Essays on Customization Applications in Marketing

Adiguzel, Feray

Chapter 1
Introduction

1.1 Customization in Marketing

True one-to-one customization has begun to be realized by more companies through the migration of marketing to the online environment. Companies are changing their marketing strategies from being seller-centric to being buyer-centric. For this purpose, they develop methods and strategies to customize marketing mix instruments i.e. product, purchase price, communication, distribution and logistics, and after-sales support and cost (Rust and Verhoef, 2005). As a result, we observe that customers are becoming active participants in the product development, purchase, and consumption processes in the digital marketplace. For example, Dell computer designs a personal computer based on the specifications which are set by customers from a choice menu. In the car industry, GM and Chrysler are examples of companies engaging in product and price customization. Wind and Rangaswamy (2001) call this emerging paradigm "customerization" and describe it as "a call to everyone in the marketing profession to rise to a new standard of interacting with customers and building relationships with them." This new paradigm merges mass customization, one-to-one marketing strategies, and focuses interest on the firm decisions of 'whom to target, when and with what' and on the customer decisions of 'whether, what, when and where to buy'. In sum, with the adaptation of one-to-one marketing strategies to the Internet, marketing strategies are becoming more individually oriented. Such strategies often require little prior information about customers, and even the product itself

can be manufactured after consumers tell the company what they want to buy.

Businesses have begun to develop databases that allow them to approach customers on an individual basis by customizing their ways of introducing, providing, and delivering products and services to the customers. Nowadays, especially in business-to-business markets, many firms are starting to involve their customers even in the product development process on the basis of information collected in questionnaires. Face-to-face or phone contacts are not the only means of communication anymore. The Internet and other new communication media such as PDAs, WAP-wireless application protocol- (mobile phones, pagers, two-way radios, smartphones and communicators) and digital TV allow companies to interact with customers much more directly and in real time.

Although customization strategies are easier and cheaper with the available technology, the strategic and organizational decisions are more complex and expensive. A company must bring together the supply and demand sides of the market for successful customization. Managers face critical decisions about where and when to customize and how to integrate this strategy with other marketing strategies. Customization begins with the database. To compile a customer database, one needs to collect customer information, which is very costly. Money and staff resources available for the firm to do this have limits. Time is a major constraint. The value of the information gained has to be weighed against some estimate of the cost of its collection. Most direct marketers collect extensive household

information; however, there is a need to develop new methods to exploit this information fully to customize the product offerings or merchandizing strategies. In the next section, we briefly discuss marketing mix customization and customizability.

1.2 Marketing Mix Customization

While customers are passive participants in traditional marketing, they are becoming active participants in customization through the processes of creating and marketing the product and service. Customers are more active in every stage of these processes through the Internet. The Internet makes it possible for customers to drive the process: to search for information they need to make choices, to create their own products and services, to set their own prices, and to self-select themselves into segment. Now, we explain how to customize five different instruments of marketing mix -- product, purchase price, communication, distribution, and after-sales support and cost-- either by the marketing firm or by consumers, with examples below and summarized in Table 1.1 (This table and section is mainly based on Logman, 1997). Some customization applications in marketing literature are illustrated in Table 1.2.

Table 1.1: Marketing mix customization and customizability options (Logman, 1997)

Elements	***By Company***	***By Customer***
Product	Offering enhanced and/or bundled products (to meet individual customer needs)	Offering final products with different options Offering a menu of product components (from which customers can select and design their final product)
Purchase price	Price discounting (dependent on sales volume, sales history, time of purchase) As a result of product customization	As a result of product customizability As a result of customers' bargaining power As a result of customers' decision timing
Communication	Using one-to-one communication tools (direct mail, sales force)	Offering a customizable interactive information network (such as the Internet)
Distribution	Offering multiple channel solutions (partly customizable)	Offering a customizable distribution network
After-Sales Support and Costs	Offering augmented product solutions (with single or bundled services) Using remote control systems	Offering do-it-yourself solutions As a result of product customizability (such as the way the product is used)

1.2.1 Customizing Product

Customers can create final products from choice menus according to their needs, budgets and preferences. Now, many companies have websites, which allow online customization. Dell, for example, has a website that allows different hardware configurations for customers. Other examples are the customization of cars by GM and Chrysler, in the car industry, and custom-made jeans (www.operand.com/portfolio/levis.php) in the clothing industry. Companies offer enhanced products (i.e. an enhanced product is a core product that has been differentiated by adding such tangible properties as features, styling, and quality) and/or bundled products (such as computer companies offering PCs with already installed software or printers) to meet individual customer needs. For this reason, they prefer to buy customizable products from suppliers and to adapt them or develop integrated solutions using modular systems (see Stremersch et al., 2003).

For instance, the Laboratory of Production Technologies of Siemens in Belgium uses integrated solutions to create products, which can be used in the production lines of different Siemens products.

1.2.2 Customizing Price

Companies can customize their product price as a result of a customer's product customization, or by offering price discounts which are based on a customer's past purchase history, a customer's sales volume, time of purchase or product bundling. Customers can control prices through their bargaining power, which is possible by choosing the right moment to buy a product (such as waiting until the price drops) or searching for prices from different websites at different time points. Some websites, such as priceline.com, dealTime.com, and online auctions allow customers to customize purchase price. More companies, such as Chrysler or General Motors, allow their potential customers to design a product based on their own choices from available specifications, and calculate the price of the product using those specifications.

1.2.3 Customizing Communication

Different information needs of customers, such as for new product versions, possible upgrades of old products, promotional or product information, call for customization methods. This customized information can be distributed to customers directly through direct mail or personal contacts, and through the Internet via websites or email. Internet advertising is the main tool for communication customization in the digital marketplace, since advertising messages can be rapidly distributed at very low cost, and are easy to

produce and distribute over the web and email. The customization of content, format, the educational component or entertainment power of the communication, mode of delivery, timing and place are becoming popular topics in marketing in recent years (see Table 1.2).

Table 1.2: Some customization applications in marketing literature

Study	***What***	***Method***
Rossi, McCulloch and Allenby (1996)	Customization of promotions Target couponing	Random coefficient choice model with individual level heterogenity
Ansari, Essagaier and Kohli (2000)	Customization of offerings (Recommendation systems)	Hierarchical Bayes estimation
Gooley and Lattin (2000)	Customization of Marketing Messages Which content to present to whom	Multi-armed bandit problem approach maximizing response rate
Liechty, Ramaswamy & Cohen (2001)	Customization of communications Web-based information service	HB multivariate probit model
Raghu, Kannan, Rao & Whinston (2001)	Customization of communications	Information theory, segmentation, clustering techniques
Ansari and Mela (2003)	Customization of email-messages	Hierarchical Bayes (HB) estimation and combinatorial optimizatition
Bertsimas and Mersereau (2003)	Customization of marketing messages	Adaptive sampling
Toubia, Simester and Hauser (2003)	Customization of adaptive conjoint questionnaire	Polyhedral question design for partial profile conjoint. Analytical center estimation
Montgomery, Hosanagar,et al. (2004)	Designing a better shopbot Which stores to search, how long to wait, and which offers present to the user	Random utility model Decision approach
Zhang and Krishnamurthi (2004)	Customization of promotions When to promote how much to whom	Incidence-choice and quantity model Optimization
Zhang and Wedel (2004)	Customization of Promotions: comparison of market, segment-based, personalized	Incidence-choice and quantity model Profit optimization

1.2.4 Customizing Distribution

Customers now have more freedom in selecting the logistics and the methods of distribution to meet their needs. New distribution strategies are developed with the increasing usage of the Internet. Customers can determine where, when and how they want goods to be delivered, and in which manner. Amazon.com, for instance, offers three different delivery

timings with different prices. In electronic shopping, customers can continuously monitor and adjust orders, schedule delivery, places of distribution and how they want goods to be delivered. Companies prefer to use multiple channels for distribution flexibility depending on the customer's product knowledge, service needs, and future price sensitivity.

1.2.5 Customizing After-Sales Support and Costs

Customers can choose do-it-yourself solutions, which are offered by the company, and buy customized products, which come with a customizable information network for after-sales support. Companies generally use remote-control systems for after-sales support. The Internet is one of the best tools for customized after-sales support. Especially in the computer industry, companies offer customized augmented solutions which include product, training, service or logistics offers, such as product maintenance, replacement, and so on. For example, some software companies use this method for updating software applications or fixing problems online.

1.3 Problem Delineation:

This thesis deals with aspects of these two key components of the customization process: 1) efficient customized data collection and 2) customization of marketing mix across multiple product categories. Both aspects involve stochastic modeling of consumer behavior/response, and optimal decision making based on the first process. Customization of marketing actions given limited information depends on inferences and the characterization of the level of uncertainty in these inferences. From this

perspective, Bayesian techniques are the most suitable tool for the problems anchored in this thesis. The Bayesian framework enables an elegant integration of response models and decision making which incorporates the uncertainty of model estimation in the decision framework. Such decisions of “what to ask whom” and “what to promote to whom” are at the core of this thesis.

We have seen an enormous increase in the use of Bayesian techniques in marketing in the past decade. The main reason behind this is that Bayesian methods are particularly appropriate to the decision orientation of marketing problems, and further, they ideally suit a wide range of marketing data and decision processes. Bayesian data analysis has the ability to handle many different types of response variables in the same analysis. Since marketing data are often lumpy and not very well-suited for making standard distributional assumptions, Bayesian methods have come to play a critical role in marketing models. Marketing data are also sparse at the individual level in general. While we need large samples in frequentist methods, for approximations of standard errors, we use posterior distributions in Bayesian inference, which enables accurate inference for all parameters and all sample sizes. That is, all Bayesian results are exact in finite samples because the distributions are derived conditional on the observed sample of data. However, many classical theory results depend on asymptotics and are only approximations for the observed sample of data. Missing responses in Bayesian analysis are easily modeled as latent variables in a manner that uses the information contained in observed data.

Marketing models often include latent variables, especially in consumer behavior and decision making problems. While frequentist methods allow for few latent variables (except for structural equation modeling) due to estimation difficulty, Bayesian models enable many latent variables to be included in a relatively straightforward fashion. Most data for marketing research is generated according to a hierarchical process, and again, such hierarchical models are easily implemented in Bayesian analysis. Hypothesis testing is different for the two approaches: While Bayesians measure the data's support for the hypothesis, classical statisticians measure the hypothesis' support for the data. Detailed explanations on the advantages of Bayesian data analysis in marketing can be found in Elrod (2005), and Bayesian statistics applications in marketing can be found in Rossi and Allenby (2003).

Bayesian statistics have been criticized by classical statisticians for the subjective prior information used. The prior information however can also be "objective." Practically, prior information may in fact improve decision making (Berger 1985). In marketing, prior information is readily available from huge databases which are collected by market research companies. Some researches in marketing use prior information in their estimations such as from experts (e.g. Sandor and Wedel 2001, Popkowski and Sinha 2005), or prior theory (e.g. Montgomery and Rossi 1999), or other datasets (e.g. Lenk and Rao 1990, Putler et el. 1996, Kamakura and Wedel 1997, Wedel and Pieters 2000, Ansari et al. 2000, Ter Hofstede et al. 2002).

1.4 Motivation of Essay 1:

In the first essay, we study how to design optimal split questionnaires, which helps to collect better quality data faster and cheaper. Usage of the Internet is doubling every year[1]. This rapid growth of the Internet creates an opportunity for conducting online marketing research. By some estimates, about 60% of the population of the United States and the European Union has Internet access. This widespread adoption of the Internet makes a large cross-section of the population accessible and ensures that information on the needs and preferences of a substantial population of the consumers can be obtained online. In 1995, some of the first articles were published comparing email with postal surveys. For example, Mehta and Sivadas (1995) showed that email could generate high response rates similar to postal surveys.

Moreover, high levels of product customization need extensive profiling and customization tools to identify and target individual customers, based on a combination of demographics, attitudes and past interactions. Growing numbers of organizations and companies need to use more sophisticated means to get information on their Web site visitors. For these companies, online questionnaires can be a tool to link future customers to specific products and services. Companies can utilize analyses of consumer interests on Web sites. A recent survey among companies by WIT inc., a

[1] www.virtualsurveys.com/news/papers/paper_9.asp

Web services provider, found that 55 percent of respondents in Michigan plan to upgrade customer relations on their sites in 2004.

Campbell-Ewald Digital, a Warren-based advertising and marketing company, is one of these companies, and according to its senior vice president/creative director Harvey Zuppke, more companies are turning to cultural anthropologists and psychologists to develop online surveys that will produce profiles of potential customers and a broader picture of their lifestyles, in efforts to build a relationship with their customers. All of the market research companies' clients use online surveys to learn more about their customers and how they interact with these sites. For instance, a Chevy Malibu Internet site by Campbell-Ewald questions visitors about their driving habits and what they value most in a car. After analyzing their answers, the Web site provides information about the car's features that should be most appealing to them. Many more companies use interactive questionnaires to help customers find the right product and help the company determine its customer base.

Developing the questions can be a complicated and time-consuming process, and long questionnaires that inquire about potential customers' lifestyles, attitudes, needs and past behavior may cause problems of attrition, nonresponse, fatigue and boredom of potential customers, and may not even be feasible on the Internet. Any efforts to improve the quality of the data will increase the effectiveness of market actions based on it. From this perspective, split questionnaire survey designs (which are not only useful in online surveys, but also for paper or phone surveys) help

market researchers to provide faster, cheaper and efficient ways of collecting data about customers.

The increasing usage of online marketing research needs more advanced methods to collect data, and from this respect the need for better questionnaire designs is increasing. Split questionnaires, adaptive questionnaires and individual level customized questionnaires have great potential for use in online surveys. In split questionnaire survey design, the original questionnaire is divided into sub-components and subjects respond to a randomly selected set of components only. Finding an optimal design for a split questionnaire involves finding the configuration of question sets (i.e. those questions given to one respondent, or a "split") such that a minimum amount of information is lost as compared to the complete questionnaire. Some ad-hoc splitting strategies often used in practice may depend on the purpose and the contents of the survey, contextual placement of certain items, and the partial correlation coefficients of the items (Raghunathan and Grizzle, 1995). We suggest, in line with previous practice in marketing research, to utilize the natural structure of the questionnaire, in which questions are placed in blocks. Mostly, several questions measuring, for example, one particular attitudinal or lifestyle trait are administered as a group or block. We use this block-structure to generate split-questionnaire designs in two different ways: selecting entire blocks of questions, which we call a "between-block design", or selecting questions in each block, which we call a "within-block design". In the between-block design, a "split" comprises of the allocation of selected

blocks of questions and respondents answer all questions in these blocks; in the within-block design, a split comprises of sets of selected questions in each of the blocks and respondents answer only those questions in each block. For the first method, our research problem then simplifies to how these blocks should be administered to respondents in an optimal way. On the other hand, for the within-block design, our research problem is how to choose questions in each block optimally. After we generate optimal split questionnaires, we administer these different versions of the questionnaires and finally we multiple impute data with the Gibbs sampler for the missing responses using information from other subjects that responded to the missing parts.

In the questionnaire design area there are several possibilities for custody of a good design: The first is to reduce questionnaire length by dropping out uninformative questions. Factor analysis can be used for this approach. The second is to find user profiles from the sample data so that future users can be classified according to those profiles with classification methods (especially discriminant analysis) and offered different versions of the questionnaire (Zhang and Fang 2003, Haaland et al. 1979, Brockett et al. 1981). We compare our approach to these two alternatives. In Chapter 3, we detail how to design optimal split questionnaires. Our approach --split questionnaire design-- differs from those methods in two ways. First, instead of dropping some questions from the questionnaire, we use all questions, only different people respond to different parts of the questionnaire. Second, instead of classifying subjects, we generate different versions of the questionnaire based on prior information.

1.5 Motivation of Essay 2:

Companies have become increasingly interested in customization possibilities of interactive media as a result of significant advances in technology. Interactive media allows the marketer to identify the consumer and characteristics of the consumer, decide on the marketing message in real time and capture response to marketing communications. For instance, e-commerce sites such as amazon.com and dell.com can customize content (e.g., information, digital products such as software, advertising, promotions, recommendations…) to increase purchases. Nowadays, increasing numbers of companies develop customized and targeted online programs such as customized ads, websites, email-messages, customized sales-promotions to loyalty card users, customized electronic coupons, etc. Targeting and customization issues have long been of interest in marketing. In the previous sections, we have mentioned customization and customizability options for marketing mix instruments. In the second essay, we focus on the customization problem of how to develop promotion designs across multiple product categories simultaneously.

The dynamic nature of the Internet (and other interactive media) is particularly suited to offer promotions to individual customers “on the fly” to guide their decisions by using information from their previous decisions. Hence, delivering promotions individually via email or the web, one of the main interests of online customization, is becoming a more important subject. Specifically, online grocery stores such as Peapod (peapod.com)

and NetGrocer (shop.netgrocer.com) possess the technological potential to customize the grocery shopping process. Currently, Peapod allows customers to create personal lists, such as frequently purchased products, products purchased for weekend parties, and products for special occasions (e.g., Thanksgiving) for its customer. Using this service, customers can reduce their shopping time, eliminate product categories of no interest to them, and keep checking totals of purchases so that they can spend within their budgets. Peapod also customizes the shopping experience by helping customers to list the items available in their pantry and refrigerator, and then suggesting recipes where these items can be used. These companies should fully utilize their technology and explore the potential for offering customized promotions. An example of using a customized promotion program is CVS Pharmacy. They use loyalty cards to offer different sales-promotions for low-tier, middle-tier, and top-tier customers. Additionally, they use targeted health mailings with segment level content and customized offers. They also target offers at the register using previous category purchase histories.

Since the decision of which items to promote to whom is very important, we consider the development of a customization method by focusing on the selection of target categories to be promoted from multiple product categories in an online shopping environment. Our method can be applied to different promotion programs such as individual specific e-coupon or point-of-purchase coupon distribution, and individual specific advertising. Personalized advertising and promotions are pervasive in a wide range of industries including services such as banking, telephony, insurance, durable goods such as autos, and a vast range of products sold in

supermarkets and drugstores. Currently, electronic coupons are issued by companies based on customer information in a way that does not depend on the (multivariate) relationships in purchase expenditures between categories. Our approach aims to obtain cross-category information and use this information in customizing coupon programs. In particular, web pages of specialized online coupon companies (e.g., couponmountain.com, coolsaving.com, couponcabin.com, and addcoupon.com) show a certain number of coupon offers and our purpose is to select the most suitable (profitable) categories to offer to individuals to minimize the search effort, as well as maximize the retailer revenue. The e-coupon is a short piece of text that can carry a commercial message, including price and availability of product in question. Electronic distribution of coupons has become more widespread under programs such as Catalina Marketing Incorporated's (CMI) Checkout Coupon and Frequent Shopper schemes (in-store coupon distribution), in which households receive coupons offering discounts through the Internet (see valuepage.com/Entry.pst). According to the Association of Coupon Professionals, Internet-delivered coupons, although still a controversial topic in the industry, saw a five-fold increase in distribution as entrepreneurial marketers sought better ways to target and deliver effective incentives (couponpros.org).

There are three key components in this essay. The first one is multicategory modeling. We fit a hierarchical Bayes type-2 multivariate tobit model which allows us to estimate individual and average level consumer preferences, cross-category incidence, expenditure and incidence-

expenditure correlations using purchase incidence and expenditure data. Multicategory models are particularly appealing in our context because (online) retailers aim to maximize store profits by jointly coordinating marketing activities across product categories. Manufacturers that sell products in multiple categories may also benefit from these models, since they can use this information in production, price setting or for product bundling. Service provider firms may be interested in undertaking cross-selling initiatives across product categories. The second concept is individual level heterogeneity. We include individual level heterogeneity in the coefficients of marketing activities for each individual consumer. Marketing models need to consider individual heterogeneity, since consumers may react differently to the marketing activities (marketing mix, such as price and promotion) and these differences between individuals form the very basis of customization. The last concept is optimal decision making. We estimate expected expenditures of each customer for each category and select the optimal combination of five categories to offer from among many. We consider parameter and estimation uncertainty in our estimation using the Bayesian decision framework. Importantly, we use the Bayesian approach to addressing these three concepts, since Bayesian statistics optimally investigate inference, estimation and decision problems of marketing.

1.6 Outline of the Dissertation

This thesis contains two essays on dealing with how to more efficiently collect data and how to customize online promotion offers across multiple

categories. In the first essay, we introduce a method to design split questionnaires to collect data more efficiently, i.e. faster, cheaper and with better quality, using experimental design techniques. In the second essay, we develop a customization approach and propose a method of optimizing the selection of categories to promote based on the Bayesian decision framework, using online grocery retail data. The Bayesian decision framework is used in both essays.

In Chapter 2, we discuss Bayesian statistics for inference and decision problems in marketing. After giving some insights for Bayesian statistics, we explain in detail why Bayesian methods are commonly accepted by the marketing community and discuss some advantages of it for marketing. We focus on the Bayesian approach for marketing decision problems. We explain briefly some Bayesian estimation algorithms used in both essays.

In Chapter 3, we focus on a split questionnaire survey design. This involves subsets of subjects responding to different parts of the questionnaire instead of the whole. Chapter 3 deals with the problem of constructing an optimal split questionnaire design, which means asking fewer questions per subject to obtain the most information. Split questionnaire design results in data missing by design. Our purpose in this chapter is to develop a method, using experimental design techniques, to select the best allocations of blocks of questions and question allocations in each block for splits (i.e. to generate different versions of split questionnaires) to maximize information. We reduce respondent burden with this method by asking fewer questions per subject. We explain the

proposed optimal split questionnaire method, which is based on prior information, and optimization by a design generating algorithm -the modified Federov algorithm- to find the optimal design from all possible designs. We explain how to construct identified split questionnaire designs, and how to impute the missing data with the Gibbs sampler. We also present empirical and simulated data results to illustrate the statistical efficiency of this method. This chapter is based on Adiguzel and Wedel (2004).

Respondent burden is related to the time and the effort a respondent has to expend to complete a questionnaire. Time and effort are a function of the length and the nature of the individual items in a questionnaire. Therefore, it is reasonable to expect a degree of correlation between respondent burden and quality of the data. A reduction in respondent burden may also have a positive impact on reducing item nonresponse rates. We investigate behavioral effects of using split questionnaires and illustrate these effects on data quality in Chapter 3 in a field study.

In Chapter 4, we define the problem of promotion customization. In this chapter, we provide a literature review of multivariate category applications in the marketing literature. For efficient customization, we need individual level customer information, and for that purpose we develop a model to analyze purchase incidence and expenditures of multiple categories. The model is a hierarchical Bayes multivariate type-2 tobit model and is estimated with the Gibbs sampling. Based on that, we develop an optimization algorithm to choose the optimal combination of categories from among many to promote for each customer. Our approach maximizes each

consumer's total expenditures among all categories involved using the Bayesian decision framework. The approach is based on design generating algorithms used in experimental design literature (i.e. modified Federov algorithm) to solve this combinatorial optimization problem. We investigate our model and its performance on synthetic data, and give the applications and results of this problem.

Finally, in Chapter 5, we present conclusions and discussion of substantive issues in these two essays, and describe the possible venues for future extensions.