Predicting customer choice in services using discrete choice analysis

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This paper presents an overview of the science and art of discrete choice modeling for service sector applications. With the ongoing momentum of service science, management, and engineering, the discrete choice modeling approach provides a sophisticated tool kit for assessing the needs and preferences of service customers. We provide directions for designing and executing discrete choice studies for services and discuss several examples for a number of industries including health care, financial services, retail, hospitality, and online services. We conclude with a discussion of the many managerial implications of the discrete choice approach.

INTRODUCTION

According to Drucker, "What business thinks it produces is not of first importance. What the customer thinks he is buying, what he considers value, is decisive. And what the customer buys and considers value is never a product. It is always utility, that is, what a product does for him."[1]

In most modern economies, the service sector now not only accounts for nearly three-quarters of total employment and revenue, but also accounts for the largest employment growth.[2] Some researchers even argue that several nations have become so service-oriented that they can be described as "experience economies."[3] Thus, effective systems that create satisfying customer experiences will increasingly create competitive advantage. Indeed, Levitt's statement that "There is no such thing as a service industry. There are only industries whose service components are greater or less than those of other industries. Everybody is in service."[4] has never been more pertinent.

Even traditional manufacturers are turning to services for growth.[5] For example, General Motors boosted its production by offering its OnStar** service in more than 50 car and truck models.[6] Eastman Kodak bought Ofoto, Inc., to expand its online digital printing services.[7] IBM, which has historically been oriented toward the providing of goods, recently generated more than 50 percent of its revenue from its services division. Service science, along with its management and engineering, is becoming an essential component of the IBM business model.[2,8] The scientific approach to services should provide great benefit to IBM and other organizations that are joining together to explore the theoretical and practical aspects underlying the science of service systems. The recent announcement of the creation of a new organization, the *Service Research and Innovation Initiative*, and ongoing efforts by various academic societies (e.g., the Production and Operations Management Society, the Decision Sciences Institute, and the American Marketing Association) are very positive steps toward the further development and refinement of service science, management, and engineering (SSME).[9]

One of the dominant underlying premises of the work that is ongoing in SSME is that this effort will assist business organizations in enhancing their capabilities to meet their customers' needs in the most effective manner. However, in today's fast-moving business environment, with its constantly changing markets and a profusion of goods, service, and experience offerings, companies often find it hard to discern what customers really want and are willing to pay for. Making things even more challenging, potential goods, service, and experience features for market offerings in many industries have grown increasingly complex. The SSME movement faces an even greater challenge: the quantification of the relative importance of the service components related to customer choices and their willingness to pay.[1]

The purpose of this paper is to provide an overview of some of the recent advances in the art and science of discrete choice modeling for applications in the service sector.[10] We discuss the underlying theory of discrete choice modeling and provide several illustrations of its managerial implications within the context of business-to-consumer (B2C) and business-to-business (B2B) service industries. We provide examples from various applications in the service industries, including health care, hospitality, retail, and financial services.

BACKGROUND

The vast proliferation of goods and services, increased emphasis on mass customization and customer experience, and the variety of new technologies require that firms carefully evaluate the factors influencing customer choice for their service offerings. For example, Schwartz[11] suggests that both mundane and involved decisions such as ordering a cup of coffee, choosing a health-care provider, or setting up a retirement plan are becoming increasingly complex because of the abundance of choices available to the consumers in the marketplace. The same challenge applies to many B2B markets and their customers (for example, selection of an IT [information technology] supplier for a hospital).

This dramatic explosion and complexity in options has ironically become a problem instead of a solution for both customer and firms. Schwartz argues that having fewer choices is better than having many for societal well-being. However, the underlying problem in predicting customer choice resides much more in the fact that purchasing decisions are made on the basis of (potentially) many different criteria simultaneously, including brand, quality, performance, price, features, distribution channel, and so on.[12] This problem is further confounded in service applications, where customers may consider intangible features and characteristics of the market offerings (e.g., service quality, safety, and trust; interactions between service providers and customers).

Thus, incorporating customer preferences and choices into day-to-day managerial decisions is extremely important for highly competitive services industries such as hotels and other hospitality businesses, retail, health care, and B2B services, because their customers evaluate them on more than one criterion. For example, customers might choose fast-food establishments based on their cost, service quality, food quality, food variety, or speed of delivery. Similarly, customers might choose a hotel based on its location, brand name, facilities, service quality, price, and loyalty program, among other things.

Managerial choices in B2B service environments become even more complex because there are multiple decision-makers, each with unique decision-making criteria and constraints. In one of our recent research projects, we found that the relative importance of various decision-making criteria used for the selection of integrated IT services differs greatly among hospital administrators, medical professionals (e.g., cardiologists and radiologists), and technical staff.[13]

Furthermore, within services, many determinants of customer choice (e.g., waiting time and variety) are directly linked to various operating decisions (e.g., labor schedules, capacity planning, operating difficulties, and task priority policies.)[14,15] Given that many services are coproduced, some drivers of customer choice are directly affected by the actions of customers. For example, waiting time is a function of employee productivity and customer arrival rate. Therefore, understanding the relative importance of the various components of service offerings on customer choice is crucial.

During the last few years, research has redefined a sophisticated set of tools for discrete choice modeling that is available to service companies seeking an accurate understanding of the drivers of customer choice. Such tools and methodologies allow the prediction of market performance for new or existing services and the expected performance of offerings with remarkable precision, even under seemingly complex and erratic market conditions. For example, recent studies have demonstrated that the discrete choice framework is very effective in modeling the choice behavior of customers when exploring service designs.[15,16]

A number of recent studies have used discrete choice analysis (DCA) within the context of new service development. For example, based on discrete choice data collected at a large international airport, Pullman et al.[17] developed a framework matching the needs of multiple market segments with service offerings. Easton and Pullman[16] developed a mathematical modeling formulation of the sellers' utility problem within the context of new service design using discrete choice data. Verma et al.[15] presented a nonlinear optimization model linking customer preferences obtained from DCA, production cost, and operating difficulty. Verma, Iqbal, and Plaschka[18] described the similarities and differences in the choice of online financial services for different market segments. The authors of this paper are currently working on several service-sector applications of DCA (both B2C and B2B). Thus, discrete choice modeling is increasingly being used in many service-sector applications to predict customer choice.

THE SCIENCE OF DISCRETE CHOICE MODELING

The discrete choice modeling framework pioneered by McFadden (winner of the 2000 Nobel Prize in Economics) focuses on both the economic reasons for individual choices and the ways in which researchers can measure and predict these choices. Subsequently, McFadden's work and the corresponding experimental-approach development by Louviere, his co-researchers, and colleagues in marketing, economics, management science, and other disciplines has led to many diverse applications, such as design and development of new products and services, transportation planning, evaluation of alternative pricing strategies, and financial services design.[18,19]

Economic choice theory assumes that individuals' choice behavior is generated by maximization of preferences or *utility*. Louviere defines utility as "judgments, impressions, or evaluations that decision makers form of products or services, taking all the determinant attribute information into account."[20] The idea of *utility maximization* and its relation to human choice behavior is not new. McFadden quotes from a 1912 economics text by Taussig: "An object can have no value unless it has utility. No one will give anything for an article unless it yields him satisfaction. Doubtless people are sometimes foolish, and buy things, as children do, to please a moment's fancy; but at least they think at the moment that there is a wish to be gratified."[12]

Information integration theory (IIT) in psychology[21,22] and random utility theory (RUT) in econometrics[23,24] provide the theoretical basis for the development of a scientific approach for modeling customer choices. Additional details about the theory of discrete choice modeling can be found at the Web site of the Centre for the Study of Choice[25] or from the author of Reference 26. Both of these sources provide details about the classical theories and the latest advances in discrete choice modeling. Rather than repeating what is available at these sources, in this paper, we describe various applications of discrete choice modeling for services.

EXECUTING DISCRETE-CHOICE-MODELING PROJECTS FOR SERVICES

The discrete-choice-modeling approach requires that a representative sample of customers make choices in simulated situations derived from realistic variations of actual service offerings. For example, one may wish to predict market preferences for upscale hotels for business travelers. This problem will require us to identify the drivers of customer choice for upscale hotels (e.g., service expectations, quality, price, brand name, location, amenities, loyalty program); construct realistic hotel choice "experiments" with potential customers (i.e., business travelers); and then estimate statistical models that can provide the necessary managerial insights.[10] Similarly, the drivers for the selection of an IT service provider for hospitals may include price, service reliability, responsiveness and availability of a service engineer on-site, and other factors.[13]

The execution of a discrete-choice-modeling project typically comprises three broad steps.[27] First, using qualitative market assessment, customer interviews, case studies, industry data, focus groups, and other information sources, a list of drivers that are believed to influence customers' buying decisions is compiled. For example, for a food service operator at an airport terminal, the relevant drivers might be type of food, variety, waiting time, brand name, and price.[28] For an upscale hotel operator, the relevant drivers might be brand name, personalization and customization options, facilities (e.g., spa, golf course, swimming pool, fitness center, business center), and so on.[10]

Great care must be taken to ensure that all (or at least as many as possible) of the determinant drivers are identified and expressed in terms understood by customers. One should consider the following questions when building a list of market choice drivers: (1) Is it necessary to include an exhaustive list of all salient product and service drivers?; and (2) How can product and service attributes be configured so that the critical choice drivers are identified while the choice experiment is at once realistic and small enough to be tractable? Once the list of choice drivers is finalized, sophisticated experimental design techniques are used to develop many realistic versions of service offerings (see Reference 29 or 30 for additional details about choice experiment design options).

Next, choice experiments are constructed that ask respondents to select one out of two or more services available to them in a series of *choice sets*. For example, Pullman, Verma, and Goodale[17] presented four descriptions of food service options to customers waiting at Chicago's O'Hare International Airport in a series of 16 choice sets. Within each set, the respondent was asked to choose one of the four presented food-service options, or none. In another study described in Verma and Plaschka,[31] customers were presented with descriptions of two hotels (using multimedia clips, hyperlinked images, and service descriptions).

An example of a choice experiment in the context of B2B supplier selection can be found in Reference 32. In this application, the respondents (purchasing and manufacturing executives in various industrial enterprises) had to select suppliers for high-technology items that contained several service features. In the experiment, respondents were asked to compare their current supplier with experimentally generated new suppliers. They were asked whether they would choose to stay with their current supplier or switch to the new supplier.

Several service sector examples are presented in ***Figures 1*** through ***3***. Figure 1 shows a screen capture of a choice experiment for the selection of an online retailer with varying degrees of customer service and other features. In this example, hyperlinks are used to provide additional information about certain service features. Figure 2 presents a screen capture of an experiment conducted to study the choice of a mobile phone service considering brand names, technical features, price, and purchase location. The experimentally designed alternatives (packages A and B) are paired with each respondent's current mobile service package to increase the realism of the choice experiment. Figure 3 shows the choice experiment for a new shopping center design considering the architectural design and various services that would be available.

For service sector applications of discrete choice modeling, special care must be taken to represent the unique and intangible nature of the service interactions. A tangible good might be easily described by its features (e.g., for a laptop computer, the hard disk capacity, CPU speed, and monitor size or resolution). Many service features can also be described by their component features (e.g., for a bank account, the interest rate, monthly charge, and ATM and online access privileges). However, many other service features, such as service quality and other intangible aspects of service delivery (e.g., reliability and responsiveness), are often relatively hard to describe. Due to the development of fast multimedia computers, it is possible to describe unique service characteristics using a series of

Which of the two websites would you choose to shop at?

Assume that everything about the two websites is exactly the same, except for the features noted.

	OPTION A	OPTION B
Online Customer Support	Online Chat (e.g. Messenger Chat)	Audio Chat from computer (e.g. Skype, or MSN Instant Messenger)
Product / Service Descriptions	1 Picture & Short Description	Brief Description & NO pictures
Shopping Assistance	Typical Search Engine	Enhanced Search Capabilities: retrieves items based on past purchases and current preferences
Offline Customer Support	1-800 # only	Can be reached by e-mail and 1-800 #
Recommendations	No Recommendations	Customer Product/Service Ratings
Loyalty Programs	Offers a % of money spent back at the end of the year	1 point for every $1 spent
Payment Methods	Only accepts Credit Cards	Accepts all payment types
Promotional / Reminders	Wish List with email reminders	Wish List without email reminders
Money Back Guarantee	Unconditional money back, no questions asked	Subject to company policies (time constraints, warranties, partial refunds)
Which one would you choose?	OPTION A ○	OPTION B ○
	NEITHER ○	

Figure 1
Choice of an online retailer

	Package A	Package B	Current Package
Phone Brand	LG	Samsung	Sharp
Phone Size	It will fit into a jeans pocket, but it is too bulky to fit in a shirt pocket	Size of an oversized credit card with ¼ inch thickness	It is small enough to fit into a typical shirt or blouse pocket
Phone Design	Slide 	Swivel 	Monoblock 
Phone Functions In addition to voice calls, voice mail, short messaging (e.g. SMS, MMS)	None	Business productivity tools (e.g., email, schedule)	Media tools (e.g., camera, music player, TV)
Phone Price	$ 250 or more	Between $ 100 and $ 149	Between $50 and $99
Wireless Carrier	Verizon Wireless	Nextel	Alternative carrier (e.g., MTV, Virgin Mobile, Boost)
Carrier Flexibility	Can be used with any other carrier of my choice	Can only be used with this carrier	Can be used with any other carrier of my choice
Phone Usage	Can be used in U.S. only	Can be used around the globe	Can be used around the globe
Purchase Location	Internet store/online	Department store (e.g., Macy's, J.C., Penney)	Wireless carrier retail store (e.g., Verizon, Sprint)
Which device package will you choose?	○	○	○

Figure 2
Choice of a mobile phone service

Figure 3
Choice of a new shopping center design

images, video clips, and accompanying text descriptions.

In the final phase, econometric models based on responses from a representative sample of customers (or potential future customers) are used to identify empirical key patterns in the survey responses, providing a relative weighting for each market driver and for interactions among drivers. Managers can then select the optimal combination of operations and market drivers to develop a profitable and sustainable value proposition that, under normal competitive constraints, will maximally leverage their available resources. After developing suitable econometric models, the results can be easily implemented in a decision-support program that can be used to perform various managerial what-if analyses. Rather than describing statistical details underlying the estimated choice models, in this paper we describe examples that illustrate the usefulness of the discrete-choice-modeling approach, beginning with some new methodological advances in customer choice modeling.

RECENT ADVANCES IN DISCRETE CHOICE MODELING

The science of discrete choice modeling continues to evolve as researchers in various academic disciplines pursue research projects with varied focus and emphasis. At the same time, the art of choice modeling is also evolving rapidly, as IT makes it possible to develop more realistic choice experiments. Some trends relevant to service-sector applications are described below.

Emergence of multimedia-driven choice experiments

Even a few years ago, a typical implementation of choice modeling involved developing printed survey forms in which respondents were subjected to a series of pre-configured, table-like formatted choice scenarios. Choice sets were presented as static tables with little room for customization to identify the respondent's most interesting purchase drivers.

However, the most recent advances in IT, including broadband Internet connections, digital imaging and streaming video technologies, almost unlimited computing resources, and sophisticated programming languages, allow researchers to develop very realistic and highly customizable choice experiments specific to each respondent. These choice experiments are visually appealing and employ easy-to-use formats, resulting in a high level of respondents' involvement. As mentioned previously, these advances are highly relevant to service-sector applications, since they allow the researchers to construct realistic experimental scenarios.

In our recent studies, we have extensively used Web-based technologies (with hyperlinked pictures or text illustrations, brand logos, and audio and video files) to realistically illustrate choice scenarios to respondents in service applications. For example, in an ongoing study, several depictions of "service scripts" in face-to-face customer interactions in a hospitality setting are created by professional actors.[33] The video clips of the service scripts, along with other features of the service interactions, are then presented to the customers in the form of a discrete choice experiment. In another study, in a retail setting, we first used a series of screens (each with several pictures and detailed descriptions) to describe the customer service, shopping experience, and parking convenience at a futuristic shopping center.[34] Later, when the respondents were presented with the discrete choice exercise, the earlier descriptions were available as hyperlinks for ready reference.

When choice experiments require transferring large amounts of data, we either give respondents high-capacity portable storage devices (e.g., USB [Universal Serial Bus] storage keys, which can contain dozens of megabytes of data) or conduct interviews at any site with a wired or wireless laptop computer. Although such options have been available for some time, they have only recently become relatively cost-effective and easy to implement. In fact, we are anxiously anticipating the day when 3-dimensional virtual-reality technologies will become inexpensive enough so that truly "information accelerated" choice experiments can be created. Some early indications of the use of such technologies in a limited fashion exist (e.g., the launch of a prototype W Hotel in the virtual-reality world Second Life**).

Advances in experimental design and estimation processes

While the role of IT in designing realistic experiments is important, even more important is the "behind the scenes" work of statisticians, mathematicians, and management science researchers who have been developing advanced procedures for estimating and fine-tuning econometric models to assess the wide array of customer choice situations. For example, recent advances in Bayesian statistics enable the estimation of choice models for each individual respondent and therefore enable us to fine-tune market-segment memberships on a case-by-case basis. Innovative optimization procedures such as chaos theory, neural networks, simulated annealing, genetic algorithms, and simulation modeling are being used in various applications to identify optimal product-service design configurations and to link choice modeling results with other managerial decisions (e.g., labor scheduling and capital-based resource constraints).

During the early days of choice modeling, researchers often debated the question of how many market drivers in a choice exercise constitute too much information for the respondents. Researchers also debated how many choice scenarios should be shown to each respondent in order to develop robust choice models. While there is still no agreement on many such theoretical and methodological issues, advanced experimental design procedures and relative ease of data collection from larger numbers of respondents will relieve some of these academic tensions in the future. For example, we used semi-randomized to completely randomized experimental designs in combination with statistical blocking, and partial experimental profiles to allow respondents to assess a highly complex choice situation in a consumer-oriented service environment.

Other advances in choice experiment design include developing sophisticated hierarchical choice experiments combined with nested and partial profile designs. While the use of such procedures increases complexity in designing choice studies, data analysis, and estimating econometric models, it allows researchers to significantly reduce the choice-task complexity and time requirement for respondents by only showing a few market drivers within each choice set at any time.

Which one service would you prefer the MOST for your facility and which one would you prefer the LEAST?

Service Descriptions	Prefer the LEAST	Prefer the MOST
No patient schedule interruption guarantee	○	○
Application support service contracts	○	○
Pay-per-use application service provider	○	○
Off-site patient image data warehouse	○	○
Accreditation and Compliance services	○	○
Education subscription	○	○

(1 of 10)

Figure 4
An example of a best-worst choice experiment

Best-worst choice experiments

The discrete choice examples presented in Figures 1 through 3 assume that the respondents are selecting a bundle of product or service offerings. However, in many applications, the respondents need to prioritize a number of alternatives and not necessarily select an option (e.g., customer satisfaction ratings or rank-ordering operational priorities or projects). For such research problems, rating scales are commonly used to assess the relative importance of various decision variables (e.g., to rate customer satisfaction on a scale of 1 to 7). However, respondents are notorious for rating items very rapidly, using simplification heuristics to speed through the task.[35]

Studies show that respondents use only a limited range of the scale points, resulting in many tie scores among items. Some respondents use only the top few boxes of a rating scale; some refuse to register a top score for any item, while others conscientiously spread their ratings across the entire range. While standardization of ratings (forcing the mean rating for each respondent to zero and the standard deviation to unity) has often been suggested as an appropriate remedy, this transformation removes the level differences between respondents and is often difficult for managers and policy-makers to understand. Furthermore, when a respondent uses just a few scale points, the standard deviation within respondents is very small, making the new standardized estimate very large. To improve the situation of low discrimination between items, some researchers use rankings. In a ranking task, respondents order the items from best to worst (with no tie scores allowed). However, respondents often find it difficult to rank more than about seven items.

Researchers have experimented with many techniques to achieve the benefits of metric scaling while also encouraging respondents to discriminate among the items. One common approach is the *constant sum* or chip allocation scale. To use a constant sum scale, respondents allocate a certain number of points or chips to each item in an array of items. As with rankings, constant sums are difficult to do with more than a small number of items.

Recently Louviere and his co-workers have developed a new choice-based approach known as *best-worst* or maximum-difference choice analysis, which provides an unbiased estimate of the relative preference ranking for a set of alternatives.[36] The best-worst choice approach requires subjects to identify the best and worst alternatives of some latent dimension (such as attractiveness or satisfaction) in each experiment. We have found this approach to be particularly useful for service-sector applications, since the decision makers (customers or managers) often have to assess the relative attractiveness of alternatives that are very different from each other. An example of a best-worst experiment for a B2B health-care application is provided in *Figure 4*.

The best-worst choice approach assumes that respondents behave as if they are examining every possible pair in each set and then choosing the most distinct pair as the maximum difference pair. Thus, one may think of the best-worst approach as a more efficient way of collecting paired comparison data. The same principles that govern traditional discrete choice experiments also apply to the design of best-worst tasks.[19] Thus, as with traditional discrete choice analysis, best-worst choice models reveal relative preferences. The derived scores are based on the relative comparisons among the items included in the study and will change if the content or number of items being compared changes.

Integration with other customer-data-driven processes

During the last few years, firms have invested heavily in customer relationship management (CRM) systems and IT in general. Such implementations generate huge amounts of customer transaction data (e.g., hotel check-in records, reservation and credit card usage patterns, frequent flyer records) which can be used to monitor customer preferences over a long period of time. Effective use of CRM data can allow organizations to customize product-service offerings to the usage patterns of individual customers, thereby increasing satisfaction, retention, and loyalty. At the same time, such data mining cannot assess customers' preferences for any new product-service features that a firm might consider offering in the future. While the use of CRM and data-mining techniques can be extremely helpful in isolating trends based on past choices, such approaches can have only limited use when making predictions about the impact of future market drivers.

An excellent example of the effective use of CRM techniques combined with customer choice data is available in a series of case studies written about Harrah's Entertainment, Inc.[37] These articles describe how Dr. Gary Loveman, a onetime Harvard Service Operations professor, led the Harrah's Entertainment analysis team in developing and fine-tuning a series of service innovations targeted toward their highest-value and most loyal customers using a series of experiments and CRM techniques. Harrah's is now one of the highest net-worth companies operating in the hospitality industry and was recently purchased by a private equity group.

Organizations can gain valuable insights on the impact of new market drivers by combining existing CRM databases with customer responses to carefully constructed choice experiments. As a matter of fact, within the domain of choice experiments, new market drivers can be varied and their relative utilities estimated. Thus, choice-modeling results combined with econometric models developed from CRM databases can realistically estimate the impact of any new product-service offering within a chosen business context. We believe that the end result of such triangulation will be the development of highly robust predictive models. Extreme caution is needed for such data-merging techniques to isolate any statistical differences, lest the resulting models be confounded with random errors. For example, it is possible that mean or variance estimates (and therefore the scale parameter) for CRM and choice-experiment-based models may differ from each other simply because of differences in data collection and estimation techniques. Therefore, the researcher needs to make appropriate corrections within the model estimation procedures to isolate the impact of such errors.

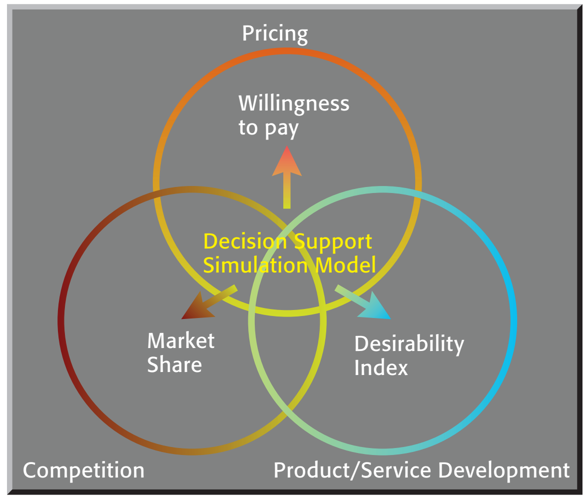

Figure 5
Interrelated managerial decision making simulations based on discrete choice modeling

MANAGERIAL INSIGHTS FROM DISCRETE CHOICE MODELING

In a series of recent articles, we have described a number of managerial insights that emerge from customer choice modeling studies.[10,30,31] In the following, we highlight and summarize some of the valuable managerial implications that we have observed in our recent studies, particularly those related to the service sector.

The statistical models developed from customer choice studies can be easily incorporated into decision support systems (DSS) (see *Figures 5* and *6*). While design of choice experiments and estimation of models requires sophisticated training and skills, implementation of the estimated models in spreadsheet-based DSSs is fairly easy. Once the DSS is available, a manager has only to input the attributes of the products of the firm and the products of its competitors to predict expected market share. The DSS essentially approximates the dynamic nature of the market, allowing managers to evaluate multiple businesses, operating and marketing strategies, and the effects of changing strategies in the competitive marketplace. The predictive power of customer choice models can be further improved by market segmentation techniques such as latent segment or Bayesian analysis.

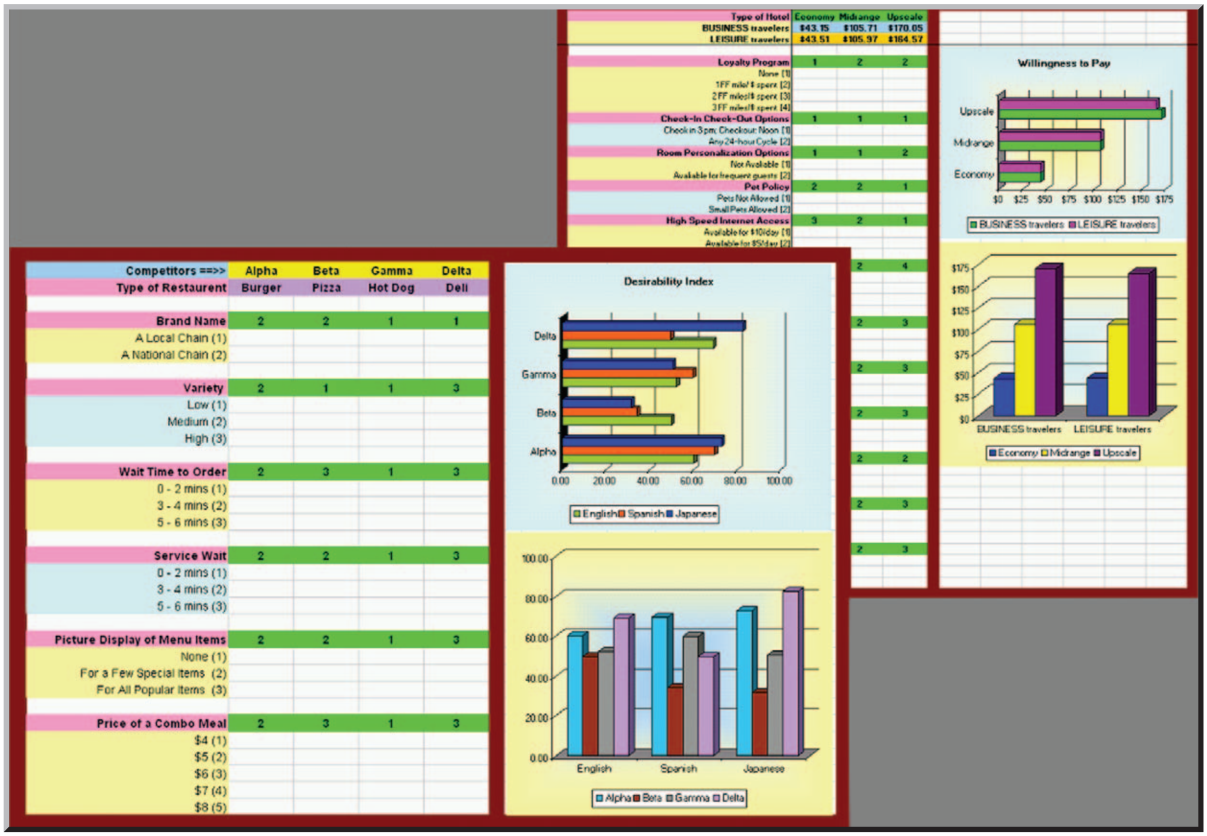

Figure 6

Sample screen shots of willingness-to-pay and desirability-index simulation

In the following, we discuss various analyses that can be conducted with a DSS developed from customer choice experiments. For the sake of clarity, we have kept the discussion in this section quite general, rather than specific to a particular study or application. More specific managerial results and examples for the hospitality, retail, financial services, health care, mobile phone services, travel and leisure, and industrial services areas can be obtained from the authors.

The relative weights of various choice drivers can be used to identify the homogeneities in the user base of a firm and to assess how they impact the current and future value of firm offerings.

The choice models can also identify key features that drive market share in different customer preference clusters. An example of customer preference clusters (such as “gourmet buyers,” “tough sells,” or “bargain hunters”) and corresponding relative utilities for various choice drivers (such as price) is presented in Reference 10. The gourmet buyers show relatively higher utilities for all of the choice drivers except price. The tough sells consider each of the four choice-drivers to be almost equally important, while bargain hunters seem to be the most price-sensitive. Identifying such preference differences between customer groups can help a firm develop a more effective marketing campaign for each cluster. A similar example for financial services in presented in Reference 18.

The relative weights of the drivers can be used to calculate two very useful what-if analyses for combinations of service offerings. The *desirability index* can be presented in the format of a relative index between zero and 100, with zero representing the least desirable service of all possible combinations, and 100 representing the most desirable. The estimated weights for various service components can also be used to calculate customers’ *willingness-to-pay* for a specific market offering. Figure 6 shows screen captures from an illustrative decision-support simulation used to calculate the desirability index and willingness-to-pay for two hospitality situations (choice of a hotel and choice of a fast-food service vendor).

In addition to identifying the overall relative impact of customer preferences, choice modeling results can also be used to assess the relative impact of changing the value of one or more choice drivers on overall market share. For example, the models can assess how the market share of one firm will be affected by a change in one or more choice drivers by the competition. Assuming that the competitor profile stays the same, the market share impact of changing service levels for the three preference clusters called "upscale," "midrange," and "economy," is shown in Figure 6. In References 15 and 38, market share simulations are presented for online financial services and the hospitality industry.

By assessing the relative weights of various market drivers to identify features that may result in a firm winning an order, the firm can further optimize its service offerings. This analysis enables the firm to focus on a few selected choice drivers when developing new products and services or changing selected features of existing offerings. This has clear implications for new service development as well as for the development of service extensions and derivatives.

Two potentially important analyses that can be conducted with the results of choice modeling are the relative assessment of *brand equity* (i.e., the value that customers perceive in a brand) and *switching inertia*. Generally speaking, the switching barrier or inertia is the tendency for customers to stay with their current service provider, despite the availability of other offerings which may be better. This might be caused by one or a combination of factors, such as customer habit or preference for status quo, satisfaction with current service offerings, lack of real or perceived alternatives, etc. Although in free markets it is always assumed that customers can choose their preferred vendor, we often observe in service-oriented markets that customers do not switch providers even if they can freely choose to do so because of switching inertia (e.g., customers rarely change bank accounts because of one bad experience or a marginal increase in fees.) Consequently, a new service provider has to overcome customer inertia and must offer a substantially stronger or highly customizable service bundle to win a customer's business or gain dominance in a market.

Robust and reliable estimates of switching inertia can be easily derived by designing customer choice experiments in which respondents have to choose between their current service provider and new alternatives.[32] Such choice experiments can be customized for each individual by first asking the respondent to describe the value levels for each market driver of their current service providers. Subsequently, we pair the currently used service with experimentally designed profiles of an alternative service provider to generate a series of choice experiments. The mobile phone choice example presented earlier in this paper (shown in Figure 2) was used to demonstrate the impact on customer choice of brand name and the corresponding switching inertia in a recent paper by Harter et al.[39]

Customer choice modeling results can also be used for developing effective implementation guidelines or for prioritizing various initiatives, so as to maximize the net gain from any chosen strategic plan. By understanding consumer choice, managers can effectively develop and position service offerings to better suit market needs. In addition, mathematical models representing consumer choice can be linked to several operating decisions (e.g., labor scheduling, special activities planning, service offerings) and optimal service configurations can be identified for further improvement. References 14 and 15 provide examples of discrete choice experiments linked with operating characteristics in services.

In addition to the applications described here, choice models and associated DSSs also can be used as education and training tools and to help managers better align their decisions with what customers want and are willing to pay for. Often managers of large service organizations (e.g., health care organizations) are too busy managing day-to-day operations and a gap may exist between the managers' perceptions of customer needs and the customers' actual needs. Comparing two choice models, one representing customer choices and another one representing the managers' beliefs about customer choices, can identify such a *perception-choice* gap.[27]

SUMMARY AND CONCLUDING REMARKS

This paper introduced discrete choice modeling as an approach for assessing customer choice in the service industry. For the ongoing SSME momentum to be successful, we believe that it is necessary that sophisticated customer choice approaches such as discrete choice modeling become an essential component of the framework. In this paper, we have provided several examples of discrete choice studies conducted for a variety of service-sector applications. We have discussed how the science and art of discrete choice modeling continues to evolve rapidly. We hope that researchers interested in SSME will find discrete choice modeling useful in their future research and applied projects.

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