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An Analysis of Effective Marketing Strategies for Miyagi Shelled Oyster after the Great East Japan Earthquake of 2011

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We aimed to investigate effective marketing strategies for shelled oyster in the Tokyo markets, subsequent to the 2011 Tohoku Earthquake. Because raw oysters from Miyagi area had accounted for around 70% of the GMS sales in metropolitan area until the day before the Great East Japan Earthquake, but now other prefectures such as Hiroshima, Okayama and Hyogo have been growing market share in GMS sales instead of Miyagi. Latent class models was applied to suggest effective marketing strategies to promote Tokyo markets. The results showed that Tokyo consumers may be categorized as "contents and raw lovers" who value raw oysters and their contents (57%), and as "casual consumers" who consume fewer oysters but value raw oysters (17%). Therefore, promotion can be focused on raw oysters and on increasing the size of contents for the "contents and raw lovers" and "casual consumers."

Key words: Latent class model, shelled oyster, marketing strategy, consumer behavior

INTRODUCTION

Four years have elapsed since the Great East Japan Earthquake in 2011, but producers in the devastated area still suffer from delays in recovering infrastructure such as the farming facilities and processing facilities washed away by the Tsunami (Demura, 2012; Demura, 2013a; Funato, 2014). These problems generate huge economic loss because oyster farming is one of the key industries in Miyagi area (Demura, 2013b). In actual fact, raw oysters from Miyagi area had accounted for around 70% of the share in the GMS sales in metropolitan area until the day before the Great Tohoku Earthquake, but now other prefectures such as Hiroshima, Okayama and Hyogo have been growing market share of GMS sales instead of Miyagi. It is necessary for Miyagi oyster farmers to reoccupy market share in order to reconstruct regional economy, although it is challenging to recover the lost market share.

This study aimed to investigate an effective marketing strategy for sales promotion, which is one of the most important seafood products from the Miyagi area. An internet survey with choice experiment was implemented to reveal consumers' stated preferences. To suggest useful marketing strategies, we adopted the latent class model to cluster consumers into several characteristic groups, so that producers can focus on specific consumers.

DATA AND METHODS

Data Collection

We conducted an internet–based survey through a web research company to obtain consumer preferences. Targeting the consumption season of oysters, we implemented the survey in mid–December 2013. We focused on Tokyo, where Tsukiji market[2] deals with a large number of Miyagi oysters – the retailers generally deal with Japanese oysters, and we analyzed shelled oyster in a plastic tray or pack –. Fig. 1 shows that major GMS sales of shelled oyster for raw consumption in the Greater Tokyo area. According to the Fig. 1, the amount of sales rose gradually between 2002 and 2006, before plunging back down to its original level. Miyagi oysters had operated in existing oyster market for a long time and accounted for around 70% of the share of sales. Therefore we surveyed consumers in Tokyo as suitable samples.

In extracting the samples, we filtered consumers so

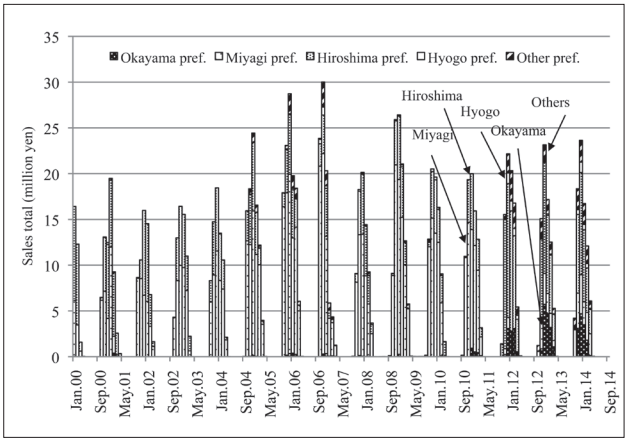

Fig. 1. Sales of shelled oyster for raw consumption in the metropolitan area[a].
Source: created by auther based on Nikkei POS data
[a] About 500 GMS data in the metropolitan area

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[2] With regard to trade volume and transaction value, Tsukiji market is the biggest in Japan.

Table 1. Summary of survey method

Item	Description
Survey Method	Web research company
Number of surveys collected (distributed)	260
Observations	3120
Extraction condition	Respondents who has purchased oyster Non–oyster farmer

Table 2. Attributes and their levels of shelled oyster for raw consumption

Attributes	Levels	Description
1. Price	4	298 yen; 398 yen; 498 yen; 598 yen
2. Contents	4	100 g; 150 g; 200 g; 250 g
3. Production area	5	Iwate; Miyagi; Hyogo; Okayama; Hiroshima
4. Type	2	For raw consumption; For cooking consumption

You will be asked similar questions. The question is about your combination of purchasing choices. Which combination of oysters did you purchase? Please compare the choice set carefully and then click one:

Attribute	Option 1	Option 2	Option 3	Option 4
Price	498yen	598yen	498yen	No buy
Contents	150g	100g	100g	
Production area	Hyogo	Hyogo	Okayama	
Type	for cooking	for raw	for raw	
Which option do you select? (click only one)	☐	☐	☐	☐

Fig. 2. Example of choice set of shelled oyster

that we could recruit those who eat oysters at home, and the age groups based on the distribution of Tokyo statistics. As a result, we totally extracted 260 consumers in Tokyo area (Table 1). The survey questions of this study had four categories, including 1) choice experiment, 2) demographics (sex, age, education, income etc.), 3) important factors of preferences for oysters (price, size, appearance, origin, the number per pack etc.), and 4) consumption patterns (frequency, favorite oyster, favorite dish, etc.).

The Design of Choice Experiment

Referring to previous marketing research, we set the sales prices and oyster types as follows: prices were set at 298, 398, 498 and 598 yen; contents at 100, 150, 200 and 250 g, and distinguished between for raw consumption and for cooking consumption (Table 2).

Using an orthogonal design, we designed 36 sets of appropriate combinations of prices, contents and types of products. We prepared 12 questions with three selective choices for participants, adding "No Buy" option to the end (Fig. 2).

Latent class model

We employed latent class model[3], whcih enables us to analyze the heterogeneity of consumer preferences. The latent class model clusters consumers into s classes, and estimates the respective parameters in respective classes to deal with the heterogeneity of consumer preference. This study followed Boxall and Admowicz (2002), and we built our model according to the following methodology. Based on the random utility theory, we constructed the utility function of a consumer n choosing j at class s in equation (1) as follows (McFadden *et al.*, 1986):

$$U_{nj|s} = \beta_s Z_{nj|s} + \varepsilon_{nj|s} \tag{1}$$

When consumers are categorized into class s, the membership probability function M is expressed in the following way:

$$M_{ns} = \gamma_s x_{ns} + \tau_{ns} \tag{2}$$

Assuming that ε and τ follow the Gumbell distribution, the probability that consumer n at class s chooses the choice j is expressed by the conditional logit model such as:

$$P_{n|s}(j) = \frac{\exp(\mu_s \beta_s Z_{nj})}{\Sigma_J \exp(\mu_s \beta_s Z_{nj})} \tag{3}$$

The probability that consumer n is categorized as class s is expressed by the multinomial logit model such as:

$$P_{ns} = \frac{\exp(\lambda \gamma_s x_n)}{\Sigma_S \exp(\lambda \gamma_s x_n)} \tag{4}$$

where μ and λ are scale parameters, and are standardized as 1 in the estimation process. The probability that consumer n chooses the choice j is expressed in the following way, based on equations (3) and (4):

[3] There are many previous researches such as McFadden *et al.* (1986), Roeder *et al.* (1999), Boxall and Adamowicz (2002), Green and Hensher (2003), Provencher *et al.* (2002), Kontoleon and Yabe(2006), and Yalin *et al.*(2015)

$$P_n(j) = \Sigma_S P_{ns} \cdot P_{n|s}(j) \quad (5)$$

$$\ln L(\gamma, \beta|S) = \Sigma_N \Sigma_S \delta_n^j \ln P_n(j) \quad (6)$$

The latent class model with maximum likelihood estimation can estimate the coefficients based on log–likelihood function as follows:

The positive signs of the estimated coefficients β_s for variable z indicates that a consumer prefers to choose a variable proportionally to z. Also, the positive signs of γ_s for variable x, indicates that consumer n tends to be cat-

Table 3. Socioeconomic and statement information of the sample

Category	Levels	Freq.	%
Sex	Female	104	40%
	Male	156	60%
Age	29>=	48	18%
	30–39	63	24%
	40–49	56	22%
	50–59	44	17%
	60=<	49	19%
Marital status	Single	127	49%
	Married	133	51%
Children	No Child	164	63%
	Single or more children	96	37%
Education	Junior/High School	53	20%
	Special, Community Colledge	50	19%
	Univ, Grad School	157	60%
Household size (in persons)	1	73	28%
	2	82	32%
	3	52	20%
	4	40	15%
	5	9	3%
	6	4	2%
	7	0	0%
	8	0	0%
	9	0	0%
Income (million yen)	0–199	24	9%
	200–399	64	25%
	400–599	65	25%
	600–799	38	15%
	800–999	30	12%
	1000–	39	15%
Consumption Frequency[a]	Oct.	81	
	Nov.	194	
	Dec.	328	
	Jan.	331	
	Feb.	236	
	Mar.	111	
	Apr.	48	
Favorite Oyster	Often buy for raw consumption	38	15%
	Often buy for cooking	64	25%
	Nothing in particular	108	42%
	No knowledge[c]	50	19%

Survey Statement	Levels	Freq.	%
"Price" of oyster is important factor	Stlongly agree	87	33%
	Agree	118	45%
	Neither agree nor disagree	41	16%
	Disagree	9	3%
	Strongly disagree	5	2%
"Size" of oyster is important factor	Stlongly agree	59	23%
	Agree	134	52%
	Neither agree nor disagree	56	22%
	Disagree	6	2%
	Strongly disagree	5	2%
"Thickness[b]" of oyster is important factor	Stlongly agree	71	27%
	Agree	116	45%
	Neither agree nor disagree	61	23%
	Disagree	6	2%
	Strongly disagree	6	2%
"Number per Pack" of oyster is important factor	Stlongly agree	44	17%
	Agree	108	42%
	Neither agree nor disagree	85	33%
	Disagree	16	6%
	Strongly disagree	7	3%
"Appearance" of oyster is important factor	Stlongly agree	42	16%
	Agree	110	42%
	Neither agree nor disagree	87	33%
	Disagree	14	5%
	Strongly disagree	7	3%
"Production area (origin)" of oyster is important factor	Stlongly agree	54	21%
	Agree	105	40%
	Neither agree nor disagree	75	29%
	Disagree	17	7%
	Strongly disagree	9	3%
"For raw consumption" is important factor	Stlongly agree	53	20%
	Agree	73	28%
	Neither agree nor disagree	90	35%
	Disagree	34	13%
	Strongly disagree	10	4%
"For cooking consumption" is important factor	Stlongly agree	37	14%
	Agree	68	26%
	Neither agree nor disagree	115	44%
	Disagree	29	11%
	Strongly disagree	11	4%

[a] The cumulative number of households which buy oyster

[b] "Thickness" indicates thickness of edible portion

[c] Respondents do not have favorit oyster because they seldome by oyster by themselves

egorized into class *s*.

RESULTS AND DISCUSSION

The summary of survey results

Table 3 summarizes the survey results, focusing on variables related to our objective in this paper. As compared with national average, respondents had higher education, higher income, and various preferences for oysters such as raw, cooked oysters or nothing in particular. With regard to the purchasing factors, more than half respondents regard the price, size, thickness of oyster, and the number of oyster in a package as important or somewhat important factors.

Results of the Latent Class Model

The latent class model sorted respondent groups into three groups, and provided the estimates shown in Table 4. We examine the results in Table 4. Segment 1, or 57% of the total Tokyo respondents, were defined as "contents and raw lovers" because they value contents and the food safety of raw oysters as important purchasing factors. Segment 2, 17% of respondents, were defined as "casual consumers" because they are infrequent oyster consumers, and value safe raw oysters as an important purchasing factor, but not origin. Segment 3, 26% of the respondents, were defined as "radiophobia" of Miyagi oysters because they devalue place of origin especially the Tohoku regions including Miyagi and Iwate prefectures.

The "contents and raw lovers" amongst the Tokyo respondents gave a slightly higher value to Miyagi oys-

Table 4. The result of Latent Class Model

Parameter	Segment 1		Segment 2		Segment 3[f]	
	Coeff.	MWTP	Coeff.	MWTP	Coeff.	MWTP[g]
Estimated coefficients of the utility function						
ASC	–4.154 ***		–0.787		–2.814 ***	
Price (yen)	–0.010 ***		–0.007 ***		–0.001 ***	
Contents (g)	0.014 ***	72	0.000		0.002 ***	60
Types (oyster for raw =1, oyster for cooking =0)	0.718 ***	73	1.260 ***	180	–0.634 ***	–454
Iwate (Iwate =1, others =0)	0.080		–0.921 ***	–131	–1.358 ***	–973
Miyagi (Miyagi =1, others =0)	–0.318 *	–32	–1.958 ***	–279	–1.551 ***	–1111
Hyogo (Hyogo =1, others =0)	–0.745 ***	–76	–0.707 **	–101	–0.827 ***	–593
Okayama (Okayama =1, others =0)	–0.841 ***	–86	–0.526 **	–75	–0.668 ***	–479
Estimated coefficients of the class membership function[a]						
Constant	1.072 ***		0.706 **		0 (Fixed Para.)	
Frequency in purchase of oysters[b]	0.000		–0.206 ***		0 (Fixed Para.)	
Contents oriented (yes =1)[c]	0.733 ***		–0.147		0 (Fixed Para.)	
Production area (Origin) oriented (yes =1)[d]	–1.215 ***		–1.100 ***		0 (Fixed Para.)	
Type oriented (yes =1)[e]	0.515 **		0.969 ***		0 (Fixed Para.)	
Share	57%		17%		26%	
Observation	3120					
Log–likelihood	–4231.118					
McFadden R^2	0.3384					
Akaike Information Criteria (AIC)	1.8562					
Limited Sample AIC	1.8564					
Bayesian Information Criteria (BIC)	1.9221					
HQIC (Hannan Quinn Info Criteria)	1.8798					

[a] Estimation included not only social demographics such as age, income, family, education , but also values of oysters, such as price, numbers, size, and kinds of oysters.
[b] The definition of "Frequency in purchase of oysters defined" is "Consumption Frequency" in table 3.
[c] The definition of "Contents" is "Number per Pack of oyster is important factor" in table 3.
[d] The definition of "Origin" is "Production area (origin) of oyster is important factor" in table 3.
[e] The definition of "Type" is "Favorite Oyster" in table 3.
[f] The responses in segment 3 include all answers except those for segments 1 and 2, and is the referenced segment at the parameter=0. Thus, the interpretation of segment 3 is limited. However, we can estimate from both signs of parameters of segments 1 and 2. In other words, both positive signs mean negative in segment 3, and both negative signs show positive in segment 3. When segments 1 and 2 have different signs, then the sign of segment 3 can be both.
[g] MWTP of Miyagi in segment 3 is lower than others because of ART respondents. As for ART respondents, please refer to chapter of RESULTS AND DISCUSSION.

ters, but "casual consumers" and "radiophobia" did not highly value them. We guess that "radiophobia" will avoid selecting Miyagi oysters as well as Iwate oysters in choice set because of Nuclear Power Plant accident. For this presumptive evidence, 37 "Absolutely–Reject–Type (ART)" respondents were included in this results. ART respondents are defined as those who rejected buying Miyagi oysters in the survey, no matter how much radioactivity is inspected in the oyster. The fact that 37 ART respondents exist out of 260 total respondents in Tokyo is a convincing reason to answer why Miyagi oysters were devalued in Tokyo.

An effective marketing strategy for "contents and raw lovers" could then be to use an "increased volume!" label, since they are the majority of the consumers, and they value not only raw oysters and contents, but also the quality of oysters as important purchasing factors. Because "casual consumers" are fond of raw oysters, safe raw Miyagi oysters can be an advantage and can be used to promote the raw oysters from Miyagi among infrequent consumers. Lastly, "radiophobia" regard places of origins as an important purchasing factor, especially whether the oyster comes from the Tohoku region. They devalue the oysters from Tohoku region as a result of the Fukushima disaster. Promotion to these consumers in segment 3 is not easy.

CONCLUSIONS

The objectives of this study were to investigate useful marketing strategies for sales promotion, targeting the farmed oysters that are one of the most important seafood products in Miyagi. The latent class model analysis indicated that Tokyo consumers gave a lower value to Miyagi oysters in general as compared with Hiroshima oysters. Especially, "radiophobia" valued origins, but devalued Miyagi oysters, and so little chance exists to attract this kind of consumers. "contents and raw lovers" and "casual consumers", on the other hand, have regarded their preferences of contents and raw oysters as important factors, thus signaling "increased volume!" or "safe raw!" would be a good promotional strategy to these groups. We found that an outlying group of radiophobia made the means of consumer preference lower than estimated. However, the latent class model successfully separated the heterogeneous groups and estimated less biased consumer preferences. Lastly, we have some limitations about our research that our study set a limit to scope of Tokyo consumers due to excluding the Internet users, and consider the possible bias coming from using only the Internet users.

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