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Price premiums for wildlife-friendly rice: Insights from Japanese retail data

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Abstract

Integrating the benefits associated with biodiversity into market mechanisms can play an important role in conservation practice. Food labeling is a widely used measure that highlights biodiversity conservation benefits to the market. However, few studies have explored the effects of labels on staple agricultural products that are associated with agro-ecosystem conservation. We evaluated the biodiversity price premium of wildlife-friendly rice by analyzing data from retail stores in Japan. The results showed a significant positive impact of biodiversity-relevant labels on rice prices. Specifically, rice with this type of labeling had about 20% price premium as compared with rice that did not. The results also showed that outcome-based certifications have the potential to work well in the market. The findings highlight the role of conservation marketing in agro-ecosystem conservation and its potential to help balance biodiversity conservation and food security.

KEYWORDS

conservation marketing, eco-label, environmentally friendly farming, hedonic price model

1 | INTRODUCTION

Traditional agricultural land use provides unique ecosystems that are indispensable for biodiversity conservation (Foley et al., 2011; Tilman et al., 2001; Tscharntke, Klein, Kruess, Steffan-Dewenter, & Thies, 2005). Global increases in demand for food supply have led to agricultural intensification, which has resulted in degradation of ecosystems and loss of biodiversity (see Culman et al., 2010; Rasmussen et al., 2018; Tilman, Cassman, Matson, Naylor, & Polasky, 2002). To address this challenge, strategies to balance biodiversity conservation and food security are required (Williams et al., 2020). The UN's Sustainable Development Goals (SDGs), for example, support both food security (SDG 2) and the conservation of biodiversity (SDGs 14 and 15).

More attention is being paid to environmentally friendly farming as a measure to balance biodiversity conservation and food security (Kremen & Merenlender, 2018; Williams et al., 2020). Many studies have provided evidence that environmentally friendly farming contributes to biodiversity conservation in practice. For example, Katayama, Osada, et al. (2019) found that environmentally friendly farming of paddy land provides high levels of richness and abundance of several species (e.g., dragonflies, frogs, and spiders). Moreover, Katayama, Bouam, Koshida, and Baba (2019) conducted a meta-analysis that showed that environmentally friendly farming significantly increased biodiversity in farmland. Environmentally friendly farming can, however, be more costly and have a lower yield than farming that uses a scheme of intensive agricultural land management (Crowder & Reganold, 2015; Katayama, Baba, Kusumoto, & Tanaka, 2015). Crowder and Reganold (2015) found that, in the absence of price premiums, the costs of producing organic products are greater than the benefits; they also found that the net present values of organic products are lower than those of conventional agricultural products.

Eco and sustainability labeling of food is one strategy that could help to solve the above challenge (Czarnezki, 2011; Sunstein, 2021). Labeling can provide information on the benefits associated with environmentally friendly products to consumers and encourage them to buy the products; this, in turn, can motivate farmers to use environmentally friendly farming practices (Kolodinsky, 2008; Xie, Gao, Swisher, & Zhao, 2016). Labeling schemes have been widely introduced for a variety of products globally and some successful cases have been reported. For example, previous studies have reported that rainforest certification provides benefits and incentives to farmers (Haggar, Soto, Casanoves, & Virginio, 2017; Ochieng, Hughey, & Bigsby, 2013) and that certification labels attract consumers (Grunert, Hieke, & Wills, 2014; Van Loo, Caputo, Nayga, & Verbeke, 2014).

However, most such cases of labeling have been limited to luxury food products (e.g., coffee and wine: Van Loo et al., 2014; Vecchio & Annunziata, 2015; Rathmell, 2017; Mazzocchi, Ruggeri, & Corsi, 2019; Ruggeri, Mazzocchi, & Corsi, 2020), and few studies have focused on using labeling schemes for staple agro-products (e.g., Ujiie, 2014). To balance biodiversity conservation and food security, it is important to extend conservation labeling schemes to staple food products such as rice and other crops that are primary products.

In Asia, rice is one of the most important staple foods (Maclean, Dawe, Hettel, & Hardy, 2002; Raghuvanshi, Dutta, Tewari, & Suri, 2017), and it contributes to the development of agro-ecosystems and conservation of biodiversity. In Japan, for example, rice is a major part of the diet and most is grown domestically (Japan's Ministry of Agriculture, Forestry, and Fisheries (MAFF), 2015). To satisfy the demand for rice, rice paddy fields were developed; they currently account for about 4% of the land area in Japan (1.47 million ha; MAFF, 2020a) and have contributed greatly to conservation in this country (Elphick, 2000; Miyashita, Yamanaka, & Tsutsui, 2014). However, most agricultural land is intensely managed, and the use of environmentally friendly farming has been extremely limited (<1% of the cultivated area in Japan; MAFF, 2010).

Therefore, in this study, we investigated the effect of biodiversity-relevant labeling on rice prices by using data from Japanese retail stores to determine how much of a biodiversity conservation premium exists in the market. Previous findings concerning biodiversity-relevant labeling have relied mostly on data acquired through questionnaire surveys and have been limited to potential demand (e.g., Inagaki, 2018; Ujiie, 2014). By applying the hedonic price model to actual retail store data in Japan, our goal was to contribute to existing knowledge concerning not only the biodiversity price premium of rice but also other environmentally friendly farming products, such as organic products. These findings should help guide practitioners to engage farmers and consumers in biodiversity conservation.

1.1 | Background

Our study was conducted in Japan, where rice plays an important role in both biodiversity conservation and food security. Over half of Japanese farmland is covered with irrigated paddy fields, and the area of paddy land is approximately 30 times that of natural wetland (Natuhara, 2013). Paddy land-use intensification has been found to decrease the biodiversity in agro-landscapes (Uchida & Ushimaru, 2015). The total amount of rice produced in irrigated paddy land is approximately 7.76 million tons per year, which provides about 57% of the domestic total caloric (energy) supply in Japan (MAFF, 2018; MAFF, 2020a).

Japan's Ministry of Agriculture, Forestry, and Fisheries (MAFF) promotes wildlife-friendly farming and the labeling of products from wildlife-friendly farming to conserve biodiversity in and around paddy land (MAFF, 2010). To promote a wildlife-friendly labeling scheme, labeling standards are relatively simple in that the label can say the farming of the product contributes to biodiversity and wildlife conservation (e.g., by irrigating paddy land during the nonfarming season for migratory birds or installing fishways in irrigation canals). Because of the relatively relaxed standards compared with other eco and sustainable labels, farmers can easily participate (Treves & Jones, 2010). Each farm community applies a different labeling scheme. Although very few studies have covered wildlife-friendly rice across Japan, a government report identified at least 39 varieties of wildlife-friendly labels on rice, and about 0.08% of Japanese paddy land area was dominated by wildlife-friendly rice in 2008 (MAFF, 2010; Tanaka & Hayashi, 2010). The report noted that about a third of the labels used birds as a flagship species (Tanaka & Hayashi, 2010; Tanaka & Oishi, 2017). The government noted that the amount of wildlife-friendly rice in Japan had increased (Ministry of Environment, 2014). Several labels have been shown to work well as market-based payments for ecosystem services and to contribute to rare species conservation (e.g., ibis: Aoki, Akai, Ujiie, Shimmura, & Nishino, 2019).

2 | METHODS

2.1 | Data

The dataset used in the present study was collected from retail stores in Japan. A total of 38 retail stores were randomly selected in 12 prefectures in Japan: Fukushima, Niigata, Tochigi, Ibaraki, Chiba, Tokyo, Fukui, Shiga, Mie, Kyoto, Hyogo, Shimane, and Oita. It included data on rice from supermarkets, farmers' markets, Japan Agricultural Cooperatives' markets, and roadside station markets, which are located along open roads and equipped with parking lots, restrooms, restaurants, and souvenir stores that sell local products. Most rice is generally purchased at supermarkets in Japan because there are some varieties of rice, including the rice produced in other prefectures, in the supermarkets. On the other hand, rice produced by the local area is mainly sold in farmers' markets, Japan Agricultural Cooperatives' markets (JA markets), and roadside station markets. Local farmers sell their own products at farmers' markets and set their own prices. Japan Agricultural Cooperatives' stores are run by the cooperatives; in the stores, individual farmers cannot set their own prices. The goods in roadside station markets are sold mainly to travelers and people who have traveled to a place on holiday. Often several types of rice are sold in each location. Although rice is also sold in other types of stores, such as convenience stores, Japanese consumers generally buy rice in the above-mentioned types of retail stores; moreover, the price of the rice sold in convenience stores is approximately the same as in supermarkets. Therefore, we considered that our data adequately reflected general Japanese rice prices.

All rice-related data were collected from each location to develop our econometric model that aims to understand the effects of wildlife-friendly labels on rice prices (Appendix S1). We selected 10 independent variables with reference to previous valuation studies (see Table 1 for variable description). For example, we selected the weight per package of the sold rice and the variety (cultivar) of rice because these two factors significantly affected the rice prices in Japan. This was done by using hedonic price models (Chino & Ohe, 2014; Kinami, Kinami, & Furuzawa, 2009). Also, Sato, Iwamoto, and Demura (2001) showed that reducing agrochemical use was an important driver for rice demands affecting price determinants by using conjoint analysis. Thus, we included a variable focusing on "whether the rice was produced with reduced agrochemical use" into our model. The definitions of all variables are presented in Table 1.

TABLE 1 Summary of data used in the analysis

Variable	Description	Mean	SD
Price	What is the price of the rice? (JPY)	1,997	1,517
WildlifeLabel	Does it have a wildlife-friendly label? (1 = yes, 0 = no)	0.064	0.245
Weight	What is the weight per package of the sold rice (kg)	4.53	4.25
Polished	Is the rice sold? (polished) (1 = yes, 0 = no)	0.740	0.440
Wash	Is the rice sold? (can be cooked without washing) (1 = yes, 0 = no)	0.080	0.272
Agrochem	Was the rice produced with reduced agrochemical use (1 = yes, 0 = no)	0.312	0.464
Supermarket	Sold at a supermarket; this is baseline of the dummy variable of places of sale.	0.320	0.467
FarmMarket	Sold at a farmers' market (1 = yes, 0 = no)	0.088	0.284
JAMarket	Sold at a Japan Agricultural Cooperatives' market (1 = yes, 0 = no)	0.132	0.339
RoadsideMarket	Sold at a roadside market (1 = yes, 0 = no)	0.460	0.499
Variety	What was the variety (cultivar) of rice?	A total of 30 varieties	

We defined wildlife-friendly labels in accordance with the criteria of Treves and Jones (2010), that is not depended on conservation status and/or contribution. This definition is broader than the one MAFF uses and includes the wildlife-friendly rice which is not certified by MAFF as "Wildlife-Marked Rice" (MAFF, 2010; Figure 1). In other words, our definition includes all rice with statements associating with wildlife friendly. There are many kinds of wildlife-friendly labels on rice (Figure 1). For example, a wildlife-friendly label claims the improvement of the cultivation method to wildlife-friendly, but it is uncertain the actual wildlife conservation (Figure 1a); another label claims evidence that specific wildlife species actually survive in and around the paddy land (Figure 1c). There is also a label claiming to donate a part of sales to wildlife conservation (Figure 1b). By collecting data on rice that was labeled as wildlife friendly and rice that was not, we aimed to reveal any price premium for the wildlife-friendly rice.

2.2 | Economic model

Hedonic pricing analysis is a main approach used to calculate the price premiums of unique attributes (Waugh, 1928). The model is based on the theory of utility maximization, in which the price is determined both by the utility the consumer gains from the characteristics or attributes of a good and by the price the producer offers for each good (see Lancaster (1966) and Rosen (1974) for details). A set of characteristics or attributes of each good, $\mathbf{z} = (z_1, z_2, ..., z_k)$ (e.g., brand and taste), determines the price for the good such that:

$$price\,(z) = f\,(z_1, z_2, ..., z_k).$$

Numerous studies have applied the hedonic approach to estimate price premiums for food product attributes (Batte, Hooker, Haab, & Beaverson, 2007; Cranfield & Magnusson, 2003; Loureiro & Hine, 2002; Loureiro, McCluskey, & Mittelhammer, 2001; Wessells, Johnston, & Donath, 1999).

Assuming that rice has k characteristics (including being wildlife friendly), the price of the rice is defined as follows:

$$Price(rice) = f\,(x_1, x_2, ..., x_{k-1}, WildlifeLabel),$$

where x is a vector representing rice attributes. Specifically, the regression full model in our study was specified with a coefficient for product attributes (β) and an error term (ε) as follows:

$$\begin{aligned} \ln(price) = \beta_0 &+ \beta_1\, WildlifeLabel + \beta_2 \ln(Weight) \\ &+ \beta_3 WildlifeLabel * \ln(Weight) + \beta_4\, Polished \\ &+ \beta_5\, Wash + \beta_6\, Agrochem + \beta_7\, FarmMarket \\ &+ \beta_8\, JAMarket + \beta_9\, RoadsideMarket \\ &+ (Variety) + \varepsilon, \end{aligned}$$

where *WildlifeLabel* is a vector of dummy variables indicating the rice's wildlife-friendly claim or label, ln

(a) (b) (c)

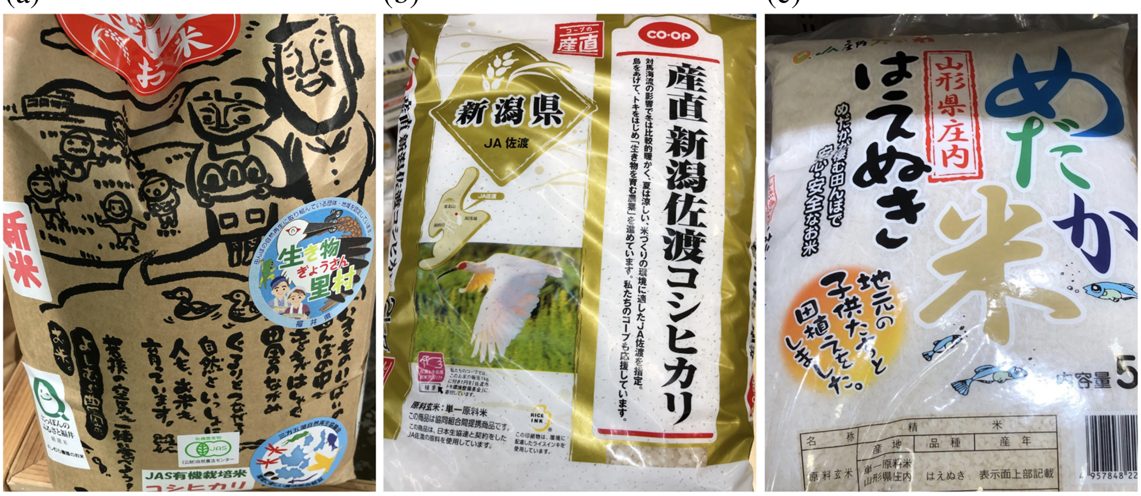

FIGURE 1 Examples of wildlife-friendly rice labels collected for this study. (a) Nontarget species label (i.e., biodiversity label): the statement about wildlife-friendly farming does not refer to a specific species. This label claims the improvement of the cultivation method to wildlife friendly. (b) Ibis label and (c) Killifish label: the statements about wildlife-friendly farming concern particular species. Ibis label claims the evidence of Ibis conservation success and the donation of a part of sales to ibis conservation. Killifish label claims evidence that killifish actually survive in the paddy land

(*Weight*) refers to the log of weights of the rice, and the other variables are similarly vectors of dummy variables as defined previously. The baseline of the place of sale is a supermarket. We also included fixed effects of the variety of rice. Although previous studies have shown that the prefecture where the rice is produced and sold has an effect on rice prices in Japan (Kinami et al., 2009; Sawamura, Ozawa, & Yamamoto, 2007), our model excludes the fixed effect of prefecture because there are aliased coefficients in the model (i.e., prefecture is multicollinearity with the variety of rice). In our model, the base variables for each category of dummy variable attribute are dropped to prevent perfect multicollinearity. We also calculated a generalized variance inflation factor (GVIF) to detect multicollinearity. If $GVIF^{(1/2)*df}$ is larger than 2, multicollinearity is considered to be in the model (Fox & Monette, 1992), where *df* refers to the degrees of freedom of the variable. We used R software for the analysis (R Core Team, 2019).

3 | RESULTS

We collected 250 samples, that is, bags of rice. Our data included 16 unique wildlife-friendly labels (mean = 0.0640, *SD* = 0.245): one "Duck" label, three "Dragonfly larva, Tadpole, and Notostraca" labels, five "Firefly" labels, four "Ibis" labels, two "Killifish" labels, and one "Nontarget species" label (i.e., Biodiversity label; Table A1). The other descriptive statistics are summarized in Table 1. The mean price was JPY 1,997 (*SD* = 1,517). In addition, the mean price/kg was JPY 484.4 (*SD* = 152.0), and the minimum and maximum were JPY 306.7 per kg and JPY 1,666 per kg, respectively.

Our models are estimated by using ordinary least squares and generalized least squares with a different variance by each weight (see Table A2 for the detailed ways for choosing residual variance structure). The estimated results are presented in Table 2. We select Model 2 as the best model based on the statistical information. In addition, the residuals of the model estimated by using ordinary least squares do not satisfy the assumption of homoscedasticity (Breusch–Pagan test: BP = 69.857, *p*-value = .02675; Table A2). Although Model 3 included the interaction term of wildlife-friendly labels and weight, that did not contribute to the improvement of the model fit. The Model 2 shows a significant positive impact of wildlife-friendly labels (coefficient = 0.238, *SE* = 0.0566; *p*-value <.001). The estimated coefficient of wildlife-friendly labels showed that the price premium for wildlife-friendly labels was about 23.8% of the rice price. The coefficient of the rice weight variable was also significant (coefficient = 0.938, *SE* = 0.0121; *p*-value <.001). The coefficient of the market-type dummy variables had no significant impact on rice price, except the dummy variable of JA markets (coefficient = −0.0899, *SE* = 0.0364; *p*-value = .0144). The other variables also had no significant impact on rice price.[1] Finally, all $GVIF^{(1/2)*df}$ values were less than 2; this implies that these variables have no potential multicollinearity problems (Fox & Monette, 1992).

4 | DISCUSSION AND CONCLUSION

Recent studies have examined how to encourage people to conserve biodiversity by sharing the benefits associated with biodiversity (Kremen & Merenlender, 2018; Tilman et al., 2017) and by applying market mechanisms (Pascual & Perrings, 2007; Veríssimo et al., 2017). Here, we extended the existing body of knowledge about eco-labeling and attempted to contribute to the conservation of agro-ecosystems by evaluating a biodiversity price premium for rice.

Our results showed that products displaying a wildlife-friendly label had a price premium of about 20% (Table 2). This finding supports the promotion of biodiversity conservation through marketing (Dinerstein et al., 2013). Specifically, our results implied that by using wildlife-friendly labeling, for example, the price of rice could be increased from JPY 2,000 to 2,476 (from $20.0 to $24.8). Although it is difficult to compare the premium with previous findings because they were based on survey data, our estimated premium seems reasonable (Inagaki, 2018; Ujiie, 2014). Considering that approximately seven million tons of rice per a year is produced in Japan, although a part of price premium could be charged by retailers and a third party that certifies the labeling scheme (Asche, Larsen, Smith, Sogn-Grundvåg, & Young, 2015; Yenipazarli, 2015), the study demonstrates that wildlife-friendly labels represent a huge potential to provide economic incentives for farmers to adopt wildlife-friendly farming in Japan. This, in turn, would help to achieve win–win situations for biodiversity and farmers. Previous studies have suggested that there are differences in the price premiums for different wildlife species (Inagaki, 2018; Smith & Sutton, 2008; Thomas-Walters & Raihani, 2017). For example, a stated preference study showed that price premium for charismatic species was about JPY 300 ($3.0) higher than general species (Inagaki, 2018). Therefore, additional studies are required to gain more detailed insights into different types of labels.

Furthermore, the results provide several important insights into the marketing of rice in general. First, the rice price was determined by the rice type and weight,

TABLE 2 Estimated results of the hedonic price model

	Model 1 (OLS: Normally distributed residuals)			Model 2 (generalized least squares regression)			Model 3 (generalized least squares regression)		
	Estimate	(*SE*)	GVIF$^{(1/2)*df}$	Estimate	(*SE*)	GVIF$^{(1/2)*df}$	Estimate	(*SE*)	GVIF$^{(1/2)*df}$
β_1 : *WildlifeLabel*	0.215***	0.0546	1.12	0.238***	(0.0566)	1.18	0.338*	(0.154)	3.24
β_2 : Ln (*Weight*)	0.900***	0.0164	1.12	0.938***	(0.0121)	1.20	0.939***	(0.0122)	1.22
β_3 : *WildlifeLabel**ln(*Weight*)	—	—	—	—	—	—	−0.0759	(0.114)	3.34
β_4 : *Polished*	0.00692	0.0355	1.30	−0.0116	(0.0268)	1.34	−0.00992	(0.0270)	1.35
β_5 : *Wash*	0.0773	0.0531	1.20	0.0925	(0.0491)	1.20	0.0893	(0.0494)	1.20
β_6 : *Agrochem*	0.0258	0.0307	1.19	0.0360	(0.0247)	1.19	0.0368	(0.0247)	1.20
β_7 : *FarmMarket*	−0.0407	0.0586	1.38	−0.0233	(0.0430)	1.33	−0.0249	(0.0428)	1.33
β_8 : *JAMarket*	−0.0577	0.0481	1.36	−0.0899*	(0.0364)	1.50	−0.0912*	(0.0366)	1.51
β_9 : *RoadsideMarket*	0.0500	0.0390	1.63	0.0355	(0.0318)	1.68	0.0327	(0.0319)	1.69
β_0 : *Intercept*	6.12***	0.198		6.08***	(0.153)		6.08***	(0.153)	
VARIETY	Yes		1.03	Yes		1.03	Yes		1.03
Akaike Inf. Crit. (AIC)	56.694			13.228			36.481		
Log likelihood	22.653			52.386			34.759		
N	250			250			250		

Note: ****p*-value < .001; ***p*-value < .01; **p*-value < .05; *SE*: standard error.
Abbreviation: GVIF, generalized variance inflation factor.

which is consistent with the findings of previous studies (e.g., Chino & Ohe, 2014; Sawamura et al., 2007). Therefore, the attributes are important for rice making and should be also integrated into conservation marketing relating to rice. Second, the impact of the wildlife-friendly labels on price was larger than that of other attributes such as reduction of agrochemical use. Our results indicate that sales promotion by using wildlife statements can enhance rice markets and increase farmers' incomes.

Our findings have two policy implications. First, the results highlight the potential role of conservation marketing in supporting agro-ecosystem conservation. The government, for example, provides subsidies to encourage environmentally friendly farming, but only 5% of farmlands have been supported by this top-down financial scheme (MAFF, 2020b), in part because the application process is complicated. If wildlife-friendly labels were to be appropriately recognized in the market and provide additional financial incentives to farmers, the use of environmentally friendly farming practices would be reinforced. The top-down approach used by the government and the bottom-up approach of the market can work together to support conservation. We then discuss another policy implication concerning the compatibility between approach-based and outcome-based certifications. Our findings revealed that one type of outcome-based certification (e.g., a biodiversity-relevant label) supported a price premium, in agreement with the results of Chen, Gao, Swisher, House, and Zhao (2018). These findings suggest that farmers and retailers need to consider and choose the labels with the highest return. Since different types of sustainability claims may have different impacts on consumption behavior (Chen et al., 2018), additional studies are required to investigate the details of consumer preferences for each type of certification—approach-based and outcome-based—on the basis of rice price.

The present study had several limitations. First, because of the limited sample size, we could not identify the impacts of different wildlife species on the marketing outcome. Many studies have investigated the roles of flagship species in conservation marketing (Senzaki, Yamaura, Shoji, Kubo, & Nakamura, 2017; Smith & Sutton, 2008; Veríssimo et al., 2014), and additional studies are required to investigate them in this context. Second, this study did not categorize the rice by the type of wildlife-friendly label. Previous studies indicate that the narrative information on the label also affects product price and consumer behavior (Treves & Jones, 2010); therefore, further studies need to be done to integrate this type of narrative into the analysis of price premiums. Third, there is an inherent issue in our sampling effort. Although we attempted to randomly collect the data from local retail stores, our findings could have potential bias associated with sampling locations. Data limitations could also cause our model to be incomplete. For instance, we could not include the fixed effect of a prefecture in our model due to multicollinearity with the variety of rice. Therefore, further research should be addressed using a model that can adopt more flexible assumptions, such as Bayesian models and Generalized linear mixed models.

In addition, further studies also need to investigate the price premiums of relevant non-genetically modified organism (non-GMO) labels. This study did not address relevant GMO labels, as the Japanese government does not allow the sale of GMOs in the nation. As some evidence indicates that GMOs have negative impacts on biodiversity (e.g., Campos & Hernández, 2015; Paull, 2018), non-GMO labels are used elsewhere in the world to enhance biodiversity conservation. In addition, some valuation studies also uncovered the impact of non-GMO labels on consumer preferences (e.g., Carlsson, Frykblom, & Lagerkvist, 2007).

To enhance the contribution of biodiversity labels to conservation, the conservation status on labels should be certified. This should enhance the price premium and increase demand for wildlife-friendly products (Treves & Jones, 2010; Sustein, 2020). Research is required to examine the degree of contributions of actual wildlife conservation status to price premiums and farmer incentives. Additional integration of marketing and ecological knowledge into conservation practices is required to enhance biodiversity conservation.

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CONFLICT OF INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could influence the work reported in this paper.

AUTHOR CONTRIBUTIONS

Kota Mameno and **Takahiro Kubo**: Conceived and coordinated the study. **Kota Mameno**: Designed the data analysis. **Takahiro Kubo**: Contributed to funding acquisition. **Yasushi Shoji**: Contributed to supervision, reviewing, and editing. **Kota Mameno**: Wrote the manuscript with contributions from **Takahiro Kubo** and **Yasushi Shoji**.

DATA AVAILABILITY STATEMENT

The data associated with the manuscript are available.

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ENDNOTE

[1] The fixed effects of *VARIETY* were partly significant: several varieties of rice were statistically significant (*p*-value <.001), but the other varieties were not significant.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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APPENDIX

TABLE A1 The number of each wildlife-friendly label included in the data

Type of wildlife-friendly label	*n*
Duck label	1
Dragonfly larva, tadpole, and Notostraca label	3
Firefly label	5
Ibis label	4
Killifish label	2
Nontarget species label (i.e., biodiversity label)	1

TABLE A2 Comparison results of hedonic price models using generalized least squares

Model	Variance structure	AIC	BIC	Log-likelihood
1	$\varepsilon_i \sim N(0, \sigma^2)$	56.69	224.9	22.65
2	$\varepsilon_i \sim N(0, \sigma^2_{Weight})$	13.23	207.8	52.39
3	$\varepsilon_i \sim N(0, \sigma^2_{Weight})$	17.38	215.0	51.31
A	$\varepsilon_i \sim N(0, \sigma^2_{WildlifeLabel})$	49.18	220.7	27.41
B	$\varepsilon_i \sim N(0, \sigma^2 \times e^{2\delta \times Weight})$	36.57	208.1	33.72
C	$\varepsilon_i \sim N(0, \sigma^2 \times \lvert Weight \rvert^{2\delta})$	38.73	210.1	32.64
G	$\varepsilon_i \sim N(0, \sigma^2 \times (\delta + \lvert Weight \rvert^{\delta'})^2$	28.67	203.5	38.67