

Comments on "Conjoint Analysis of Price Premiums for Hotel Amenities"

Introduction

Firms are often faced with the problem of designing and pricing new products. In durables such as houses, cars, and personal computers and also in services such as hotel accommodations, there is a basic unit that the firm can offer at a base price. In addition, the firm can offer (and the consumer may choose) optional add-ons at a premium. The types of decisions to be made by a firm in this context are

1. Out of all feasible and a priori reasonable options, which ones should be offered to consumers?
2. Given that a subset of options has been decided on, which of the following bundling strategies should be implemented:
 - a) all chosen options separately priced and offered;
 - b) all chosen options bundled and offered at a single price; or
 - c) a mixed strategy offering both a bundle and separate options?
3. If the options are to be bundled should they be further bundled with the basic unit, offered independently, or both?
4. Given that a bundling strategy has been chosen, what is the profit maximizing price level at which the options should be offered?

In order to answer these questions, the framework offered in economics works relating to the bundling of two goods needs to be extended to the multiple-options case. Further, the methodology used by marketers to estimate utility functions needs to be modified to allow the estimation of reservation prices.

We will start by discussing the conditions for bundling as opposed to separate offering of options. In particular, we will examine the results obtained by Schmalensee (1984). We will infer from those results the

(Journal of Business, 1984, vol. 57, no. 1, pt. 2)

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0021-9398/84/5712-0021\$01.50

type of consumer-based information required for the bundling decisions. This will lead us to review the existing methodology of estimation of utility functions and Goldberg, Green, and Wind's (1984) approach to the estimation of the value of product options. Next we will evaluate the empirical findings of the latter study and propose some additional analyses aimed specifically at the bundling decisions.

The Conditions for Bundling

Adams and Yellen (1976) examine the use of bundling as a price discrimination mechanism that may allow the capture of consumer surplus. They evaluate three strategies for a monopolist selling two goods: unbundled sales (the two goods are priced and sold separately), pure bundling (the two goods are jointly priced and sold), and mixed bundling (both the two goods and the bundle are offered). Their conclusion is that the choice of strategy depends on the costs of the products and the distribution of the reservation prices across consumers. They imply, in their examples, that bundling will dominate unbundled sales only if there is a negative correlation in the population of buyers between the reservation prices of the two goods. Schmalensee (1984) assumes that the distribution of reservation prices is bivariate normal and is able to obtain some conditions for the dominance of the bundling strategies. Unlike the Adams and Yellen examples he shows that bundling may dominate unbundled sales even if the correlation in the population of buyers between the reservation prices of the two goods is positive. The underlying reason is that even when the correlation is positive the standard deviation of the distribution of reservation prices for the bundle is less than the sum of the standard deviations for the two component goods. Specifically, Schmalensee shows that if the average willingness to pay, as measured by the normalized difference between the mean reservation price and cost, is high enough and if the correlation is smaller than $+1$ the profits associated with bundled sales will be higher than those associated with unbundled sales. The profit advantage of bundling is shown to get larger as the average willingness to pay increases and as the correlation gets smaller than $+1$. Schmalensee also shows that mixed bundling always dominates pure bundling. He further illustrates that mixed bundling dominates unbundled sales if the correlation is negative or, if it is not, as long as the average willingness to pay is not too low, although it can be much lower than costs. Thus for all practical purposes mixed bundling always dominates the other two strategies, because it is basically a very efficient mechanism for price discrimination. It reduces through the bundle the heterogeneity of the buyers who care for both goods, while allowing the collection of a high price for each good from those buyers who only care for one good.

Schmalensee's results show that it is optimal to follow a policy of

mixed bundling. There are however, several major issues that are not addressed in Schmalensee's work, which need to be considered in making the bundling decisions in the context of product options.

First is the issue of costs. The unit costs were assumed by Schmalensee to be constant. This implies, in the product-options context, that all possible options should be offered. Because of the continuity of the reservation price distribution, regardless of how high price is set, there will always be some consumers whose reservation price is above the set price and who will purchase the option. If price is set above costs, positive profits will result. Thus, in order to decide which options *not* to offer, the theory has to be modified either to have fixed costs associated with offering each option or to have some other equivalent assumption relating costs to output.

Second, is the issue of multiple (as opposed to two) options and their substitutability. In any product-options case there will be a lot of possible options, and even assuming that all the results relating to the bundling of two goods can be generalized, some issues that do not appear in the two-goods case emerge. For example, suppose a radio in a car is an option, and that there are two suboptions, an AM and an AM/FM radio. Clearly, at most one of these suboptions will be chosen by any given consumer. From a bundling point of view this means that while both suboptions can be offered separately, in a bundled form they can only appear in separate bundles.

Finally, Schmalensee does not determine the actual prices to be charged for the bundle and separate offerings. In any practical problem that will, of course, be necessary. It is clear that in order to find the profit-maximizing prices we will need some specific information. First are the unit costs of production, then the consumers' reservation prices. With respect to the latter, we will need their means, their dispersions, and the magnitudes of the correlation of the reservation prices for the separate options.

In order to estimate the above reservation price characteristics, the reservation prices for the separate options and for bundles of these will need to be elicited from a representative sample of consumers. Such information could be obtained either from a controlled experiment or from a survey. In the following discussion we will elaborate on the possible use of survey data in this context.

Estimation of Consumer's Utility Functions

Marketers have been estimating what they call multi-attribute models, which are essentially utility functions in which the arguments are not quantities, as assumed in classical economics, but are instead amounts of attributes provided by each product. This approach is most amenable to the analysis of choice among brands within a product class.

What has typically been done in marketing is to estimate the utility

function at the individual level. First, the researcher finds through aggregate factor analysis and multidimensional scaling what are the relevant perceptual attributes to consider. Then, various techniques utilizing stated preferences are used to estimate the individual's utility function. If the functional form is prespecified, the parameters or attribute-importance weights can be estimated through procedures such as LINMAP. If a functional form is not specified, the utility associated with each level of an attribute can be estimated through conjoint analysis (see, e.g., Green and Srinivasan [1978] for a review of utility-function estimation techniques). It is worth noting that the estimation of multi-attribute functions parameters based on observed preference—that is, choice rather than stated preferences—has also been done in marketing following McFadden's (1980) logit analysis. In this case, however, an aggregate as opposed to individual utility function is estimated.

In general, the price of the brand has been handled in the marketing works as an additional attribute. This has the shortcoming that if consumers have some idea of the supply curve or the hedonic price, that is, the likely price that the producer will offer the good at, they may have difficulties in responding to certain price/quality combinations that are unlikely to exist in reality. In the context of reservation prices, this is borne out by the work by Gabor and Granger (1965). However, the emergence of works in economics (e.g., by Lancaster [1971] and Rosen [1974]) and their application to marketing (e.g., by Agarwal and Ratchford [1980] and Rao and Gautschi [1982]) have started a movement in the right direction, toward handling price in the context of the multi-attribute model.

The Goldberg, Green, and Wind Methodology of Estimating the Preferences for Unbundled and Bundled Options

Goldberg et al. (1984), in a very interesting study, examine the relationship between the preferences for unbundled and bundled hotel amenities. It is a real-world problem in which the number of considered amenities or options reaches 100. In essence, they test whether the value of a bundle of options in such large scale problems can be determined in two stages. First, the value of each separate option, at a prespecified price, is determined. Then the preference for a bundle of options is predicted by adding the values (estimated in the first stage) of its separate components.

In greater detail, Goldberg et al.'s methodology and findings are,

1. In the first stage they estimate the average value of each option. Data are collected from 180 respondents on 43 attributes (such as type of pool) and within each attribute for several options (such as no pool, rectangular pool, or free form pool). On each option the respondent indicates whether he will or will not accept the option at a price specified by management—based on cost considerations. In addition

the most preferred option/price combination from the ones offered in that attribute is indicated.

These data are used in a cross-sectional (across individuals) analysis. Each facet (a collection of related attributes, e.g., pool location, pool type, and landscaping, are part of the atmosphere/facilities facet) is analyzed separately. The methodology is one of canonical correlation. On the left-hand side are two dummy variables expressing the three levels (most preferred, acceptable, unacceptable) and on the right-hand side are dummy variables representing the 20–40 options belonging to the facet. Through this analysis the authors find the *average* part worth value of each option. They find that at the given price, some options have no value to the average consumer.

2. In the second stage, the authors try to predict the overall preference for certain bundles or concepts. Fifty different full-profile concepts (bundles) of hotels are designed through a factorial design. Their prices are determined by adding the managerially determined prices of their separate components. Each individual rates five (out of the 50) different full-profile concepts of hotels on a 1–10 scale of the likelihood of staying at that hotel. Each individual also states the relative importance of each facet through a constant sum scale.

These data are used in a cross-sectional regression analysis. The left-hand side of the regression consists of the likelihood-of-stay rating and the right-hand side includes a hybrid individual utility for that concept. That utility is the sum of the part worth values of the options that make up the concept (determined in the previous stage), each weighted by the individual's stated facet-importance weight.

The authors examine here the following issues: Do the individual weights and the overall concept price help in predicting the value of the overall concept? The *a priori* assumptions are that the first would, since it adds an individual component, while the latter would not, since the prices of the component options were already considered in the first stage. When the stated weights were replaced by equal weights, that is, when the individual component was left out, the resulting average utility of the concept was more highly correlated with the overall likelihood-of-stay rating than was the weighted utility. When the residuals of the second-stage regressions were regressed on dummies representing the overall price levels of the concepts, all the dummies were found to be significant. Their magnitudes indicated that the greater the price of the concept, the greater the reduction in the previously predicted likelihood of stay. Thus, both findings contradicted the authors' *a priori* beliefs.

Insights into Goldberg et Al.'s Findings

There are two phenomena that the authors uncover, for which I will try to offer an explanation. First is the fact that equal attribute weights do

better than stated ones in predicting preferences. This finding has commonly been reported in the past (see, e.g., Beckwith and Lehmann 1973 and Einhorn and Hogarth 1975). Based on recent results by Horsky and Rao (1984), equal weights do perform slightly better than stated weights but estimated weights, particularly if estimated at the individual level, do markedly better. Thus it seems there is considerable evidence that individuals are not able to state directly the parameters entering their utility function and that such parameters ought to be estimated. This individual level analysis also points to a considerable heterogeneity in attribute weights. Thus, ideally, individual level analysis should be conducted.

The second finding is that the overall concept price is significant in explaining the likelihood of hotel stay even though that price information is supposedly captured in the first-stage part worth analysis, where the price of each option was specified. This should not be surprising, for several reasons. First, this is an attempt to predict individual preferences from *average* part worth components. When this is done, consumer heterogeneity in terms of reservation prices is ignored. Moreover, the correlations (negative or positive) between the reservation prices of the separate options, which influence the reservation price for the bundled good, are unaccounted for. Thus, when in the second stage the overall price of the concept—actually a bundle—was provided to consumers, it triggered the individual consumer's real and so far unmeasured reservation price for the entire concept in terms of determining the likelihood of stay.

The second reason has to do with the fact that in the first stage each option has only one associated price: Thus the part worth result is a measure, not of the mean of reservation prices, but of the acceptability of the option. This measure is related to the proportion of individuals who say that at that price they will take the option, that is, those whose reservation price is higher than the stated price. As demonstrated by Schmalensee for the two-good case, while the mean of the joint reservation price distribution for the bundle is equal to the sum of the separate means of the distribution of the two goods, the dispersion across the population is not the sum of the dispersions. Thus, at any point along the joint reservation price distribution other than the mean, the proportion who will buy the bundle will be different from the proportion who would have bought the separate components.

Goldberg et al. (1984) resort to a different rationale for the significance of the overall price. They cite Tversky's story in which an individual sequentially expresses readiness to buy options at certain prices but at the end is not ready to buy the whole bundle for the summed price. There is actually no evidence here of such a phenomenon since no direct individual level part worth analysis was conducted. However, Tversky's story, if substantiated in additional analysis,

could be explained by imperfect information. The questions about the acceptability of the options, are asked independent of what else will be chosen by the consumer in terms of the hotel and without his really knowing the price of these other options. Thus, those are marginal decisions. However, the consumer, here a traveling businessman, in choosing a hotel is attempting to maximize his overall utility subject to a travel budget constraint. It is only when the full concept, along with its total price, is provided to him that he is asked to make a choice, not on the margin but rather on the entire package. It is possible that only at that stage are his real reservation prices formed, and the negative correlations between different options' reservation prices then become more pronounced.

Suggestions for Managerial Implications

The data collected in the hotel amenities case can be further analyzed in order to reach some of the bundling decisions we have mentioned earlier—that is, what options to offer and in what bundling form. The steps which could be taken are the following:

1. Examine each option for the proportion of the sample who say they would accept it on the margin. Check if that proportion is high enough to make it worthwhile, from a fixed cost viewpoint, for the hotel management to offer the option. If on the margin it will not fare well, it can be eliminated from further consideration. These results can be cross-checked with Goldberg et al. canonical correlation analysis.

2. Run regressions on the likelihood-of-stay ratings of the full-profile concepts ($180 \times 5 = 900$ observations in all), using as independent variables 100 dummies representing the various options, and the overall price of each concept. This would lead to the determination of average, not on the margin, part worths for each option. At this point all options now (not on the margin) insignificant in terms of their impact on the likelihood of stay can be eliminated. It is likely that those will include the ones eliminated at the first stage plus many more. It should be noted that if data were collected again, this second stage should include only concepts composed of options that had remained from the first stage.

3. Now we have left only those options that seem to be promising, on the average, both at the margin and overall. Some of these may be further eliminated. Subsets of these options may belong to the same attribute and possibly only one, for example, a certain pool type, can be offered. Out of such mutually exclusive options the option with the highest average value in the second stage should be chosen. In terms of bundling, the theoretical conditions we reviewed in the beginning imply that a mixed bundling strategy should be followed. However, in some cases the option (such as the selected pool type) cannot be of-

ferred separately and so will be bundled with the basic hotel unit. In other attributes the options may not be mutually exclusive but rather dependent. Those will need to be treated differently. For example, color TV could be mixed bundled with the basic hotel room while an HBO movie option can only be mixed bundled with the TV set. Overall, given the mixed bundling strategy, in addition to offering many of the options separately, a more luxurious room including options in bundle with the basic room should be offered. That is, we should end with a mixed bundling situation similar to the one existing in the car industry. For example, in the Chevrolet large car line, the basic Impala model is offered and options can be added to it. In addition, an Impala bundled with some of the options—that is, the Caprice—is also offered. It would seem that as long as we do not question the optimality of the managerially provided prices, the decisions regarding which hotel amenities should be offered, which should be bundled, and how, can be reached.

4. If optimal prices (other than the ones set by the managers) are desired, then additional analysis is required. From the data used in steps 1 and 2 above, the correlations between the various options' part worth values could be assessed. Those jointly with the other results obtained above could provide some preliminary basis for optimal price determination.

Conclusions

Bundling of options is a profitable pricing strategy in that it allows the extraction of consumers' surplus by taking advantage of consumers heterogeneity in terms of reservation prices. The Schmalensee (1984) theoretical results for bundling and the pioneering empirical bundling application of Goldberg et al. (1984) have brought us closer to answering the important and difficult pricing problem of bundling of product options. It is to be hoped that their works will lead to further efforts in this line of research. On the theoretical side, the issues of costs and multiple goods, not all of which are independent, will need to be addressed. On the empirical side, methods to estimate individual reservation prices will need to be perfected. Possibly methods such as the one proposed by Jones (1975) could be extended and utilized in this context.

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