telecom industry.

Our results give a clear indication of the extra insight we can gain by disentangling the bundling, brand choice and bundle size decisions. First, the findings show that promotions affect these bundling related issues differently. In our study, the impact of promotions is primarily on brand choice, secondarily on bundling decisions, and small on bundle size. These results imply that it is important to consider the role of promotional schemes both within a multiple-supplier and multiple-decision context, which more closely resembles the situation consumers face in reality. Second, we find that consumers' preference for buying a bundle from a particular brand is significant for the one-segment solution as well as for both segments in the two-segment solution. This implies that it is important to incorporate potential brand effects within the bundling decision and that it would be beneficial for future studies to depart from the non-competitive contexts commonly studied. Third, although we do not find very convincing evidence that consumers are willing to purchase larger bundles based on the promotions offered, the results do, however, indicate that the services consumers currently use affect their willingness to bundle. Probably, these consumers will include the services they currently subscribe to in the bundle. This suggests that customization of bundles indeed is important; maybe not so much with respect to the number of services to be included in the bundle, but rather with respect to the consumer's free choice of including the services that are particularly preferred. This may also affect consumer satisfaction. The lack of customized packages or bundles can lead to situations of forced choice. Recent research on the impact of forced choice (Dhar and Simonson 2003) shows that under preference uncertainty, forced choice leads to weaker preference, higher conflict, and lower commitment. It can also create negative affect. Thus, forced choice obviously makes these customers more likely to switch. Offering customisable bundles can reduce this problem.

The implications of this study should be considered against some limitations. First, our methodology allows for limited unobserved heterogeneity viz. the multiple latent segments. We assume that all the members of a segment share the same response parameters. This is clearly a convenient assumption. More recent Bayesian approaches (Jedidi, Jagpal and Manchanda 2003, Chung and Rao 2003) can be used to estimate individual specific parameters for customizable bundle situations. Second, we use data on behavioral intentions rather than actual behavior. Although such data were not available when conducting the study, it would be interesting to use actual data on bundling to see if our findings can be replicated. Also the business needs of the client sponsoring this project limited respondents to choose between three and five services. Future studies may benefit from considering a larger number of possible services. Finally, although our model allows firms to consider competitive effects, game theoretic approaches would allow more complete analysis of competitive behavior.

Conclusion

Customized bundles are becoming more important as a strategic tool. Despite the limitations of this study, we believe that its findings provide useful insights that help to further our knowledge of consumers' decision making with respect to bundling issues and, consequently, help managers to design more effective bundling strategies. Our findings also suggest that future research may benefit from developing theoretical bundling models that include customizable bundles in competitive contexts. We hope that this study may help and stimulate researchers in doing so.

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Appendix

Details of the bundling, brand choice, and quantity model

We observe a consumer choosing a number of services in a bundle in response to promotions being offered by competing firms. We decompose the observed choice of a consumer into three related choices; whether to buy a bundle of services or to continue buying the services separately (bundling model); which brand (or provider) of service to buy from (brand choice model) conditional on deciding to bundle; and finally how many services to put in the bundle (bundle size model).

One segment model

The unconditional probability of a consumer h buying q_t units of brand i on choice card t is decomposed as,

(1) $PR_i^h(q_t) = P_t^h(\text{bundling})\, P_t^h(i/\text{bundling}) P^h(q_t = k)$.

Where P_t^h (bundling) is the probability of bundling, P_t^h (i/bundling) is the probability of choosing brand i conditional on bundling, and $P^h(q_t = k)$ is the probability of choosing q_t services conditional on the first two decisions. The model parameters are estimated by jointly maximization the log likelihood.

Brand choice model. The probability that a consumer *h* buys the bundle from brand *i* on choice card *t*, conditional on deciding to bundle, is given by the multinomial logit model,

(2) $$P_t^h(i/bundling) = \frac{\exp(u_i + \beta X_{it})}{\Sigma_k \exp(u_i + \beta X_{kt})}$$

X_{it} represents the vector of marketing and observed heterogeneity variables (the promotion and preference for bundling variables in this case) for brands i on choice card t, while β represent the vector of response coefficients. u_i is a constant for brand i.

Bundling model. On each choice card t, the consumer has to make a decision whether to bundle or to continue buying their services separately. This binary choice is modeled with a nested logit, in which the bundling incidence on a choice card t is given by

(3) $$P_t^h(bundling) = \frac{\exp(\gamma_0 + \gamma Y_t)}{1 + \exp(\gamma_0 + \gamma Y_t)}$$

γ_0 is a constant, while Y_t represent the set of variables affecting the bundling decisions (bill size, current services and desire for bundling in this case) on choice card t. γ is the vector of response coefficients. Since the brand choice decision is nested in the bundling decision, this is modeled by including the category value, CV_t^h, as one of the explanatory variables in Y. The category variable is the maximum expected utility available to household h from buying a brand in the bundle on choice card t, and is given by the log of the denominator of the brand-choice probability (Ben-Akiva and Lerman 1985),

$$(4) \qquad CV_t^h = \ln \sum_k \exp(u_k + \beta X_{kt})$$

Quantity model: Given bundling and brand choice, the consumer now decides to buy q_t^i services on choice card t. The study design only allows respondents to choose between three and five services (due to the nature of the promotion investigated). Thus the dependent variable, q_t^i, is discrete and its distribution is highly truncated. We model the probability that household h chooses q_t^i services as an ordered logit model (McCullagh 1980, Gupta 1988). The ordered logit assumes that there is an underlying continuous variable V_t, where V_t is defined as:

(5) $V_t = \delta Z_t + \varepsilon$; Z_t is the vector of explanatory variables (promotion variables and current services subscribed to in this case).

The response variable, q_t, is treated as an ordinal response variable with L (3 in our case) response categories. The relationship between the observed response and the underlying latent variable V_t is given by;

(6) $q_t = k$ if $\theta_{k-1} < V_t < \theta_k$
and $q_t \leq k$ if $V_t \leq \theta_k$; θ_k are the unknown cutoff points to be estimated.

There is an ordinal constraint on θ_k;
$-\infty < \theta_0 < \theta_1 \leq \theta_2 \leq \ldots\ldots \leq \theta_{L-1} < \theta_L = \infty$

It can be shown that if we assume a logistic distribution for the error term ε in equation (4),

$$(7) \qquad P(q_t \leq k) = \frac{\exp(\theta_k - \delta Z_t)}{1 + \exp(\theta_k - \delta Z_t)} \quad \text{and}$$

(8) $P(q_t = k) = P(q_t \leq k) - P(q_t \leq k\text{-}1)$.

Where $P(q_t)$ represents the condition probability of buying q_t units on choice card t, conditional on bundling and choosing the brand.

Multiple segment model
In a multiple segment model, we assume there are s segments, where the probability of consumer h being in segment s is given by

$$(9) \qquad P_s^h = \frac{\exp(\pi_s)}{1 + \sum_{r=1}^{S-1} \exp(\pi_r)}$$

where π_s is empirically estimated.

The unconditional probability of buying q_t^h units is given by the weighted sum of the segment level probabilities;

$P_t^h(q_t) = \Sigma_s P_s^h * P_t^h(i/\text{bundling})\, P_t^h(\text{bundling})\, P(q_t=k)$.

The log-likelihood of the jointly estimated multiple segment model is given by

$$LL = \sum_h \ln(\sum_s \pi_s \{\prod_t P_{st}^h(bundling)^{\delta_h^t}[1-P_{st}^h]^{1-\delta_t^h} \prod_i [P_{st}^h(i/bundling)P_s(q_t = k)]^{\delta_h^t}\})$$

where $\delta^h_{it} = 1$ if consumer h buys brand i on choice card t, and 0 otherwise, and $\delta^h_t = \Sigma_i \delta^h_{it}$.

Figure 1
Example of bundling choice task

Step 1: Check one of the five boxes

Telecommunications Packaging Plans

L1 *Cash Back At End of Year Plan*			N1 *Free Services Plan*			N2 *Discount Off Total Bill Plan*			N3 *Cash Back at End of Year Plan*			
3 Services	4 Services	5 Services	3 Services	4 Services	5 Services	3 Services	4 Services	5 Services	3 Services	4 Services	5 Services	No Package
10% Cash Back	15% Cash Back	20% Cash Back	Free: Voice Mail	Free: Basic local service	Free: Both Voice mail and Basic local service	5% Discount	10% Discount	15% Discount	10% Cash Back	15% Cash Back	20% Cash Back	I wish to purchase my services from multiple providers as I do now
	☐			☐			☐			☐		☐

Step 2: Check off at least 3 services

Services in the plan

Check the boxes of the services you wish to purchase

Local Telephone Service	☐
Long Distance Telephone Service	☐
Cellular Telephone Service	☐
Local Paging	☐
Unlimited Internet Access	☐

Table 1
Bundle plans used

Number	Promotion	Type	Description		
			Buy 3 services	**Buy 4 services**	**Buy 5 services**
1	Cash Back Monthly Low	Monetary, Front loaded	Get 5% off total monthly bill	Get 10% off total monthly bill	Get 15% off total monthly bill
2	Cash Back Monthly High	Monetary, Front loaded	Get 10% off total monthly bill	Get 15% off total monthly bill	Get 20% off total monthly bill
3	Freebie Low	Non Monetary	Free Call Waiting and Call Forwarding	Free Local Service	Free Voice Mail and Local Service
4	Freebie High	Non Monetary	Get Free Voice Mail	Get Free Paging	Get Free Internet
5	Cash Back Yearend Low	Monetary, Rear Loaded	10% cash back	15% cash back	20% cash back
6	Cash Back Yearend High	Monetary, Rear Loaded	15% cash back	20% cash back	25% cash back
7	No Discount				

Table 2a
Correct prediction percentage for estimation and prediction samples

	Estimation Sample			Prediction Sample		
	Number of Choices	One-segment Model	Two-segment Model	Number of Choices	One-segment Model	Two-segment Model
% Correct prediction of bundling choice	2892	84.16%	69.46%	482	84.65%	68.87%
% Correct prediction of brand choice (of those choosing to bundle)	1944	54.16%	89.45%	323	49.85%	52.32%
% Correct prediction of number of services chosen (of those choosing to bundle)	1944	60.80%	68.83%	323	60.37%	68.42%
Overall	6780	68.86%	75.01%	1128	67.73%	64.00%

Table 2b
Parameter estimates for the one- and two-segment models

Variables	*One-segment Model*		*Two-Segment Model*			
			Segment 1		*Segment 2*	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Bundling Model						
Constant	<u>-4.107</u>	(-40.14)	-11.701	(-1.73)	<u>-3.778</u>	(9.99)
Category Value	<u>0.587</u>	(32.46)	1.000	(.95)	<u>1.000</u>	(15.29)
Desire for Bundling Services	<u>0.387</u>	(10.98)	0.079	(.12)	-0.066	(-.99)
Total Bill	<u>0.254</u>	(11.58)	0.167	(.61)	<u>0.524</u>	(3.71)
Presently have Cellular Service	<u>0.410</u>	(10.53)	0.898	(1.08)	<u>-0.632</u>	(-8.31)
Presently have Paging Service	<u>0.495</u>	(13.43)	0.577	(.28)	-0.138	(-.99)
Presently have Internet Service	<u>1.012</u>	(27.19)	<u>3.319</u>	(2.91)	<u>0.790</u>	(10.97)
Brand Choice Model						
Brand L1 constant	<u>0.424</u>	(22.85)	-0.398	(-.61)	0.366	(.58)
Brand N1 constant	<u>0.247</u>	(13.24)	-0.890	(-1.78)	0.197	(.32)
Brand N2 constant	<u>0.340</u>	(19.87)	<u>-0.330</u>	(10.00)	0.232	(.39)
Brand N3 constant	<u>0.252</u>	(15.32)	0.418	(.71)	0.085	(.14)
Cashback-monthly Low	<u>1.589</u>	(51.70)	2.784	(1.10)	<u>1.670</u>	(30.19)
Cashback-monthly High	<u>2.788</u>	(78.60)	3.412	(1.22)	<u>2.986</u>	(34.32)
Freebie Low	<u>2.085</u>	(64.28)	2.055	(1.01)	<u>2.258</u>	(49.22)
Freebie High	<u>1.750</u>	(52.13)	2.954	(1.34)	<u>1.830</u>	(47.24)
Cashback-yearend Low	<u>2.275</u>	(68.18)	<u>3.174</u>	(2.55)	<u>2.448</u>	(30.73)
Cashback-yearend High	<u>3.473</u>	(88.88)	4.093	(1.43)	<u>3.700</u>	(81.45)
Preference for buying bundle from particular brand	<u>0.810</u>	(91.51)	<u>1.095</u>	(26.79)	<u>0.787</u>	(39.72)
Bundle Size Model						
Cutoff $\theta 1$	<u>2.480</u>	(39.85)	2.625	(.60)	<u>2.978</u>	(30.89)
Cutoff $\theta 2$	<u>3.963</u>	(60.45)	<u>5.371</u>	(11.11)	<u>4.584</u>	(23.87)
Cashback-monthly Low	<u>0.511</u>	(9.54)	1.257	(.50)	<u>0.736</u>	(5.44)
Cashback-monthly High	<u>0.625</u>	(11.83)	0.402	(.09)	<u>0.812</u>	(8.64)
Freebie Low	<u>0.265</u>	(5.08)	0.873	(.18)	<u>0.358</u>	(4.82)
Freebie High	<u>0.823</u>	(13.53)	1.976	(.57)	<u>1.062</u>	(8.52)
Cashback-yearend Low	<u>0.273</u>	(5.03)	1.384	(.87)	<u>0.523</u>	(2.25)
Cashback-yearend High	<u>0.584</u>	(11.22)	-3.412	(-.58)	<u>0.881</u>	(10.63)
Total Bill	0.022	(1.50)	-0.166	(-.49)	<u>0.126</u>	(5.99)
Presently have Cellular Service	<u>0.518</u>	(12.96)	1.870	(.46)	<u>0.578</u>	(2.30)
Presently have Paging Service	<u>1.216</u>	(30.70)	0.471	(1.65)	<u>1.370</u>	(9.06)
Presently have Internet Service	<u>0.973</u>	(24.79)	-2.535	(-.70)	<u>1.463</u>	(7.78)
Segment Size	100%		34%		66%	
Log Likelihood	-5014.02		-4123.86			
Adjusted Rho Square	0.173		0.314			

Note: significant effects (p<.05) are underlined.

Table 3
Impact of promotions on market shares
(Based on one-segment results)

		Promotion						
		No Promotion	Cash Back Monthly Low	Cash Back Monthly High	Freebie Low	Freebie High	Cash Back Yearend Low	Cash Back Yearend High
Only N1 Promoting								
	Bundling %	256 (53%)	289 (60%)	316 (66%)	300 (62%)	293 (61%)	304 (63%)	323 (67%)
Market Share (for those bundling)	L1	131 (51%)	18 (6%)	0 (0%)	9 (3%)	19 (6%)	9 (3%)	0 (0%)
	N1	37 (14%)	241 (83%)	316 (100%)	281 (94%)	264 (90%)	285 (94%)	323 (100%)
	N2	48 (19%)	12 (4%)	0 (0%)	2 (1%)	2 (1%)	2 (1%)	0 (0%)
	N3	40 (16%)	18 (6%)	0 (0%)	8 (3%)	8 (3%)	8 (3%)	0 (0%)
	Total	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)
# of services	3 services	220 (86%)	251 (87%)	278 (88%)	262 (87%)	255 (87%)	266 (88%)	285 (88%)
	4 services	36 (14%)	38 (13%)	38 (12%)	38 (13%)	38 (13%)	38 (13%)	38 (12%)
Both N1 N2 promoting								
	Bundling %	256 (53%)	300 (62%)	334 (69%)	318 (66%)	307 (64%)	327 (68%)	342 (71%)
Market Share (for those bundling)	L1	131 (51%)	12 (4%)	0 (0%)	5 (2%)	8 (3%)	5 (2%)	0 (0%)
	N1	37 (14%)	138 (48%)	147 (47%)	149 (50%)	141 (48%)	152 (50%)	151 (47%)
	N2	48 (19%)	141 (49%)	187 (59%)	157 (52%)	151 (52%)	163 (54%)	191 (59%)
	N3	40 (16%)	9 (3%)	0 (0%)	7 (2%)	7 (2%)	7 (2%)	0 (0%)
	Total	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)
# of services	3 services	220 (86%)	262 (91%)	296 (94%)	280 (93%)	269 (92%)	289 (95%)	304 (94%)
	4 services	36 (14%)	38 (13%)	38 (12%)	38 (13%)	38 (13%)	38 (13%)	38 (12%)

Table 4
Net profit of different promotions on brands N1 and N2
(Based on one-segment results)

		No Promotion	Cash Back Monthly Low	Cash Back Monthly High	Freebie Low	Freebie High	Cash Back Yearend Low	Cash Back Yearend High
Only N1 Promoting								
Annual Revenue	N1	$60,828	$396,204	$519,504	$461,964	$434,016	$468,540	$531,012
	N2	$78,912	$19,728	$0	$3,288	$3,288	$3,288	$0
Assumed Promotion Cost		0%	5%	10%	1%	2%	10%	15%
Net Revenue	N1	$60,828	$376,394	**$467,554**	$457,344	$425,336	$421,686	$451,360
	N2	**$78,912**	$19,728	$0	$3,288	$3,288	$3,288	$0
Both N1 and N2 promoting								
Annual Revenue	N1	$60,828	$226,872	$241,668	$244,956	$231,804	$249,888	$248,244
	N2	$78,912	$231,804	$307,428	$258,108	$248,244	$267,972	$314,004
Assumed Promotion Cost		0%	5%	10%	1%	2%	10%	15%
Net Revenue	N1	$60,828	$215,528	$217,501	**$242,506**	$227,168	$224,899	$211,007
	N2	$78,912	$231,804	$307,428	$258,108	$248,244	$267,972	**$314,004**

Note that the highest profit is bolded.