TOURISMOS: AN INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF TOURISM
Volume 9, Number 1, Spring 2014, pp. 15-35
UDC: 338.48+640(050)

CUSTOMER SATISFACTION AND ONLINE HOTEL REVIEW EVALUATION

Hikaru Hasegawa
Hokkaido University

In this article, we analyse the relationship between customers' satisfaction with several types of hotel attributes and reviewer's descriptive information included in online hotel reviews. In particular, we consider the possibility of a causal relationship between reviewer's descriptive information and customer satisfaction ratings. For this purpose, we construct dummy variables that represent the characteristics of reviewer's descriptive information and use them as explanatory variables in a multivariate ordered probit model. From our empirical results, we find that reviewer's descriptive information related to hotel's attributes have substantial effects on corresponding customer satisfaction. In particular, the evaluations of service and hospitality have substantial effects on all satisfaction variables.

Keywords: *Markov chain Monte Carlo (MCMC); multivariate ordered probit model; polychoric correlation; reviewer's descriptive information; text-mining*

JEL Classification: C11, C35, M31

INTRODUCTION

In the tourism and hospitality industry, many web sites offer online hotel reviews. Online hotel reviews provide tourists with several kinds of descriptive information on accommodations. Furthermore, most online hotel reviews provide reviewers' satisfaction ratings for several hotel attributes. For example, online hotel reviews on *tripadvisor.com* provide reviewer ratings on a 5-point scale for several hotel attributes: value, rooms, location, cleanliness, service, and sleep quality. Online hotel reviews describe how hotel services are good and/or poor. Further, reviewers post their descriptions and ratings of hotel services at the same time. Thus, these descriptions could be regarded as the reasons why reviewers assign a score for hotel services. Thus, in this sense, they are not word-of-mouth (WOM) information.

The present study explores which types of descriptive information in online hotel reviews affect customer satisfaction ratings by estimating a multivariate ordered probit model for reviewer satisfaction ratings. The data used in this article are taken from online reviewers' evaluations of a traditional Japanese inn. Before applying the multivariate ordered probit model, we investigate the characteristics of the contents of descriptive information in online hotel reviews. We use a text-mining tool to characterize reviewer's descriptive information, and construct dummy variables that represent the characteristics of descriptive information. These dummy variables become explanatory variables in the multivariate ordered probit model. As far as we know, there does not exist a study that utilizes reviewer's descriptive information on hotel services as explanatory variables for analysis of customer satisfaction.

The remainder of this article is organized in the following manner. In the next section, we review literature related to the current analysis. In the third section, we briefly summarize the multivariate ordered probit model employed for analysing customer satisfaction. In the forth section, we provide an explanation of the characteristics of the data used in this study, and present the empirical results of applying the multivariate ordered probit model to the unit records data for a traditional Japanese inn. Finally, in the fifth section, we provide brief concluding remarks.

LITERATURE REVIEW: ANALYSIS OF SARISFACTION

Numerous studies have been devoted to analysing customer satisfaction in the field of tourism and hospitality research; for example, Kozak (2001b), Yuksel and Yuksel (2001a, 2001b), Bowen and Clarke (2002), and Ryan and Cessford (2003) review the research on tourist satisfaction. Studies on customer satisfaction often use a C-point scale to measure satisfaction (Tonge and Moore, 2007, Sandvik and Grønhaug, 2007, Doğan et al., 2012). In the literature on tourism, most of the studies regarding consumer satisfaction use discrete ordinal data, considering them continuous. For example, Tonge and Moore (2007) calculated sample means of satisfaction and importance measures and found that the gap between the two means was statistically significant. Kozak (2001a) and Yu and Goulden (2006) use ordinal data in the same manner as Tonge and Moore (2007). Further, many studies employ structural equation models, which include factor analysis, to analyse tourist satisfaction (Sirakaya et al., 2004, Thompson and Schofield, 2007, Silvestre et al., 2008). These analyses often use the values of ordinal data. However, since these values only indicate the order of the degrees of satisfaction,

they are meaningless per se; nevertheless, it is useful to examine the magnitude of the relation between the ordinal values. Therefore, an ordered probit model can be used for statistically analysing the data of such ordinal choices. In the existing literature on tourist satisfaction, few studies employ an ordered probit model. The studies by Oliveira and Pereira (2008) and Hasegawa (2010) are an exception. Oliveira and Pereira (2008) employ an ordered probit model to examine how the socio-demographic characteristics of tourists and the different aspects of a trip affect tourists' evaluations of 30 different aspects of a destination. In general, a multivariate ordered probit model can be employed when the questionnaire contains two or more attributes, such reviewer ratings of hotel attributes. Hasegawa (2010) applies a multivariate ordered probit model to tourist satisfaction derived from several aspects of a trip to Hokkaido, an island in Northern Japan. He estimates the model using a simulation-based Bayesian method and investigates the relationship between overall satisfaction and the degree of satisfaction from individual aspects of the trip according to the estimation of the Bayesian multivariate ordered probit model.

In this article, we characterize the contents of online hotel reviews by using a text-mining tool, and construct dummy variables that represent the characteristics of descriptive information included in online hotel reviews. Thereafter, we estimate a multivariate ordered probit model for satisfaction ratings using several hotel attributes with the dummy variables for reviewer's descriptive information.

METHODOLOGY: MULTIVARIATE ORDERED PROBIT MODEL

Now, let y_{ij} denote the ordinal discrete response of individual i to question j for $i = 1,\cdots,n$ and $j = 1,\cdots,m$, that is, $y_{ij}=c$ for $c = 1,\cdots,C$. Further, let z_{ij} denote the latent variable of individual i to question j such that

$$y_{ij} = c \quad \text{if} \quad z_{ij} \in (\gamma_{j(c-1)}, \gamma_{jc}], i = 1,\cdots,n; c = 1,\cdots C; j = 1,\cdots,m, \tag{1}$$

where γ_{jc} is a cutoff point for the j ordinal response. Further, we specify that

$$-\infty = \gamma_{j0} < \gamma_{j1} = 0 < \gamma_{j2} < \cdots < \gamma_{j(C-1)} = 1 < \gamma_{jC} = \infty, j = 1,\cdots,m, \tag{2}$$

where the conditions $\gamma_{j1} = 0$ and $\gamma_{j(C-1)} = 1$ are required for establishing the identifiability of the cutoff parameters (see Chen and Dey, 2000,

pp.135-136). Further, we use the following transformation for the cutoff points:

$$\delta_{jc} = \log\left(\frac{\gamma_{jc} - \gamma_{j(c-1)}}{1 - \gamma_{jc}}\right), c = 2, \cdots, C-2$$

(see Chen and Dey, 2000, p.140). It is assumed that the latent variable z_{ij} is determined by the linear model

$$z_{ij} = \mathbf{x}_{ij}'\boldsymbol{\beta}_j + u_{ij}, i = 1, \cdots, n; j = 1, \cdots, m,$$

where $\mathbf{x}_{ij} = (x_{ij1}, \cdots, x_{ijk})'$ and $\boldsymbol{\beta}_j = (\beta_{j1}, \cdots, \beta_{jk})'$. Defining $\boldsymbol{\beta} = (\boldsymbol{\beta}_1', \cdots, \boldsymbol{\beta}_m')'$ and

$$\mathbf{z}_i = \begin{pmatrix} z_{i1} \\ \vdots \\ z_{im} \end{pmatrix}, \mathbf{X}_i = \begin{pmatrix} \mathbf{x}_{i1}' & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \mathbf{x}_{im}' \end{pmatrix} = \mathrm{diag}(\mathbf{x}_{i1}', \cdots, \mathbf{x}_{im}'), \mathbf{u}_i = \begin{pmatrix} u_{i1} \\ \vdots \\ u_{im} \end{pmatrix},$$

the linear model for the latent variables is rewritten as

$$\mathbf{z}_i = \mathbf{X}_i\boldsymbol{\beta} + \mathbf{u}_i, i = 1, \cdots, n.$$

Now, we assume that $\mathbf{u}_i \sim \mathrm{N}(\mathbf{0}, \boldsymbol{\Sigma})$, that is,

$$\mathbf{z}_i \sim \mathrm{N}(\mathbf{X}_i\boldsymbol{\beta}, \boldsymbol{\Sigma}), i = 1, \cdots, n, \tag{3}$$

where $\boldsymbol{\Sigma}$ is an $m \times m$ positive definite covariance matrix. Equations (1), (2), and (3) establish a multivariate ordered probit model. Following Hasegawa (2010), we estimate the multivariate ordered probit model by using the simulation-based Bayesian method, that is, the Markov chain Monte Carlo (MCMC) method.

We can use the multivariate ordered probit model (3) to investigate the relationship y_1 and the others $(y_2, \cdots, y_m)$. By omitting the suffix i in (3), we consider population regression, that is $\mathbf{z} \sim \mathrm{N}(\mathbf{X}\boldsymbol{\beta}, \boldsymbol{\Sigma})$, where $\mathbf{X} = \mathrm{diag}(\mathbf{x}_1', \cdots, \mathbf{x}_m')$. We then divide $\mathbf{z}$ as $\mathbf{z} = (z_1, \mathbf{z}_{(-1)}')'$. Suppose that z_1 is a latent variable associated with a dependent variable of interest y_1 and $\mathbf{z}_{(-1)}$ is a vector of latent variables corresponding to the other ordinal variables. Multivariate normal model $\mathbf{z} \sim \mathrm{N}(\mathbf{X}\boldsymbol{\beta}, \boldsymbol{\Sigma})$ can be used to predict z_1 given $\mathbf{z}_{(-1)}$ (see Hoff, 2009, pp.118-120). Then, we have

$$p(\mathbf{z} \mid \mathbf{X}, \cdots) = p(z_1, \mathbf{z}_{(-1)} \mid \mathbf{X}, \cdots) = p(z_1 \mid \mathbf{z}_{(-1)}, \mathbf{X}, \cdots) p(\mathbf{z}_{(-1)} \mid \mathbf{X}, \cdots),$$

where "$|\cdots$" denotes the conditioning of the other unspecified variables in the equation. On the basis of the property of multivariate normal distribution, we obtain

$$z_1 \,|\, \mathbf{z}_{(-1)}, \mathbf{X}, \cdots \sim \mathrm{N}(\widetilde{\mu}_1, \widetilde{\sigma}_{11}), \tag{4}$$

where

$$\widetilde{\mu}_1 = \mathbf{x}_1'\boldsymbol{\beta}_1 + \boldsymbol{\sigma}_{(-1)}'\boldsymbol{\Sigma}_{(-1)}^{-1}(\mathbf{z}_{(-1)} - \mathbf{X}_{(-1)}\boldsymbol{\beta}_{(-1)})$$
$$\widetilde{\sigma}_{11} = \sigma_{11} - \boldsymbol{\sigma}_{(-1)}'\boldsymbol{\Sigma}_{(-1)}^{-1}\boldsymbol{\sigma}_{(-1)}$$
$$\mathbf{X} = \begin{pmatrix} \mathbf{x}_1' & \mathbf{0}' \\ \mathbf{O} & \mathbf{X}_{(-1)} \end{pmatrix}, \boldsymbol{\beta} = \begin{pmatrix} \boldsymbol{\beta}_1 \\ \boldsymbol{\beta}_{(-1)} \end{pmatrix}, \boldsymbol{\Sigma} = \begin{pmatrix} \sigma_{11} & \boldsymbol{\sigma}_{(-1)}' \\ \boldsymbol{\sigma}_{(-1)} & \boldsymbol{\Sigma}_{(-1)} \end{pmatrix}.$$

$\boldsymbol{\alpha} = \boldsymbol{\Sigma}_{(-1)}^{-1}\boldsymbol{\sigma}_{(-1)} = (\alpha_1, \cdots, \alpha_{m-1})'$ becomes a coefficient vector of $\mathbf{z}_{(-1)}$ in the regression of z_1 on $\mathbf{z}_{(-1)}$, given $\mathbf{X}$ (see Hasegawa, 2010). The coefficients of explanatory variables in $\mathbf{X}$ can be calculated from $\mathbf{x}_1'\boldsymbol{\beta}_1 - \boldsymbol{\sigma}_{(-1)}'\boldsymbol{\Sigma}_{(-1)}^{-1}\mathbf{X}_{(-1)}\boldsymbol{\beta}_{(-1)}$.

EMPIRICAL RESULTS

Data collection

This study used online hotel reviewers' evaluations that were posted on an online review web site, say *B*. Site *B* is one of the biggest online hotel review sites in Japan. The hotel considered in this study, say *A*, is an *Onsen Ryokan* located in Hokkaido. *Onsen Ryokan* is a traditional Japanese inn with its own private hot-spring bath (Rowthorn et al., 2009, p.102). Since this study does not intend to evaluate the management of this *Onsen Ryokan* but to reveal the feasibility of the methods proposed in this article, we anonymised this *Onsen Ryokan* as *A* and the online review website as *B*. (In addition, for more details on *Onsen* (hot spring) and *Onsen Ryokan*, see travel guidebooks on Japan, such as Rowthorn et al. (2009). Further, for a detailed introduction to Hokkaido, see Rowthorn et al. (2009, pp.578-643).

Table 1. Definitions of variables

Explained variables	
Variables	Definition
SatAll	Overall satisfaction that takes five ordinal choices from 1 (Dissatisfied) to 5 (Satisfied).
SatRoom	Satisfaction with guest rooms that takes five ordinal choices from 1 (Dissatisfied) to 5 (Satisfied).
SatBath	Satisfaction with hot-spring bath that takes five ordinal choices from 1 (Dissatisfied) to 5 (Satisfied).
SatBF	Satisfaction with breakfast that takes five ordinal choices from 1 (Dissatisfied) to 5 (Satisfied).
SatDinner	Satisfaction with dinner that takes five ordinal choices from 1 (Dissatisfied) to 5 (Satisfied).
SatServ	Satisfaction with service and hospitality that takes five ordinal choices from 1 (Dissatisfied) to 5 (Satisfied).
SatClean	Satisfaction with cleanliness that takes five ordinal choices from 1 (Dissatisfied) to 5 (Satisfied).
Explanatory variables	
price	Logarithm of price of one night stay at the accommodation.
female	A dummy variable that takes 1 if the reviewer is female, and 0 if the reviewer is male.
age3	A dummy variable that takes 1 if the reviewer in his/her 30s, and 0 otherwise.
age4	A dummy variable that takes 1 if the reviewer in his/her 40s, and 0 otherwise.
age5	A dummy variable that takes 1 if the reviewer in his/her 50s, and 0 otherwise.
age6	A dummy variable that takes 1 if the reviewer is aged 60 or above, and 0 otherwise.
quarter1	A dummy variable that takes 1 if the reviewer stayed at *Onsen Ryokan A* between January 2010 and March 2010, and 0 otherwise.
quarter2	A dummy variable that takes 1 if the reviewer stayed at *Onsen Ryokan A* between April 2010 and June 2010, and 0 otherwise.
quarter3	A dummy variable that takes 1 if the reviewer stayed at *Onsen Ryokan A* between July 2010 and September 2010, and 0 otherwise.
Explanatory variables (reviewer's descriptive information)	
food_p (food_n)	A dummy variable that takes 1 if a reviewer's descriptive information includes positive (negative) words and/or phrases about meals and 0, otherwise.
bath_p (bath_n)	A dummy variable that takes 1 if a reviewer's descriptive information includes positive (negative) words and/or phrases about hot-spring bath and 0, otherwise.

service_p (service_n)	A dummy variable that takes 1 if a reviewer's descriptive information includes positive (negative) words and/or phrases about service and hospitality and 0, otherwise.
room_p (room_n)	A dummy variable that takes 1 if a reviewer's descriptive information includes positive (negative) words and/or phrases about rooms and 0, otherwise.
equip_p (equip_n)	A dummy variable that takes 1 if a reviewer's descriptive information includes positive (negative) words and/or phrases about facilities and amenities of accommodation and 0, otherwise.
price_p (price_p)	A dummy variable that takes 1 if a reviewer's descriptive information includes positive (negative) words and/or phrases about price of accommodation and 0, otherwise.
clean_p (clean_n)	A dummy variable that takes 1 if a reviewer's descriptive information includes positive (negative) words and/or phrases about cleanliness and 0, otherwise.
season	A dummy variable that takes 1 if a reviewer's descriptive information includes words and/or phrases about seasons and events and 0, otherwise.

Staying in an *Onsen Ryokan* usually includes dinner in the evening, followed by breakfast the next morning. Therefore, hot-spring baths and meals are important aspects for the evaluation as well as quality of the guest rooms, service and hospitality, and cleanliness. In fact, the online hotel review evaluation comprises ratings on customer satisfaction derived from several hotel attributes, namely, guest rooms, hot-spring baths, breakfast, dinner, service and hospitality, cleanliness, and overall satisfaction (the definitions of the variables are provided in Table 1). Satisfaction with regard to these attributes is measured using a 5-point scale. Furthermore, the online hotel review evaluations include reviewer's descriptive information. The aim of this article is to analyse customer satisfaction indicated through reviewer's descriptive information using a multivariate ordered probit model.

We used the online evaluations of reviewers who stayed at *Onsen Ryokan A* for the period between October 2009 and September 2010 and posted their reviews on website *B*. We collected all the online reviews of *Onsen Ryokan A* for the corresponding period from website *B*. As a result, the data comprised 925 unit records, which included the reviewers' descriptive information, satisfaction ratings for several hotel attributes, price for a one-night stay at the inn, gender and age of reviewers, and period of stay. The reviewer satisfaction ratings represent a reviewer's overall satisfaction with staying at the inn and their satisfaction with hotel attributes, i.e., guest rooms, hot-spring bath, breakfast, dinner, service and

hospitality, and cleanliness. Eliminating unit records with missing values, we obtained 879 unit records for this estimation. Since these unit records were not randomly sampled from the population, the analyses were restrictive. One reason for this is that the unit records are presumed to be a sample from the population of responses of virtual online reviewers. Table 1 presents the definitions of the variables that are used in the current analysis.

Descriptive results

Table 2 provides the frequencies and percentages of the unit records under each category of satisfaction. According to this table, the percentage of overall satisfaction ratings (**SatAll**) of 4 and 5 points was 87.14%. With regard to satisfaction from individual items, the percentage of ratings of 4 and 5 points was highest for the hot-spring bath (**SatBath**) (87.71%) and lowest for the guest rooms (**SatRoom**) (72.59%). *Onsen Ryokan A* is an established inn in Hokkaido, but its room accommodations and facilities are rather old. This may have led to the relatively low satisfaction with guest rooms.

Table 3 provides the values of the polychoric correlation and Pearson's correlation. These values were calculated using **R** version 2.11.1 of the package **psych** (for details on polychoric correlation, see, for example, Olsson, 1979). The data relating to satisfaction were measured using a 5-point scale; in other words, they are ordinal data. Therefore, Pearson's correlation was not suitable for calculating the correlation between any two sets of these data. Instead, the polychoric correlation was used to calculate the correlation between two ordinal variables. From Table 3, it is evident that the values of polychoric correlation are fairly larger than those of Pearson's correlation are. In other words, the values of Pearson's correlation underestimated the relationships between two of these ordinal variables. According to the polychoric correlation, satisfaction with service and hospitality (**SatServ**) had the largest effect on overall satisfaction (0.78), and satisfaction with cleanliness (**SatClean**) had the second-largest effect (0.74); moreover, satisfaction with the hot-spring bath (**SatBath**) had the smallest effect (0.59). Further, it must be noted that the magnitudes of the relationships between overall satisfaction and satisfaction with the hotel's attributes are reconsidered after the multivariate ordered probit model is analysed in the next subsection.

Table 2. Summary statistics (Satisfaction)

Satisfaction	Dissatisfied 1	2	3	4	Satisfied 5
SatAll	9 (1.02)	18 (2.05)	86 (9.78)	428 (48.69)	338 (38.45)
SatRoom	16 (1.82)	40 (4.55)	185 (21.05)	395 (44.94)	243 (27.65)
SatBath	6 (0.68)	18 (2.05)	84 (9.56)	362 (41.18)	409 (46.53)
SatBF	4 (0.46)	17 (1.93)	143 (16.27)	377 (42.89)	338 (38.45)
SatDinner	12 (1.37)	26 (2.96)	107 (12.17)	298 (33.90)	436 (49.60)
SatServ	21 (2.39)	39 (4.44)	135 (15.36)	354 (40.27)	330 (37.54)
SatClean	11 (1.25)	22 (2.50)	161 (18.32)	420 (47.78)	265 (30.15)

Notes: Values in parentheses denote percentage.

Table 3. Correlation matrix

	SatAll	**SatRoom**	**SatBath**	**SatBF**	**SatDinner**	**SatServ**	**SatClean**
SatAll		0.67	0.59	0.65	0.73	0.78	0.74
SatRoom	(0.58)		0.40	0.35	0.32	0.50	0.70
SatBath	(0.49)	(0.33)		0.35	0.36	0.45	0.46
SatBF	(0.55)	(0.31)	(0.30)		0.69	0.43	0.41
SatDinner	(0.62)	(0.28)	(0.29)	(0.59)		0.50	0.42
SatServ	(0.70)	(0.42)	(0.37)	(0.37)	(0.45)		0.64
SatClean	(0.64)	(0.63)	(0.38)	(0.35)	(0.35)	(0.55)	

Notes: Values without parenthesis denote the polychoric correlations. Values in parentheses denote Pearson's correlations.

The data of the online hotel review evaluation includes the reviewer's descriptive information. After a preliminary morphological analysis using text-mining software **ttm** (*TinyTextMining*, Matsumura and Miura, 2009), we selected 12 types of words and/or phrases: words and/or phrases related to the guest rooms (**room**), hot-spring bath (**hot-spring**), meals (**meal**), service and hospitality (**service**), cleanup (**cleanup**), facilities and amenities of accommodation (**f & a**), and price of accommodation (**price**); positive and negative words and/or phrases (**positive** and **negative**); sentences with negative polarity (**not**); words and/or phrases

regarding family members or friends lodging with the reviewer (**family**) and regarding seasons and events (**s & e**).

Table 4. Number of appearance in the reviews

	room	**hot-spring**	**meal**	**service**	**cleanup**	**f & a**
room	(481)	367	419	224	45	240
hot-spring		(644)	571	286	48	274
meal			(753)	335	50	310
service				(392)	38	170
cleanup					(61)	36
f & a						(348)
price						
positive						
negative						
not						
family						
s & e						

	price	**positive**	**negative**	**not**	**family**	**s & e**
room	66	461	246	214	200	55
hot-spring	80	629	289	253	236	59
meal	94	727	332	292	266	74
service	55	375	201	187	162	47
cleanup	5	57	46	40	30	9
f & a	53	335	185	181	145	41
price	(107)	103	50	55	45	12
positive		(844)	357	318	302	77
negative			(379)	213	138	42
not				(333)	135	43
family					(311)	48
s & e						(80)

Notes: Values without parenthesis denote the number of joint appearance, while values in parentheses denote the total number of appearance. **room**: *words and/or phrases about rooms.* **hot-spring**: *words and/or phrases about hot-spring bath.* **meal**: *words and/or phrases about meals.* **service**: *words and/or phrases about service and hospitality.* **cleanup**: *words and/or phrases about cleanup.* **f & a**: *words and/or phrases about facilities and amenities of accommodation.* **price**: *words and/or phrases about price of accommodation.* **positive**: *positive words and/or phrases.* **negative**: *negative words and/or phrases.* **not**: *sentences with negative polarity.* **family**: *words and/or phrases about family members or friends lodging with reviewer.* **s & e**: *words and/or phrases about seasons and events.*

Table 4 presents a cross-tabulation of the number of appearances of the 12 types of words and/or phrases in the reviews. Values without

parenthesis denote the number of joint appearances, while values within parentheses denote the total number of appearances. For example, from the 879 reviews, words and/or phrases regarding rooms appeared in 481 reviews, and those regarding rooms and positive statements appeared together in 461 reviews. Words and/or phrases regarding meals appeared most often (753), and those regarding the hot-spring bath and rooms were the second- and third-most common, respectively (644 and 481). The qualities of meals and rooms (whether good or bad) may have had considerable influence on customer satisfaction with *Onsen Ryokan A*. Further, there were 844 positive words and/or phrases and 379 negative words and/or phrases. However, it must be noted that positive and negative words and/or phrases appeared together in 357 reviews. In other words, reviewers tended to give positive and negative impressions in the same review.

The above preliminary analysis suggests that the qualities of several aspects of *Onsen Ryokan A* that appeared in reviewers' descriptive information influenced reviewers' satisfaction with the hotel. Therefore, in the next subsection, we incorporate the reviewers' descriptive information into a multivariate probit analysis.

Posterior results of multivariate ordered probit model

In this sub-section, we estimate the multivariate ordered probit model by using the online hotel reviewers' data described in the previous sub-sections. Table 5 provides the summary statistics of explanatory variables (**female**, **age**, **quarter**, and **price**). In addition, considering the analyses of reviewers' descriptive information, we construct dummy variables that correspond to the 12 types of words and/or phrases in the reviewers' descriptive information. **food_p** is a dummy variable that is set to 1 if a reviewer's descriptive information included positive words and/or phrases regarding meals, and 0 otherwise; **food_n** is a dummy variable that is set to 1 if reviewers' descriptive information includes negative words and/or phrases regarding meals; **bath_p** and **bath_n** are dummy variables that respectively correspond to positive and negative evaluations of the hot-spring bath; **service_p** and **service_n** are dummy variables that correspond to positive and negative evaluations of the service and hospitality respectively; **room_p** and **room_n** are dummy variables that correspond to positive and negative evaluations of the rooms respectively; **equip_p** and **equip_n** are dummy variables that correspond to positive and negative evaluations of the facilities and amenities of the accommodation respectively; **price_p** and **price_n** are dummy variables

that correspond to positive and negative evaluations of the price of the accommodation respectively; **clean_p** and **clean_n** are dummy variables that correspond to positive and negative evaluations of cleanliness respectively. Further, **season** is a dummy variable that is set to 1 if reviewer's descriptive information includes words and/or phrases regarding seasons and events, and 0 otherwise. Table 6 presents the summary statistics of these dummy variables.

Table 5. Summary statistics (Explanatory variables)

Gender (**female**)		Age (**age3**, **age4**, **age5**, **age6**)				
Female	Male	10~20	30	40	50	60~80
419	460	264	298	167	109	41
(47.67)	(52.33)	(30.03)	(33.90)	(19.00)	(12.40)	(4.66)

Quarter (**quarter1**, **quarter2**, **quarter3**)			
Oct/09~ Dec/09	Jan/10~ Mar/10	Apr/10~ Jun/10	Jul/10~ Sep/10
206	243	217	213
(23.44)	(27.65)	(24.69)	(24.23)

Price (Yen) (**price**)						
Mean	SD	Min	25%	50%	75%	Max
11774.5	3328.6	7500.5	9500.5	10500.5	12500.5	27500.5
(131.5)	(37.2)	(83.8)	(106.1)	(117.3)	(139.6)	(307.2)

Notes: For Gender, Age, and Quarter, values in parentheses denote percentage. For Price, values in parentheses denote those converted into US dollars. The exchange rate used in the table is an average of daily exchange rates from October 2009 to September 2010.

Table 6. Summary statistics (reviewer's descriptive information)

food_p		**food_n**		**bath_p**		**bath_n**	
0	1	0	1	0	1	0	1
228	651	707	172	375	504	768	111
(25.94)	(74.06)	(80.43)	(19.57)	(42.66)	(57.34)	(87.37)	(12.63)
service_p		**service_n**		**room_p**		**room_n**	
0	1	0	1	0	1	0	1
549	330	788	91	642	237	770	109
(62.46)	(37.54)	(89.65)	(10.35)	(73.04)	(26.96)	(87.60)	(12.40)
equip_p		equip_n		price_p		price_n	
0	1	0	1	0	1	0	1
713	166	827	52	788	91	862	17
(84.11)	(18.89)	(94.08)	(5.92)	(89.65)	(10.35)	(98.07)	(1.93)
clean_p		**clean_n**		**season**			
0	1	0	1	0	1		
702	177	798	81	800	79		
(79.86)	(20.14)	(90.78)	(9.22)	(91.01)	(8.99)		

Notes: Values in parentheses denote percentage.

The estimated equations are presented below:

$$\begin{aligned} z_j &= \beta_{j,1} + \beta_{j,2} price + \beta_{j,3} female + \beta_{j,4} age3 + \beta_{j,5} age4 \\ &+ \beta_{j,5} age5 + \beta_{j,7} age6 + \beta_{j,8} quarter1 + \beta_{j,9} quarter2 \\ &+ \beta_{j,10} quarter3 + \beta_{j,11} food\_p + \beta_{j,12} food\_n \\ &+ \beta_{j,13} bath\_p + \beta_{j,14} bath\_n + \beta_{j,15} service\_p \\ &+ \beta_{j,16} service\_n + \beta_{j,17} room\_p + \beta_{j,18} room\_n \\ &+ \beta_{j,19} equip\_p + \beta_{j,20} equip\_n + \beta_{j,21} price\_p \\ &+ \beta_{j,22} price\_n + \beta_{j,23} clean\_p + \beta_{j,24} clean\_n \\ &+ \beta_{j,25} season + u_j, j = 1, \cdots, 7, \end{aligned} \tag{5}$$

where equation $j = 1$ corresponds to the overall satisfaction (**SatAll**), and equations $j = 2$ to 7 correspond to the satisfaction with rooms (**SatRoom**), the hot-spring bath (**SatBath**), breakfast (**SatBF**), dinner (**SatDinner**), service and hospitality (**SatServ**), and cleanliness (**SatClean**), respectively. According to the above specification, a reviewer who satisfied the following conditions was selected as a "reference reviewer": male in his twenties or younger who stayed in *Onsen Ryokan A* for the period between October 2009 and December 2009. Further, the values of dummy variables of the reviewers' descriptive information of the reference reviewer are equal to zero. The MCMC simulation was run for 15,000 iterations with a thinning interval of 5; the first 5,000 samples were discarded as the burn-in period. The posterior results obtained thereafter were generated using Ox version 6.21 (Doornik, 2009). We set the prior distributions in the following manner:

$$\begin{aligned} \boldsymbol{\beta}_j &\sim \mathrm{N}(\mathbf{0}, 100\mathbf{I}_{25}), \boldsymbol{\delta}_j \sim \mathrm{N}(0, 100\mathbf{I}_2), j = 1, \cdots, 7 \\ \boldsymbol{\Sigma}^{-1} &\sim \mathrm{W}(10, 50\mathbf{I}_7), \end{aligned}$$

where $\boldsymbol{\delta}_j = (\delta_2, \delta_3)'$, and $\mathrm{W}(10, 50\mathbf{I}_7)$ denotes a Wishart distribution with degrees of freedom 10 and scale matrix $50\mathbf{I}_7$.

Table 7. Posterior results of multivariate ordered probit model

	SatAll	SatRoom	SatBath	SatBF	SatDinner	SatServ	SatClean
intercept	1.1613**	-0.5190	0.1348	2.3092**	2.5115**	0.5244	-0.0283
price	-0.0363	0.1282**	0.0771	-0.1623**	-0.1761**	0.0267	0.0805*
female	0.0432	-0.0038	0.0063	0.0006	-0.0615**	0.0242	0.0060
age3	0.0510*	0.0185	0.0464	0.0685**	0.0020	0.0316	0.0344
age4	0.0420	0.0694**	0.0852**	0.0437	-0.0328	0.0049	0.0488
age5	0.0254	0.0202	0.0242	0.0572	-0.0433	-0.0365	0.0332
age6	0.0435	0.0985*	0.1451**	0.0988	0.0208	0.0186	0.0456

quarter1	-0.0657**	0.0150	-0.0301	-0.0541	-0.0437	-0.0185	-0.0043
quarter2	-0.0411	0.0052	-0.0143	-0.0392	-0.0531	-0.0045	0.0181
quarter3	-0.0664*	0.0061	-0.0255	-0.0074	-0.0044	-0.0069	-0.0163
food_p	0.1074**	-00055	-0.0220	0.1740**	0.3567**	0.0364	0.0384
food_n	-0.2044**	-0.0947**	-0.1017**	-0.2568**	-0.3892**	-0.1123**	-0.0967**
bath_p	0.0151	0.0273	0.2534**	-0.0211	-0.0386	0.0015	0.0113
bath_n	-0.0709**	0.0040	-0.3027**	-0.0112	-0.0093	-0.0295	-0.0093
service_p	0.1766**	0.1568**	0.0622**	0.0848**	0.1291**	0.3470**	0.1464**
service_n	-0.3375**	-0.1175**	-0.1768**	-0.1349**	-0.1660**	-0.5288**	-0.1532**
room_p	0.0983**	0.2883**	-0.0048	0.0497*	-0.0070	0.1040**	0.1090**
room_n	-0.2239**	-0.3352**	-0.0113	-0.1012**	-0.0511	-0.1293**	-0.1619**
equip_p	-0.0039	0.0261	0.0159	-0.0208	0.0307	0.0001	0.0459
equip_n	0.0106	-0.0304	0.0198	0.0648	0.0345	-0.0327	0.0228
price_p	0.0312	0.0259	0.1016**	0.0115	-0.0940**	-0.0048	0.0053
price_n	-0.0848	-0.1384*	-0.1041	-0.0259	-0.0681	-0.0137	-0.1426*
clean_p	0.0178	0.0191	0.0039	0.0276	0.0129	-0.0114	0.1244**
clean_n	-0.0236	-0.0413	-0.0724	0.0255	-0.0322	0.0045	-0.2647**
season	-0.1056**	0.0004	-0.0146	-0.1053**	-0.0155	-0.0374	-0.0176
γ_{j2}	0.1776**	0.2236**	0.1881**	0.2002**	0.2089**	0.2448**	0.1755**
γ_{j3}	0.4809**	0.5726**	0.5047**	0.5878**	0.5645**	0.5750**	0.5608**

*Notes: The values are posterior median. "**" and "*" denote that zero is not included in the 95% and 90% credible interval, respectively.*

Table 7 presents the summary of the posterior results of the estimation of (5). As mentioned below, from Table 5, we found that the price of accommodation, reviewer's gender and age, and the dummy variables of reviewers' descriptive information have substantial effects on customer satisfaction in the estimation of (5). The following observations can be made from the results in Table 7:

- First, the reviewers' descriptive information for the hotel's attributes has substantial effects on the corresponding customer satisfaction. In other words, **room_p** and **room_n** have positive and negative effects on the satisfaction with rooms (**SatRoom**), respectively; **bath_p** and **bath_n** have positive and negative effects on the satisfaction with the hot-spring bath (**SatBath**), respectively; **food_p** and **food_n** have positive and negative effects on the satisfactions with breakfast (**SatBF**) and dinner (**SatDinner**), respectively; **service_p** and **service_n** have positive and negative effects on the satisfaction with rooms (**SatServ**), respectively; **clean_p** and **clean_n** have positive and negative effects on the satisfaction with cleanliness (**SatClean**), respectively.
- The dummy variables of positive and negative evaluations of service and hospitality (**service_p** and **service_n**) have substantial positive and negative effects, respectively, on customer satisfaction with regard to all the attributes. Consequently, we conclude that the hotel's service and hospitality are very important aspects for the reviewers' hotel evaluations.

- With respect to overall satisfaction (**SatAll**), the dummy variables for negative evaluations of meals, the hot-spring bath, service and hospitality, and guest rooms (**food_n**, **bath_n**, **service_n**, and **room_n**) have a substantial negative effect, whereas the dummy variables for positive evaluations of meals, service and hospitality, and guest rooms (**food_p**, **service_p**, and **room_p**) have a positive effect. This result indicates that it is important for the managers of *Onsen Ryokan A* to improve the quality of meals, hot-spring baths, and service and hospitality in order to improve customer satisfaction; otherwise, customers may immediately have negative impressions of the hotel.
- With respect to satisfaction with guest rooms (**SatRoom**), apart from the dummy variables for guest rooms (**room_p** and **room_n**), the dummy variables of negative evaluations of meals, and positive and negative evaluations of service and hospitality (**food_n**, **service_p** and **service_n**) have a substantial effect. Guests staying at *Onsen Ryokan* usually dine in their own guest rooms, in a separate private dining room, or in a communal dining area. Therefore, since one of the optional services of staying in an *Onsen Ryokan* is to have dinner served in the guests' rooms, the evaluations of meals as well as service and hospitality may be factors that determine customer satisfaction with rooms. Further, the price of accommodation (**price**) has a positive effect, and the dummy variable for negative evaluations of price (**price_n**) has a slightly negative effect. Since *Onsen Ryokan A* is an established hotel in Hokkaido, customers would be satisfied even if the price were high, given that the services and hospitality provided were consistent with the high price. However if the services and hospitality provided were not consistent with the high price, customers have negative impressions of guest rooms.
- With respect to satisfaction with the hot-spring bath (**SatBath**), apart from the dummy variables for the hot-spring bath (**bath_p** and **bath_n**), the dummy variables of negative evaluations of meals (**food_n**), positive and negative evaluations of service and hospitality (**service_p** and **service_n**), and positive evaluations of price (**price_p**) have a substantial effect. The reason why the negative evaluation of meals (**food_n**) has a substantially negative effect on satisfaction with the hot-spring bath is unclear, although the tetrachoric correlation between **bath_n** and **food_n** is relatively high. Positive evaluations of price

(**price_p**) included words and/or phrases regarding the affordability of accommodation. Since the quality of the hot-spring bath is high for the price of accommodation, the positive evaluation of price seems to have a substantially positive effect on satisfaction with the hot-spring bath. Further, the dummy variables for some age groups (**age4** and **age6**) have a substantial effect on satisfaction with the hot-spring bath. In particular, people aged over sixty were satisfied with the hot-spring bath.

- With respect to satisfaction with breakfast (**SatBF**), apart from the dummy variables for meals (**food_p** and **food_n**), the dummy variables of negative evaluations of guest rooms (**room_n**), positive and negative evaluations of service and hospitality (**service_p** and **service_n**), and seasons and events (**season**) have a substantial effect. Like most *Onsen Ryokan*s, *Onsen Ryokan A* offers buffet-style breakfasts that include both Japanese and Western dishes in a communal breakfast area. Therefore, the reason why negative evaluations of guest rooms (**room_n**) have a substantially negative effect on satisfaction with breakfast is unclear. Some guests stay at *Onsen Ryokan A* for family events such as the celebration of a family member's 60th birthday. Since *Onsen Ryokan A* offers buffet-style breakfasts in a communal breakfast area, the area is occasionally congested during peak periods. This congestion may create a negative impression among guests and ruin their celebratory mood. Hence, the dummy variable for seasons and events (**season**) may have a substantially negative effect on satisfaction with breakfast. Further, the price of accommodation (**price**) has a negative effect on satisfaction with breakfast. Some guests are unsatisfied with the breakfast because of the price.
- With respect to satisfaction with dinner (**SatDinner**), apart from the dummy variables for meals (**food_p** and **food_n**), the dummy variables of positive and negative evaluations of service and hospitality (**service_p** and **service_n**) and positive evaluation of price (**price_p**) have a substantial effect. Further, the price of accommodation (**price**) and the dummy variable for gender (**female**) have a negative effect on satisfaction with dinner. Since some guests are unsatisfied with dinner because of the price, the price of the accommodation (**price**) has a negative effect. Moreover, some guests feel that the price of the

accommodation is affordable; however, they are of the opinion that the quality of dinner is low --- consistent with the affordability of the accommodation. Thus, the positive evaluation of price (**price_p**) has a negative effect. Further, since the reference reviewer is male, female reviewers are more critical of the quality of dinner.

- With respect to satisfaction with service and hospitality (**SatServ**), apart from the dummy variables for service and hospitality (**service_p** and **service_n**), the dummy variables of the negative evaluation of meals (**food_n**) and positive and negative evaluations of guest rooms (**room_p** and **room_n**) have a substantial effect.
- With respect to satisfaction with cleanliness (**SatClean**), the dummy variables of negative evaluation of meals (**food_n**), and positive and negative evaluations of guest rooms and service and hospitality (**room_p**, **room_n**, **service_p** and **service_n**) have a substantial effect apart from the dummy variables for cleanliness (**clean_p** and **clean_n**). Insufficient cleaning of guest rooms has a negative effect on satisfaction with cleanliness. Substandard tray services also have a negative effect.

Table 8 provides the posterior results of the model with ordinal explanatory variables using equation (4). The following observations are evident from Table 8:

- All customer satisfaction ratings derived from several of the hotel's attributes, that is, guest rooms, hot-spring bath, breakfast, dinner, service and hospitality, and cleanliness, have a substantially positive effect on the overall satisfaction level. In particular, satisfaction with dinner (**SatDinner**) has the largest effect (the posterior mean of α_5 is 0.2868), and satisfaction with service and hospitality (**SatServ**) has the second-largest effect (the posterior mean of α_6 is 0.2640); satisfaction with breakfast (**SatBF**) has the smallest effect (the posterior mean of α_4 is 0.0873). The order of the magnitudes of effect on overall satisfaction is different from the order of the values of the polychoric correlation stated in Table 3. It is important to note that the values of the posterior mean of s in Table 6 are derived under the control of explanatory variables, while those of the polychoric correlation in Table 3 are not. If we do not consider

the effects of explanatory variables, we may wrongly evaluate the effects of customer satisfaction derived from the previously mentioned hotel attributes.

- The dummy variables for gender (**female**) have a positive effect on overall satisfaction, while the dummy variables for quarters (**quarter1** and **quarter3**), negative evaluations of service and hospitality and guest rooms (**service_n** and **room_n**), and the dummy variable for seasons and events (**season**) have a negative effect on overall satisfaction.

Table 8. Posterior results of model with ordinal explanatory variables

		SatAll		
		Mean	SD	Median
room	(α_1)	0.2222	0.0393	0.2218**
hot_spring	(α_2)	0.1348	0.0304	0.1344**
breakfast	(α_3)	0.0873	0.0363	0.0871**
dinner	(α_4)	0.2868	0.0355	0.2867**
service	(α_5)	0.2640	0.0357	0.2638**
cleanliness	(α_6)	0.1851	0.0442	0.1849**
intercept	(β_1)	0.2059	0.2946	0.2107
price	(β_2)	-0.0330	0.0310	-0.0331
female	(β_3)	0.0535	0.0156	0.0532**
age3	(β_4)	0.0197	0.0187	0.0196
age4	(β_5)	0.0111	0.0221	0.0110
age5	(β_6)	0.0276	0.0253	0.0276
age6	(β_7)	-0.0262	0.0394	-0.0259
quarter1	(β_8)	-0.0421	0.0204	-0.0422**
quarter2	(β_9)	-0.0236	0.0214	-0.0238
quarter3	(β_{10})	-0.0575	0.0216	-0.0574**
food_p	(β_{11})	-0.0227	0.0199	-0.0227
food_n	(β_{12})	0.0120	0.0193	0.0121
bath_p	(β_{13})	-0.0145	0.0174	-0.0145
bath_n	(β_{14})	-0.0178	0.0232	-0.0179
service_p	(β_{15})	-0.0296	0.0188	-0.0298
service_n	(β_{16})	-0.0604	0.0267	-0.0601**
room_p	(β_{17})	-0.0146	0.0217	-0.0147
room_n	(β_{18})	-0.0605	0.0268	-0.0606**
equip_p	(β_{19})	-0.0271	0.0201	-0.0273
equip_n	(β_{20})	0.0029	0.0322	0.0026
price_p	(β_{21})	0.0380	0.0261	0.0380
price_n	(β_{22})	0.0107	0.0483	0.0100
clean_p	(β_{23})	-0.0133	0.0217	-0.0132
clean_n	(β_{24})	0.0505	0.0311	0.0507
season	(β_{25})	-0.0770	0.0261	-0.0769**

*Notes: "Mean," "SD" and "Median" denote the posterior mean, posterior standard deviation and posterior median, respectively. "**" and "*" denote that zero is not included in the 95% and 90% credible interval, respectively.*

CONCLUDING REMARKS

In this study, we analysed the relationship between customer satisfaction with several hotel attributes and reviewers' descriptive information using the Bayesian multivariate ordered probit model. The data used in this study were gathered from online hotel reviews of a traditional Japanese inn with its own private hot spring (*Onsen Ryokan*). We used several reviewer or customer satisfaction ratings and constructed dummy variables that represent the characteristics of reviewers' descriptive information in online hotel reviews.

The reviewers' descriptive information for the hotel's attributes had substantial effects on the corresponding customer satisfaction ratings. Therefore, reviewers' descriptive information must be incorporated in the analysis of customer satisfaction. Further, the dummy variables of service and hospitality had substantial effects on the customer satisfaction ratings for all attributes. Therefore, hotel's service and hospitality were very important aspects for reviewers' evaluations of the hotel. In particular, negative evaluations of service and hospitality had a significant effect on overall satisfaction. According to Table 8, all the customer satisfaction ratings derived from several attributes of the hotel had a substantially positive effect on overall satisfaction. However, the order of the magnitudes of the effect on overall satisfaction in Table 8 was different from that of the values of the polychoric correlation in Table 3. It is important to note that the values of the posterior mean of αs in Table 8 were derived under the control of explanatory variables, while those of the polychoric correlation in Table 3 were not. If we do not consider the effects of explanatory variables, the effects of customer satisfaction derived from the previously mentioned hotel attributes may be wrongly evaluated.

REFERENCES

Bowen, D. & Clarke, J. (2002). Reflections on tourist satisfaction research: Past, present and future. *Journal of Vacation Marketing*, Vol.8, No.4, pp.297-308.

Chen, M.-H. & Dey, D.K. (2000). Bayesian analysis for correlated ordinal data models. In D.K. Dey, S.K. Ghosh, and B.K. Mallick (Eds.) *Generalized Linear Models: A Bayesian Perspective*, New York: Marcel Dekker.

Doğan, H., Üngüren, E. & Barutçu, S. (2012). Russian and German tourist potential and satisfaction in sustainable competitive advantage of Alanya

destination. *TOURISMOS: An International Multidisciplinary Journal of Tourism*, Vol.7, No.2, pp.381-399.

Doornik, J.A. (2009). *An Object-oriented Matrix Programming Language Ox^{TM} 6*. , London: Timberlake Consultants Ltd.

Hasegawa, H. (2010). Analyzing tourists' satisfaction: A multivariate ordered probit approach. *Tourism Management*, Vol.31, No.1, pp.86-97.

Hoff, P.D. (2009). *A First Course in Bayesian Statistical Methods*. Dordrecht, Springer-Verlag.

Kozak, M. (2001a). Comparative assessment of tourist satisfaction with destinations across two nationalities. *Tourism Management*, Vol.22, No.4, pp.391-401.

Kozak, M. (2001b). A critical review of approaches to measure satisfaction with tourist destinations. In A.G. Woodside, J.A. Mazanec, J.R. Brent Ritchie, I. Geoffrey and G.I. Crouch (Eds.) *Consumer Psychology of Tourism, Hospitality and Leisure*, Vol.2, New York: CABI Publishing.

Matsumura, N. & Miura, A. (2009). *Text Mining for Humanities and Social Science*. Tokyo, Seishin Shobo (in Japanese).

Oliveira, P. & Pereira, P.T. (2008). Who values what in a tourism destination? The case of Madeira Island. *Tourism Economics*, Vol.14, No.1, pp.155-168.

Olsson, U. (1979). Maximum likelihood estimation of the polychoric correlation coefficient. *Psychometrika*, Vol.44, No.4, pp.443-460.

Rowthorn, C., Bender, A., Firestone, M.D., Hornyak, T.N., Walker, B. & Yanagihara, W. (2009). *Japan*, 11th ed. Footscray, Lonely Planet.

Ryan, C. & Cessford, G. (2003). Developing a visitor satisfaction monitoring methodology: Quality gaps, crowding and some results. *Current Issues in Tourism*, Vol.6, No.6, pp.457-507.

Sandvik, K. & Grønhaug, K. (2007). How well does the firm know its customers? The Moderating effect of market orientation in the hospitality industry. *Tourism Economics*, Vol.13, No.1, pp.5-23.

Silvestre, A.L., Santos, C.M. & Ramalho, C. (2008). Satisfaction and behavioural intentions of cruise passengers visiting the Azores. *Tourism Economics*, Vol.14, No.1, pp.169-184.

Sirakaya, E., Petrick, J. & Choi, J. (2004). The role of mood on tourism product evaluations. *Annals of Tourism Research*, Vol.31, No.3, pp.517-539.

Thompson, K. & Schofield, P. (2007). An investigation of the relationship between public transport performance and destination satisfaction. *Journal of Transport Geography*, Vol.15, No.2, pp.136-144.

Tonge, J. & Moore, S.A. (2007). Importance-satisfaction analysis for marine-park hinterlands: A Western Australian case study. *Tourism Management*, Vol.28, No.3, pp.768-776.

Yu, L. & Goulden, M. (2006). A comparative analysis of international tourists' satisfaction in Mongolia. *Tourism Management*, Vol.27, No.6, pp.1331-1342.

Yuksel, A. & Yuksel, F. (2001a). Measurement and management issues in customer satisfaction research: Review, critique and research agenda: Part one. *Journal of Travel and Tourism Marketing*, Vol.10, No.4, pp.47-80.

Yuksel, A. & Yuksel, F. (2001b). Measurement and management issues in customer satisfaction research: Review, critique and research agenda: Part two. *Journal of Travel and Tourism Marketing*, Vol.10, No.4, pp.81-111.

ENDNOTES

1. The author appreciates the comments from two anonymous reviewers and the participants of the seminar held at Nihon Fukushi University; these comments have significantly improved the article. This work was supported in part by Grants-in-Aid for Scientific Research (No.22530203) from the Japan Society of the Promotion of Science (JSPS).

SUBMITTED: JAN 2013
REVISION SUBMITTED: AUG 2013
ACCEPTED: SEP 2013
REFEREED ANONYMOUSLY

Hikaru Hasegawa (hasegawa@econ.hokudai.ac.jp) is a professor at Hokkaido University, Graduate School of Economics and Business Administration, Kita 9, Nishi 7, Kita-ku, Sapporo 060-0809, Japan.