研究速報

大学の学生食堂メニューの選択実験に関する研究速報

Preliminary Report of a Choice Experiment on a University Restaurant Menu

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大学食堂において，待ち時間の削減やメニューに関する再検討は喫緊の課題である．利用者満足の向上を，各大学の資源制約の中で高めていかなければならない．そこで，獨協大学内で選択実験を用いたアンケートを実施し，一般化多項ロジットのフレームワークで分析した．選択実験の属性として，待ち時間，品数のほか，食品ラベルを複数設定し，学生の選好構造を抽出した．分析の結果，待ち時間に不効用があること，品数は多様な選好があるものの平均的には少なくてもよいこと，ポリフェノールが豊富なメニューに比べて，埼玉県産の食材が希望されている一方で，同じくポリフェノールが豊富なメニューに比べて，オーガニック食材は多様な選好があるものの平均的には望まれていないことが示唆された．

Reduction in waiting times and reconsideration of menus to improve user satisfaction are two urgent issues facing university restaurants. We conducted an undergraduate survey that included a choice experiment and analyzed the results using a generalized multinomial logit approach. We incorporated waiting time, the number of menu items, and various food labels into the attributes of the choice sets. Our results indicate that waiting times create disutility. Although there are some preference heterogeneities, respondents generally prefer fewer menu items. Compared with the food characteristic of being rich in polyphenols, local product origin enjoys a significant positive preference. In contrast, organic labeling is evaluated negatively, although preference heterogeneity exists for such labels.

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1. Introduction

There is an urgent need to improve the service and quality of Japanese university restaurants. An undergraduate survey conducted at Yamaguchi Prefectural University by Ando and Kanda [(2)] highlighted issues such as the contents of menus and prices. Because undergraduates need to have lunch during official lunch breaks so as not to miss afternoon lectures, waiting-time management is also an important issue for university restaurants and their managers.

To review the issues facing university restaurants, it is necessary to understand the preferences of users. In the context of new food product development, Krystallis et al. [(5)] suggested the usefulness of hypothetical choice experiments (CE), which include social surveys, to predict the latent market structure or consumer preferences for brand-new food products. Louviere [(6)] illustrated the use of CE in fast-food restaurants. CE include hypothetical scenarios that enable us to examine menus that do not exist. Therefore, we decided to conduct a CE survey at Dokkyo University.

The remainder of the article is organized as follows. In Section 2, we briefly review the literature. Section 3 outlines our survey design and econometric method. In Section 4, we present and discuss our results, and note issues for future research.

2. Literature Review

Waiting time at restaurants is a key topic in the context of consumer research. Studies have examined how it may be useful to distract consumers and clients during waiting time and what measures are effective in reducing perceived or subjective waiting time, rather than physical or objective time. Bae and Kim [(3)] conducted within-subject quasi-experiments on distracting consumers during waiting time in the waiting areas of restaurants in South Korea. They demonstrated that offering menu information can successfully reduce perceived waiting time. When resources are scarce for the management of waiting times at university restaurants, it may be beneficial to reduce perceived waiting time using some type of distraction. To avoid missing the start of afternoon lectures, undergraduates are urged to have lunch in a short period of time. However, at the same time, they are also forced to wait in long lines at restaurants. Thus, universities should aim to reduce not only the perceived but also the physical waiting time.

In the health economics literature, waiting times at pharmacies or hospitals have been analyzed using CE surveys. Porteous et al. [(10)] conducted a CE on community pharmacy services and found that there are negatively significant preferences, or significant disutility, associated with waiting time. As such information may be used to justify and design waiting-time management policies by the relevant authorities, we need to understand in detail the nature of the disutility associated with waiting time.

A number of studies have examined the effects of food labels. Some simple food labels may provide reputational information (Scarpa et al. [(15)]) that helps consumers choose with confidence, which may then alleviate “information overload” (Malhortra [(8)]). Organic labels or sustainability labels (Aizaki et al. [(1)]) and labels related to health risk or safety (Mørkbak et al. [(9)]) have also been examined. Because studies have generally demonstrated the positive effect on consumer choices of certain labeling, we decided to include several food labels in our CE attributes.

Thus, our survey focused on waiting time, menu improvement, and food labels. We chose “Dokkyo Lunch” as the evaluated object, which is a special lunch set on the menu at restaurants for undergraduates at Dokkyo University.

3. Materials and Method

We administered our survey at Dokkyo University from April 15 to May 25, 2015. Before implementation, we conducted preliminary discussions with seven undergraduates on the design of the questionnaire to help in the selection of the

attributes of the CE questions. We then conducted a pretest session to improve the quality of the questionnaire. We conducted an in-person self-administered CE survey to elicit the preferences for the attributes of the improved "Dokkyo Lunch" menu. The attributes included waiting time, the number of items in the lunch set, the characteristics of the food in the lunch set according to the food labels, and the price.

We then selected the levels of attributes (Table 1). For waiting time, the number of items, and the price, we selected levels to mimic real situations at restaurants at Dokkyo University. For the characteristics of the foods, we selected Saitama prefecture (the location of the university) as the product origin, as well as organic, and rich in polyphenols.

In our questionnaire, we first collected information about the demographic variables. Second, we provided information on the organic products, including an explanation of polyphenols as an antioxidant. Third, we provided our hypothetical improved "Dokkyo Lunch" menu, eight CE questions, and commenced with an example CE (Fig. 1). Finally, we determined the respondents' risk perceptions regarding the foods.

In creating the CE choice sets, we eliminated any possible correlation with the attributes primarily by using the main effects of a fractional factorial design along with the attributes and levels given in Table 1 to reduce the number of combinations below the maximum factorial $3^4 = 81$. We created 16 profiles, and randomly selected two of these to create our choice sets. Then, we provided two alternatives and one opt-out option for each CE question.

We surveyed as many undergraduates at Dokkyo University as possible using convenience sampling and campus street intercepts. We distributed our eight CE survey questionnaires to 200 undergraduates, and obtained 137 responses, of which 75 completed our questionnaire creating 595 useful CE observations.

A discrete choice model, known as a generalized multinomial logit (GMNL) model, is able to cope with several heterogeneous responses (Fiebig et al. [4]). The GMNL model can analyze preference heterogeneity, and simultaneously scale heterogeneity, which can describe differences in preference certainty across individuals. Moreover, because the GMNL model contains the subclasses of multinomial logit (McFadden [7]), random parameter or mixed logit (Revelt and Train [12]), scale heterogeneity logit, and GMNL type I and type II, five models can be examined in an integrated manner.

We employed R 3.2.5 (R Core Team [11]) and the procedure "gmnl" (Sarrias and Daziano [13]) when estimating the GMNL model. We set alternative-specific constants (ASCs) for the leftmost and middle options in Fig. 1 in the choice set. We set the left option of opt-in options as ASC1, and the right option as ASC2. In searching for the best fit for the GMNL approach, we employed a stepwise regression procedure with forward selection, judged by the BIC, AIC3, CAIC, and AIC. In the estimation, we set a multinomial or conditional logit model as a base model. We utilized the 100 Halton draw sequence (Train [14]). We decided not to include any covariates in the models as this is a preliminary study.

4. Results and Discussion

According to McFadden's ρ, we selected the model based on AIC3. We present our estimated results in Table 2. The results indicate that there is some disutility associated with waiting time. In addition, although there are some preference heterogeneities, the respondents prefer fewer items in the lunch set and Saitama prefecture as the product origin. In contrast, an organic label was not evaluated positively compared with rich in polyphenols.

Given that there is some disutility associated with waiting time at university restaurants, when managing the objective waiting time, the increase of seats and tables, the some automation of the order system, or a smartphone application, such as a reservation system for university restaurants, may be helpful. Our results also suggest that some menu improvement is required, including the number of dishes and/or usage of local produce.

Our preliminary study has some limitations, namely the rather small sample size and the fact that the levels of attributes we used may not sufficiently mimic real situations. Moreover, a status quo option should be set as an opt-out. In future research, a more sophisticated survey should be used and specific proposals included for changes to restaurants for university restaurant management.

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References

(1) Aizaki H, T Nanseki, H Zhou “Japanese Consumer Preferences for Milt Certified as Good Agricultural Practice”. Animal Science Journal 84: 82–89 (2013).

(2) Ando M, T Kanda “Current States and Problems of Student Dining Room by User Questionnaire [in Japanese]”. Bulletin of Yamaguchi Prefectural University Faculty of Human Life Sciences 31: 49-55 (2006).

(3) Bae G, DY Kim. “The Effects of Offering Menu Information on Perceived Waiting Time”. Journal of Hospitality Marketing and Management 23: 746–767 (2014).

(4) Fiebig DG, Keane MP, Louviere JJ, Wasi N “The Generalized Multinomial Logit Model: Accounting for Scale and Coefficient Heterogeneity”. Market Science 29(3) 393–421 (2010).

(5) Krystallis A, M Linardakis, S Mamalis “Usefulness of the Discrete Choice Methodology for Marketing Decision-making in New Product Development: An Example from the European Functional Foods Market”. Agribusiness 26 (1) 100–121 (2010).

(6) Louviere JJ “Using Discrete Choice Experiments and Multinomial Logit Choice Models to Forecast Trial in a Competitive Retail Environment: A Fast Food Restaurant Illustration”. Journal of Retailing 60(4): 81-107 (1984).

(7) McFadden D “Conditional Logit Analysis of Qualitative Choice Behaviour”, in: P. Zarembka (Eds.) Frontiers in Econometrics. Academic Press, New York, 105–142 (1974).

(8) Malhortra NK “Information Load and Consumer Decision-making”. Journal of Consumer Research 8: 419–430 (1982).

(9) Mørkbak MR, T Christensen, D Gyrd-Hansen, SB Olsen “Is Embedding Entailed in Consumer Valuation of Food Safety Characteristics?” European Review of Agricultural Economics 38(4): 587–607 (2011).

(10) Porteous T, M Ryan, C Bond, M Watson, V Watson “Managing Minor Ailments; The Public’s Preferences for Attributes of Community Pharmacies: A Discrete Choice Experiment”. PLoS ONE 11(3): e0152257. doi:10.1371/journal.pone.0152257 (2016) (retrieved on Oct. 5th 2016).

(11) R Core Team “R: A Language and Environment for Statistical Computing”. R Foundation for Statistical Computing, Vienna, Austria. (2016) URL: https://www.R-project.org/ (retrieved on Jul 26th 2016).

(12) Revelt D, KE Train “Mixed Logit with Repeated Choice: Households’ Choices of Appliance Efficiency Level”. Review of Economics and Statistics 80(4): 647–657 (1998).

(13) Sarrias M, R Daziano “gmnl: Multinomial Logit Models with Random Parameters”. R package version 1.1-1. (2015)
URL: https://CRAN.R-project.org/package=gmnl (retrieved on Oct. 4th 2016)

(14) Train KE (2009) Discrete Choice Methods with Simulation, 2nd Edition. Cambridge University Press, New York.

(15) Scarpa R, M Thiene, F Marangon “The Value of Collective Reputation for Environmentally-Friendly Production Methods: The Case of Val di Gresta”.

Journal of Agricultural and Food Industry Organization 5, Article 7 (2007).

Waiting time	1 minute	5 minutes	I cannot choose between the two alternatives
Number of items in lunch set	4 dishes	6 dishes	
Food characteristics	Organic	Rich in polyphenols	
Price	JPY550	JPY750	
	□	□	□

Fig. 1: Example of Choice Set

Table 1: Attributes and Levels of Our CE Question

Attributes	Level 1	Level 2	Level 3
Waiting time	1 minute	3 minutes	5 minutes
Number of items in lunch set	2 dishes	4 dishes	6 dishes
Food characteristics	Rich in polyphenols	Organic	Saitama as product origin
Price	JPY550	JPY650	JPY750

Table 2: Estimated Result Selected by AIC3

	Distr.	Mean		SD	
ASC of leftmost option		13.081***	(8.375)		
ASC of middle option		13.150***	(8.665)		
Waiting time (minutes)		−0.329***	(−4.735)		
Number of items in lunch set	Log-normal	−0.614***	(−2.500)	0.911***	(2.891)
Saitama as product origin		0.386***	(2.003)		
Organic	Uniform	−0.417**	(−1.788)	1.542***	(3.024)
Price	Normal	−0.017***	(−8.733)	0.005***	(5.744)
No. of observations		565			
No. of samples		75			
Log likelihood		−411.809			
McFadden's ρ	No. coefficient	0.355			
	Constants only	0.288			
Chi^2 Statistic		483.731***			

Notes: *** and **denote significance at the 1% and 5% levels, respectively. Distr, the mixing distribution; SD, standard deviation. The dummy for food characteristics was eliminated in Level 1 in Table 1.