JARQ 49 (2), 143 - 148 (2015) http://www.jircas.affrc.go.jp

Examining Substitution Patterns Between Domestic and Imported Agricultural Products for Broccoli, Kiwifruit, Rice and Apples in Japan

Hideo AIZAKI*

Rural Development and Planning Division, Institute for Rural Engineering, National Agriculture and Food Research Organization (Tsukuba, Ibaraki 305-8609, Japan)

Abstract

Economic simulation systems such as computable general equilibrium modeling have been used to predict the impacts of climate change on the economy and evaluate countermeasures to mitigate its effects. In this regard, forming an assumption about international trade in agricultural products becomes problematic if limited information is available on substitution between domestic and imported agricultural products. This study examined the substitution patterns of Japanese consumers between domestically produced and imported agricultural products such as broccoli, kiwifruit, rice and apples using discrete choice experiments. Three web surveys were conducted in January 2011, February 2012 and January 2013 to gather responses to the discrete choice experiment questions for each of the four products. The responses were analyzed using the error components multinomial logit model. The results showed that the substitution of imported products for domestic sources was relatively large in the case of broccoli and kiwifruit and relatively low in the case of rice and apples. Although economic simulation systems sometimes assume that substitution patterns between domestic and imported products are fixed for different kinds of agricultural products, our results indicate that this assumption does not necessarily apply in all cases.

Discipline: Agricultural economics
Additional key words: discrete choice experiment, Japanese consumer, price elasticity of choice probability, stated preference method

Introduction

Economic simulation systems such as computable general equilibrium (CGE) modeling have been used to predict the impacts of climate change on the economy and evaluate countermeasures to mitigate its effects. One issue with such simulations is to set an appropriate assumption about international trade in agricultural products. Climate change is expected to alter the suitability of areas for agricultural production. For example, areas suitable for apple production in Japan are predicted to decline by the mid–21st century due to variation in annual average temperature (Sugiura & Yokozawa 2004). A shift in areas suitable for agriculture would, in turn, alter patterns of international trade in agricultural products: decreasing the area suitable for cultivating a particular agricultural product would potentially restrict its domestic supply, consequently increasing the amount of imports to compensate for the domestic production shortfall. To predict these reactions, an assumption for the substitution pattern between domestic and imported agricultural product has to be set in economic simulation systems, which becomes problematic if limited information is available on substitution. This problem interrupts the process of making an appropriate assumption when the agricultural product under investigation is not imported due to reasons such as a ban on imports due to phytosanitary measures. Under such circumstances, a specific substitution pattern between domestic and imported products is usually assumed for all kinds of agricultural products (e.g. Kunimitsu 2011). Our research project on "Economic evaluation of agricultural mitigation and adaptation technologies for climate change" which is a sub-project of a research project "Development of technologies for mitigation and adaptation to climate change in Agriculture, Forestry and Fisheries" and includes studies using economic simulation systems, also faces the issue of assumption of the same substitution patterns (see Furuya et al. 2015 for the project outline). The empirical

Present address:
Research Faculty of Agriculture, Hokkaido University (Sapporo, Hokkaido 060-8589, Japan).
*Corresponding author: e-mail azk-r@ec.hokudai.ac.jp
Received 11 October 2013; accepted 17 March 2014.

validity of such assumption remains unanswered.

As a first step in answering this question, this study examined the substitution patterns of Japanese consumers between domestic and imported agricultural products for four kinds of products—broccoli, kiwifruit, rice and (fresh) apple—using discrete choice experiments (DCEs). While imported broccoli and kiwifruit are widely distributed and available in Japanese retail markets, imported rice and apples have limited availability. Of the 8.63 million t of rice demanded in 2011, only 0.77 million t were imported (Ministry of Agriculture, Forestry and Fisheries of Japan 2013). Rice imported in limited quantities is mainly supplied for industrial usage and thus unavailable in retail markets. The stock of imported fresh apples is also very limited: only 148 t of apples were imported in 2011 (Aomori Prefecture 2012). A comparison among the substitution patterns of these four agricultural products enables us to understand the relationship between prevalent international trade conditions (i.e. whether imported stock of a particular agricultural product is available in the retail market or not) and consumer preferences for the imported product. Establishing such relationship would also be useful for examining international trade conditions pertaining to agricultural products in economic simulation systems.

The DCE approach, developed by Louviere & Woodworth (1983), is a stated preference method, a survey methodology that gathers decisions of individuals regarding a specified action under a statistically designed hypothetical situation, analyzes the factors affecting decision-making and extracts valuable information from the analytical results. The approach is therefore a suitable method for capturing consumer preferences for rice and apples, which are available in limited quantities in Japanese retail markets.

Although DCEs have been applied for consumer research on various agricultural products in Japan (Aizaki 2012), relatively little work has been done on examining substitution patterns between domestic and imported agricultural products and comparing patterns among different agricultural products. Some previous studies have focused on mini tomatoes, a long variety of Welsh onion, broccoli, onion, kiwifruit (Oura et al. 2002); apple (Nakamura et al. 2007); rice (Peterson & Yoshida 2004); bread (Saito & Saito 2013); beef (Aizaki et al. 2012); and pork (Saito et al. 2009). These studies have indicated that Japanese consumers prefer domestic agricultural products to imported products. These studies mainly used willingness-to-pay (WTP) for a specified product and/or marginal WTP for a specific attribute-level of the product as measures to evaluate consumer preference, except Peterson & Yoshida (2004) who calculated direct and cross price elasticities of the probability of selecting domestic and imported rice, besides computing WTP and marginal WTP. However, Peterson & Yoshida (2004) focused only on rice and did not extend the price elasticity comparison to other agricultural products.

Data and Methods

1. Survey design

Responses to DCE questions on the consumer evaluation of broccoli, kiwifruit, rice and apples were collected through three web surveys. The first two web surveys were carried out by NTT NaviSpace Corporation (NTTNavi) while NTTCom Online Marketing Solutions Corporation (NTTCom) carried out the last survey. The DCE questions on broccoli and kiwifruit were included in the first survey conducted in January 2011, for which respondents were recruited from among the survey panel members registered at NTTNavi. They were recruited on the basis of certain parameters: they lived in Tokyo, purchased fresh fruit and belonged to age groups of 20s, 30s, 40s, or over 50 in a 1:1:1:1 ratio. The DCE questions for rice and apples were included in the second and third surveys conducted in February 2012 and January 2013, respectively. Respondents for the two surveys were recruited from among the survey panel members registered at NTTNavi and NTTCom, respectively. The respondents were recruited based on certain parameters pertaining to individual characteristics applied to population distributions: sex (male and female), age (20s, 30s, 40s and 50s) and region (47 prefectures in Japan were categorized into seven regions in the case of the rice survey and nine regions in the case of the apple survey). The sample size for the surveys conducted in January 2011, February 2012 and January 2013 were 1,920, 1,500 and 1,500, respectively and the number of respondents used in this study was 480, 750 and 750, respectively. This is because each survey also conducted between-subject experiments that had different objectives.

It should be noted that the Great East Japan Earthquake of March 11, 2011 and the resulting accident at the Fukushima Daiichi Nuclear Power Plant of the Tokyo Electric Power Company occurred between the first and second surveys (January 2011 and February 2012) and consequent problems may have affected consumer choice behavior with respect to agricultural products, especially their evaluation of product origin attribute (Yoshida 2013, Ujiie 2013).

For each survey, respondents had to mark their preference out of three alternatives for each question in DCEs: domestic agricultural products, imported agricultural products and none-of-these option. Figure 1 presents a sample DCE question for broccoli.

In DCE questions for broccoli and kiwifruit, agricultural product alternatives have three attributes: product origin, reduction rate of CO_2 and price. Product origin is an alternative specific attribute and has two levels: “Domestic” and “United States” for broccoli or “New Zealand” for kiwi-

	Product origin	Reduction rate of CO_2	Price per 100g
Broccoli A	Domestic	3%	78 JPY
Broccoli B	United States	3%	43 JPY

Which broccoli would you like to purchase?

1. I would like to purchase broccoli A.
2. I would like to purchase broccoli B.
3. None-of-these

Fig. 1. Discrete choice experiment questions for broccoli

fruit. The reduction rate of CO_2 attribute shows the ratio of reduction of CO_2 from producing the product compared to the conventional production method. It has six levels: 0, 3, 6, 10, 15 and 30%. A detailed technological explanation regarding the difference between the production method of reducing CO_2 and the conventional production method was not shown to the respondents. Although four different explanations for the reduction rate of CO_2 were randomly displayed to the respondents, this study used responses only under the baseline explanation: no explanation about the reduction rate of CO_2. The price attribute shows price per 100g (in Japanese Yen) for each product (1 USD ≈ 100 JPY, as at August 2013). It has six levels: 58, 63, 68, 73, 78 and 83 JPY for domestic broccoli; 43, 48, 53, 58, 63 and 68 JPY for imported broccoli; and 68, 73, 78, 83, 88 and 93 JPY for domestic and imported kiwifruit. Price levels were set according to previous studies (Oura et al. 2001) and retail price surveys for broccoli and kiwifruit conducted before the web survey.

In DCE questions for rice and apples, agricultural product alternatives have two attributes: product origin and price. Product origin attribute has two levels: "Niigata" for rice or "Aomori" for apple and "United States" for both rice and apple. While Niigata prefecture is famous for rice production in Japan, Aomori is famous for apple production. Price attributes show the price per package (5 kg) for rice and price per piece (350g) for apple. Prices have four levels: 2,000, 2,300, 2,600 and 2,900 JPY for domestic rice; 900, 1,200, 1,500 and 1,800 JPY for imported rice; 100, 120, 140 and 160 JPY for domestic apples; and 60, 80, 100, and 120 JPY for imported apples. Price levels were set according to retail price surveys for rice and apples conducted before the web surveys and previous research (Sato et al. 2001, Peterson & Yoshida 2004, Nakamura et al. 2007). "Koshihikari" and "Fuji," major Japanese varieties of rice and apples were respectively considered for the study. Although another version of the survey was conducted separately for rice and apples in which an additional agricultural product characteristic was set as an attribute for each, respondents to these surveys were excluded from this study.

Although price and product origin attributes are important for our research project (examining the substitution patterns of domestic and imported products), meaning these attributes are commonly used in DCE questions for the four products, other attributes were selected according to the objective of the between-subject experiment in each survey. The results of the between-subject experiment in each survey would be reported in other papers.

Choice sets for each agricultural product were generated using the L^{MA} method (Louviere et al. 2000). The choice sets for broccoli, kiwifruit, rice and apples were set at 36, 36, 16 and 16, respectively and further divided into six or two subsets, respectively. Each respondent was randomly assigned one of the subsets and requested to answer six, six, eight and eight DCE questions for broccoli, kiwifruit, rice and apples, respectively.

2. Empirical model

To capture the substitution pattern between domestic and imported products for broccoli, kiwifruit, rice and apples, we calculated two types of elasticities: direct elasticity of the probability for selecting alternative j with a change in price of alternative j and cross elasticity of the probability for selecting alternative j with a change in price of alternative k ($j \neq k$). The error component multinomial logit (ECMNL) model, which was implemented using the ECLOGIT procedure in NLOGIT 4.0 (Econometric Software, Inc., Plainview, NY, USA), was used in this study to analyze responses to DCE questions since the model can relax the property of independence from irrelevant alternatives (IIA), which the conditional/multinomial logit model holds. According to the IIA property, the conditional/multinomial logit model has the same cross elasticity for each alternative with a change in price of alternative k. In the ECMNL model, all cross elasticities could vary. This feature is essential for us to capture substitution patterns between domestic and imported agricultural products by examining elasticities.

The conditional probability of the ECMNL model for selecting alternative j when there are three alternatives in a choice set, domestic agricultural product (j = D), imported agricultural product (j = I) and none-of-these (j =N), is expressed as follows:

$$\Pr(j|E_{k\mathrm{D}}, E_{k\mathrm{I}}, E_{k\mathrm{N}}) = \exp(V_{kj})/\{\exp(V_{k\mathrm{D}}) + \exp(V_{k\mathrm{I}}) + \exp(V_{k\mathrm{N}})\},$$

where k refers to kinds of agricultural products (k = B for broccoli, K for kiwifruit, R for rice and A for apples); E_{kj} is the error component for alternative j under k; and V_{kj} is the systematic component of utility for alternative j under k with E_{kj}. The systematic components of utility are assumed to be the following:

For broccoli:

$$V_{BD} = ASC_{BD} + b_{cBD}\, CO_{2BD} + b_{pBD}\, P_{BD} + b_{fBD}\, FEM + b_{aBD}\, AGE + \theta_{BD}\, E_{BD}$$

$$V_{BI} = ASC_{BI} + b_{cBI}\, CO_{2BI} + b_{pBI}\, P_{BI} + b_{fBI}\, FEM + b_{aBI}\, AGE + \theta_{BI}\, E_{BI}$$

For kiwifruit:

$$V_{KD} = ASC_{KD} + b_{cKD}\, CO_{2KD} + b_{pKD}\, P_{KD} + b_{fKD}\, FEM + b_{aKD}\, AGE + \theta_{KD}\, E_{KD}$$

$$V_{KI} = ASC_{KI} + b_{cKI}\, CO_{2KI} + b_{pKI}\, P_{KI} + b_{fKI}\, FEM + b_{aKI}\, AGE + \theta_{KI}\, E_{KI}$$

For rice:

$$V_{RD} = ASC_{RD} + b_{pRD}\, P_{RD} + b_{fRD}\, FEM + b_{aRD}\, AGE + b_{tRD}\, TKY + \theta_{RD}\, E_{RD}$$

$$V_{RI} = ASC_{RI} + b_{pRI}\, P_{RI} + b_{fRI}\, FEM + b_{aRI}\, AGE + b_{tRI}\, TKY + \theta_{RI}\, E_{RI}$$

For apples:

$$V_{AD} = ASC_{AD} + b_{pAD}\, P_{AD} + b_{fAD}\, FEM + b_{aAD}\, AGE + b_{tAD}\, TKY + \theta_{AD}\, E_{AD}$$

$$V_{AI} = ASC_{AI} + b_{pAI}\, P_{AI} + b_{fAI}\, FEM + b_{aAI}\, AGE + b_{tAI}\, TKY + \theta_{AI}\, E_{AI}$$

For none-of-these:

$$V_{kN} = \theta_{kN} E_{kN}, \text{ for } k = \text{B, K, R and A,}$$

where *ASC* is an alternative specific constant; CO_2 is the reduction rate of the CO_2 variable; *P* is the price variable; *FEM* is a dummy variable that takes the value 1 if the respondent is a female, 0 otherwise; *AGE* refers to the respondent's age; *TKY* is a dummy variable that takes the value 1 if the respondent lives in Tokyo, 0 otherwise; and b and θ are parameters to be estimated. Characteristic variables of respondents (*FEM*, *AGE* and *TKY*) were used to control differences in sampling conditions among the three surveys. These variables were also used as independent variables in the final models for each agricultural product if their estimated coefficients differed significantly from zero.

Results and Discussion

Table 1 presents the ECMNL model estimates for broccoli, kiwifruit, rice and apples. McFadden's R^2 values exceed 0.5, indicating that each model fits the data reasonably well. Error component parameters differed significantly from zero, except for domestic kiwifruit, indicating that the ECMNL model was well suited to our data. Price coefficients were significantly negative, indicating that consumers prefer cheaper agricultural products. While the final models for broccoli and kiwifruit contained no variables for

Table 1. ECMNL model estimates for each product

	Broccoli	Kiwifruit	Rice	Apple
Domestic				
ASC	21.239**	28.415**	10.522**	12.965**
CO_2	0.043**	0.039**		
P	–0.179**	–0.176**	–0.003**	–0.089**
FEM			–0.955*	–1.943**
Imported				
ASC	14.401**	27.956**	8.395**	17.407**
CO_2	0.059**	0.061**		
P	–0.149**	–0.191**	–0.003**	–0.084**
FEM			–3.038**	–1.745**
Error components				
Domestic	1.863**	0.724	3.299**	3.942**
Imported	3.805**	2.711**	3.805**	1.305**
None-of-these	5.134**	8.333**	4.259**	5.476**
Summary statistics				
Number of respondents	480	480	750	750
Number of observations	2,880	2,880	6,000	6,000
Log likelihood at estimates	–1,360.1	–1,454.2	–3,277.4	–3,169.4
McFadden's R^2	0.569	0.540	0.502	0.519

Note: ** $p < 0.01$; * $p < 0.05$

Table 2. Direct and cross price elasticities of choice probability for each product

	A change in price of...							
	Broccoli		Kiwifruit		Rice[a]		Apple[a]	
Product	Domestic	Imported	Domestic	Imported	Domestic	Imported	Domestic	Imported
Domestic	–1.58	0.90	–2.53	2.58	–1.27[b]	0.48[b]	–1.15[c]	0.81[c]
	—	—	—	—	–1.26[d]	0.45[d]	–1.14[d]	0.80[d]
Imported	3.07	–2.11	4.59	–5.09	0.81[b]	–0.61[b]	1.76[c]	–1.53[c]
	—	—	—	—	0.83[d]	–0.64[d]	1.76[d]	–1.58[d]

Note: [a] These values are weighted means of price elasticity under *FEM* = 1 and *FEM* = 0.
[b] The weight is the ratio of female respondents in the survey for rice.
[c] The weight is the ratio of female respondents in the survey for apple.
[d] The weight is the ratio of female respondents in the survey for broccoli and kiwifruit.

respondent characteristics, those for rice and apples included *FEM*.

Table 2 presents direct and cross elasticities of the probability for selecting alternatives with a change in price for each agricultural product. These values were calculated at sample means. Elasticity for both rice and apples, in which case the final model included the variable *FEM*, was calculated as weighted means of elasticity when *FEM* = 1 and 0. In each row for "Domestic" and "Imported," the upper value shows the elasticity calculated using the ratio of female respondents in the survey for rice or apples as the weight, while the lower value shows elasticity calculated using the ratio of female respondents in the survey for broccoli and kiwifruit as the weight. For example, the direct elasticities of probability for selecting domestic rice with change in domestic rice price were –1.27 and –1.26 on using the ratio of female respondents in the survey for rice, and broccoli and kiwifruit as the weight, respectively. Direct elasticities of probability for selecting imported apples with the change in imported apple price were –1.53 and –1.58 on using the ratio of female respondents in the survey for apples, and broccoli and kiwifruit as the weight, respectively.

While the probabilities for selecting broccoli and kiwifruit were relatively sensitive to price changes, this was less applicable for rice and apples. Direct and cross price elasticities (absolute values) of kiwifruit were relatively large, while those of rice were relatively small. The substitution of imported products for domestic products was relatively large in case of broccoli and kiwifruit, while relatively small in the case of rice and apples. The ratio of cross elasticity to the absolute value of direct elasticity with the change in domestic prices for broccoli and kiwifruit are 1.9 (= 3.07/1.58) and 1.8 (= 4.59/2.53), respectively. The ratio in the case of rice and apples are 1.5 (=1.76/1.15 or 1.76/1.14) and 0.6 or 0.7 (= 0.81/1.27 or 0.83/1.26), respectively.

These results seem attributable to the following reasons. Imported broccoli and kiwifruit are distributed in the retail markets of Japan. Accordingly, consumers are familiar with imported and domestic broccoli and kiwifruit and consider domestic and imported varieties as interchangeable. Conversely, Koshihikari rice from Niigata has strong brand equity in Japan and since rice is a staple food for Japanese people, consumers prefer domestically produced rice to imported rice from the United States. This strong brand value and consumer tendency to prefer domestic rice over imported varieties may cause less price sensitivity in the case of rice and lower substitution of imported rice for the domestic variety. Moreover, since apples are a major fruit consumed in Japan and its imported varieties are scarce in Japan, there is a consumer tendency to prefer domestic over imported apple varieties.

This study has two limitations. First, the famous production prefectures of Niigata and Aomori were set as levels of product origin attribute for rice and apples, respectively. Furthermore, Koshihikari and Fuji were assumed to be varieties of rice and apple, respectively. Since rice and apples are very popular in Japan and its main agricultural products, consumers are usually interested in the production area (prefecture) and variety. Accordingly, a specific prefecture and variety are set for these products. However, this attribute setting may affect the substitution of imported and domestic products. For example, if another prefecture that is not famous for production of rice/apples is used as a level of the product origin attribute, there may be great substitution of imported and domestic varieties compared to our results. This limitation calls for further investigation regarding the conditions of product origin and varieties of rice and apples. Second, revealed preference data regarding broccoli and kiwifruit were not used. Since the availability of imported rice and apples is limited to the Japanese retail markets, the DCE approach was used as a common method to capture consumer preferences for the four agricultural products. The strength of our approach is in comparing the results obtained by applying a common method across the four products. However, the usage of the common stated prefer-

ence method prevented us from using the revealed preference data of imported broccoli and kiwifruit. An approach that integrates stated preference data and revealed preference data (e.g. Louviere et al. 2000) is needed to solve this issue.

Conclusion

This study examined substitution patterns of Japanese consumers between domestic and imported agricultural products for broccoli, kiwifruit, rice and apples, using discrete choice experiments. The results showed that substitution of imported broccoli and kiwifruit for domestic varieties was relatively large, but relatively low in the case of rice and apples. Although economic simulation systems such as CGE sometimes assume fixed substitution patterns between domestic and imported agricultural products for different kinds of agricultural products, our results indicate that this assumption does not necessarily apply in all cases. We conclude that substitution patterns between domestic and imported agricultural products can be ascertained according to product characteristics from the perspective of current trade and consumer familiarity. Although the estimated elasticities in this study may not be directly used in economic simulation systems, these would be of some help in considering substitution patterns in the systems.

Acknowledgements

This study was financially supported by the Ministry of Agriculture, Forestry and Fisheries, Japan, through a research project entitled “Development of technologies for mitigation and adaptation to climate change in Agriculture, Forestry and Fisheries.”

References

Aizaki, H. (2012) Choice experiment applications in food, agriculture, and rural planning research in Japan. *AGri-Bioscience Monographs*, **2**, 1-46.

Aizaki, H. et al. (2012) A noncompensatory choice experiment analysis of Japanese consumers’ purchase preferences for beef. *Applied Economics Letters*, **19**, 439-444.

Aomori Prefecture (2012) Data on apple: Export and import http://www.pref.aomori.lg.jp/sangyo/agri/ringo-data04.html. (Accessed on 17 September, 2013) [In Japanese].

Furuya, J. et al. (2015) Economic evaluation of agricultural mitigation and adaptation technologies for climate change: Model development for impact analysis and technological assessment. *JARQ*, **49**, 119-125.

Kunimitsu, Y. (2011) Asset management of public facilities in an era of climate change: Application of the dynamic computable general equilibrium model. *In* Sustainable Development and Planning V, eds. Brebbia, C. A. & Beriatos, E., WIT Press, Southampton, UK, 533-562.

Louviere, J. J. & Woodworth, G. (1983) Design and analysis of simulated consumer choice or allocation experiments: An approach based on aggregate data. *Journal of Marketing Research*, **30**, 350-367.

Louviere, J. J. et al. (2000) *Stated choice methods: Analysis and application*. Cambridge University Press, Cambridge, UK. pp. 402.

Ministry of Agriculture, Forestry and Fisheries of Japan (2013) *Materials regarding rice*. pp.74 [In Japanese].

Nakamura, T. et al. (2007) The analysis of consumers’ preference after lifting the ban on import of fresh apples to Japan. *Nougyou keiei kenkyuu* (*Japanese Journal of Farm Management*), **45**(2), 73-78 [In Japanese].

Oura, Y. et al. (2002) Estimation for brand power on fresh vegetables and fruits producing districts with choice-based conjoint analysis. *Nougyou keiei kenkyuu* (*Japanese Journal of Farm Management*), **40**(1), 106-111 [In Japanese].

Peterson, H. H. & Yoshida, K. (2004) Quality perceptions and willingness-to-pay for imported rice in Japan. *Journal of Agricultural and Applied Economics*, **36**, 123-141.

Saito, Y. et al. (2009) Consumer evaluations of pork from hogs raised on recycled food waste. *Nougyou jyouhou kenkyuu* (*Agricultural Information Research*), **18**, 152-161 [In Japanese with English summary].

Saito, H. & Saito, Y. (2013) Motivations for local food demand by Japanese consumers: A conjoint analysis with reference-point effects. *Agribusiness*, **29**, 147-161.

Sato, K. et al. (2001) Using choice based conjoint analysis to assess competitiveness of chemical-free Hokkaido rice. *Nouringyou mondai kenkyuu* (*Journal of Rural Problems*), **37**, 37-49 [In Japanese with English summary].

Sugiura, T. & Yokozawa, M. (2004) Impact of global warming on environments for apples and satsuma mandarin production estimated from changes of the annual mean temperature. *Engei gakkai zasshi* (*Journal of the Japanese Society for Horticultural Science*), **73**, 72-78 [In Japanese with English summary].

Ujiie, K. (2012) Consumer’s evaluation on radioactive contamination of agricultural products in Japan: Decomposition of WTA into a part due to radioactive contamination and a part due to area of origin. *Food system kenkyuu* (*Journal of Food System Research*), **19**, 142-155 [In Japanese with English summary].

Yoshida, K. (2013) An economic analysis of consumer’s averting behavior caused by the radioactive contamination of agricultural, forest and fishery products. *2013-nendo Nihon nougyou keizai gakkai ronbunshuu* (*Journal of Rural Economics, Special Issue 2013*), 258-265 [In Japanese].