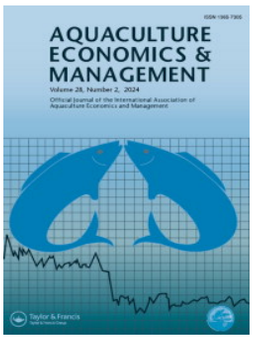

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TECHNICAL REPORT

Is there a demand for eco-labeled restaurants: Consumer preference and willingness to pay for eco-labeled seafood restaurants

Yingkai Fang[a], Zhifeng Gao[b], and Xumin Zhang[b]

[a]School of Economics, Hangzhou Normal University, Hangzhou, China; [b]Food and Resource Economics Department, University of Florida, Gainesville, FL, USA

ABSTRACT

With increasing concerns over the environmental impacts of the production process for seafood, many consumers are willing to pay premiums for eco-labeled seafood to support sustainable fisheries. Most studies of consumer preferences for ecolabels are conducted in the retail setting, focusing on food attributes. Limited attention is given to sustainable seafood consumption away from home and none about preferences for ecolabel certifications of restaurants. However, seafood consumption away from home at restaurants makes up a significant share of the total seafood consumption, and ecolabels are used only to a limited extent. Hence, consumer behavior at restaurants is important to the efficiency of ecolabels. Consumers' preferences for eco-labeled seafood restaurants may reinforce the impact of the ecolabels. Using a national online survey, this article investigates consumer preferences and willingness to pay (WTP) for eco-labeled seafood restaurants. The results show a positive WTP (26%) for eco-labeled seafood restaurants, but varying by consumer groups.

KEYWORDS

Ecolabels; restaurants; seafood; willingness to pay

Introduction

Consumers are showing an increasing interest in the environmental attributes of food products, and eco-labeling is one of the most common ways for suppliers to provide such information (Loureiro et al., 2001; Roheim et al., 2018). Restaurants are key agents in one of the most important food supply chains with respect to the environmental impacts of food production (Elitzak & Okrent, 2018; Malone et al., 2021). A large and increasing share of food consumption is occurring away from home (Love et al., 2020, 2021; Love, Thorne-Lyman, et al., 2022), with restaurants as the main outlet. In 2016, almost one-half of the total food expenditure in the USA was

CONTACT Yingkai Fang yingkai.fang@hznu.edu.cn School of Economics, Hangzhou Normal University, Hangzhou, China.

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away from home (USDA, 2018). However, ecolabels have seen limited use in this market segment, potentially undermining efforts to incentivize producers to become more sustainable by providing uncertified producers with an alternative market channel. In recent years, an increasing number of restaurants have started offering eco-labeled food (National Restaurant Association, 2022). For instance, the restaurant chain Chipotle claims to sell pork that is "all-natural" or "antibiotic-free", and IKEA only sells seafood from sustainably certified resources (Alfnes et al., 2018). In addition to providing eco-labeled food on menus, some restaurants get certified as whole restaurants.

Seafood is one of the food groups where the share of expenditure away from home is the highest, as seafood expenditures away from home in the USA made up 68% in 2016 (NOAA, 2017; Love et al., 2020). In 2016, U.S. consumers spent $63.4 billion on fishery products away from home out of total expenditure for fishery products at $93.2 billion (NOAA, 2017). The increasing trend of seafood consumption away from home highlights the potential importance of restaurants in shaping the market for sustainable seafood. Consumer preferences for sustainable seafood have been extensively studied, and most consumers are found to be willing to pay premiums for eco-labeled products (Bittmann et al., 2020; Bronnmann & Asche, 2017; Fonner & Sylvia, 2015; Gao et al., 2020; Johnston et al., 2001; Ovando et al., 2013; Roheim & Zhang, 2018; Uchida, Onozaka, et al., 2014; Wakamatsu et al., 2017; Wessells et al., 1999; Zhang et al., 2020). There is also significant evidence of price premiums in retail sales associated with specific ecolabels (Asche et al., 2015, 2021; Botta et al., 2023; Bronnmann & Hoffmann, 2018; Roheim et al., 2011; Sogn-Grundvåg et al., 2014; Uchida, Roheim, et al., 2014; Ward & Phillips, 2008). However, the focus of these studies is on a retail setting or home consumption.

Despite a large body of studies on consumer preferences for eco-labeled seafood in retail settings, only a few examined this issue for seafood consumption away from home (Love et al., 2020, 2021; Nguyen, Gao, Anderson, & Love, 2022; Nguyen, Gao, & Anderson, 2022). Demand for sustainable seafood at restaurants will motivate the restaurateurs to put more eco-labeled seafood on their menus and even get ecolabel certified as a whole, thus fostering the sustainable seafood movement in the restaurant sector. Estimating consumer preference and willingness to pay (WTP) for restaurants' ecolabel certification provides essential information for policymakers to develop appropriate programs to encourage more sustainable food supply in the market, particularly in the restaurant industry. A higher WTP indicates higher potential revenue for the suppliers, thus giving incentives to more eco-labeled suppliers to join such programs that will

also motivate the seafood producers to adopt sustainable production practices.

In this study, an online survey was conducted to investigate whether consumers are willing to pay premiums in ecolabel-certified seafood restaurants. To examine the effect of information on preferences in eco-labeled restaurants, respondents received different information on one of the most widely applied eco-labeling programs, the Marine Stewardship Council (MSC) (Roheim et al., 2018).[1] We focus on MSC-certified restaurants, meaning seafood restaurants get certified by MSC as a whole, and all seafood products provided by them are sustainable.[2] A hurdle model is used to determine the factors that affect consumers' decisions to pay a premium and those that affect the amount of premium that consumers are willing to pay in eco-labeled restaurants. This is important information for assessing to what extent increased use of ecolabels at restaurants can complement the use of ecolabels in retail sales to limit market outlets for uncertified seafood, thereby providing even stronger incentives for producers to become certified.

The rest of this article is organized as follows: a description of the survey and data will be given to introduce the collected data and the survey design. The next section will show the method and model specification with the hurdle model. The empirical results will be given before some concluding remarks in the final section.

Survey and data

A questionnaire was developed based on a focus group discussion by faculty members and students at the University of Florida. A pilot study with 10% of the samples was also conducted to test the instruments of the survey, with no significant changes made. The online survey was conducted in May 2018 and distributed by Qualtrics to a nationally representative consumer panel in the USA, matching the characteristics of the U.S. national population, with 1106 complete responses collected and used in this study.[3] Participants of the survey were required to be adult ($>=$ 18 years) seafood consumers. A trap or validation question was also used in the middle of

[1]The MSC was created by the World Wildlife Fund (WWF), an international environmental organization, and Unilever, an international cooperation company and one of the world's largest seafood retailers in 1996 (Gudmundsson & Wessells, 2000). MSC has proved to be the most used seafood ecolabel (Roheim et al., 2018), and it certifies the restaurants providing sustainable seafood being traceable to sustainable resources and being harvested, processed, and distributed in a sustainable way (MSC, 2018).

[2]There are two types of eco-labeled restaurants, one provides certified food without being certified as a whole, and another type of restaurants get certified as a whole. In the survey, we ask participants to choose restaurants with ecolabel certification to measure the value of labels to restaurants.

[3]Out of the 1,359 surveys collected, we excluded responses from individuals who did not consume seafood, resulting in 1,106 respondents who meet our criteria.

Table 1. Comparisons of demographics from the survey and actual census population, 2018.

Demographic characteristics	Sample data	U.S. census data
Median age (in years)	49.5	37.8
Female (%)	47.2	50.8
Education		
High school (%)	16.0	28.5
College (%)	66.6	48.2
Master and above (%)	17.4	13.1
Ethnic group		
White (%)	75.8	60.7
African American (%)	9.4	13.4
American Indian (%)	1.4	1.3
Asian (%)	5.9	5.8
Hispanic (%)	4.1	18.1
Pacific Islander (%)	0.4	0.2

the survey to ensure responses, in the final analysis, were from respondents who carefully read the survey questions, thus improving the data quality from online surveys (Gao, House, & Bi, 2016; Gao, House, & Xie, 2016; Malone & Lusk, 2018).

A summary of several demographic variables for the survey respondents is given in Table 1 and is compared to the U.S. Census data (USCB, 2018). Here, college education includes community college as well as university education. The demographics of the respondents in the sample do not precisely match the U.S. population since our respondents were selected from seafood consumers and are above 18 years old. In particular, our respondents were older and with a smaller proportion of Hispanics and African Americans. Besides, most of the respondents in our sample lived in suburban areas (45.1%), followed by those who lived in major towns or cities (24%), and the rest were from small towns (15.5%) and rural areas (15.4%).

To obtain information about the respondents' knowledge of seafood ecolabels, we ask respondents if they have heard about and how much they know about the MSC and ASC ecolabels, the two most popular seafood ecolabels in the global market (see footnote 1). Figure 1 shows that only a small proportion of the respondents have heard about the MSC or ASC before. More than 70% of the respondents have never heard about the MSC or ASC. In comparison to prior research, our findings reveal a slightly lower awareness of the MSC and the Aquaculture Stewardship Council (ASC, 2022) among consumers. Gutierrez and Thornton (2014) reported that approximately 17.4% of respondents in Washington DC had encountered MSC labels in the market. Additionally, a GlobeScan (2022) report indicated that 21% of Australian respondents frequently observed MSC labels, while 40% were uncertain or had never seen them in 2022. On the other hand, the ASC Foundation reported that 46% of U.S. consumers could recognize the ASC label. In Europe, recognition rates varied: 66% in

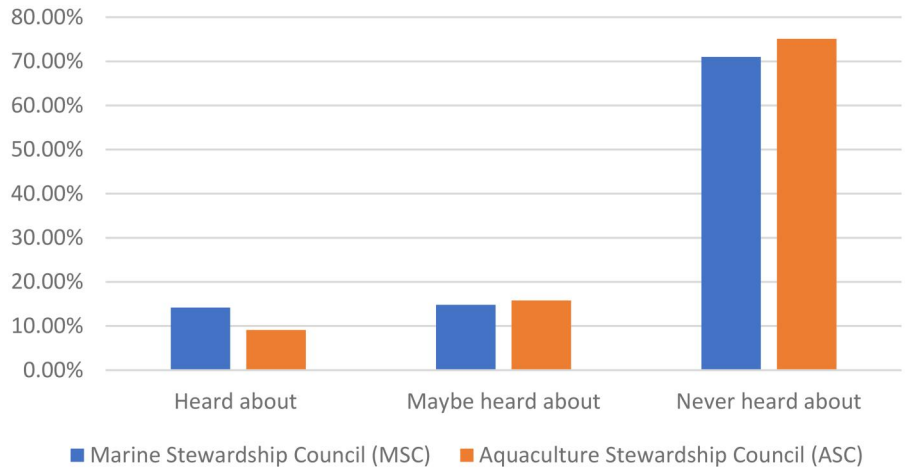

Figure 1. Number of respondents (in percentage) who have heard about the seafood ecolabels.

Table 2. Description of information treatment groups.

Information treatment groups	Information given to the respondents
Group 1	Minimum description on MSC eco-label
Group 2	MSC description + Explanation of sustainability
Group 3	MSC description + Explanation of traceability

the Netherlands, 60% in Belgium, 58% in Germany, and 48% in France were familiar with the ASC label.

However, in out sample, even among those respondents who have heard about these seafood ecolabels before, few perceive themselves as knowledgeable about these seafood ecolabels. The findings imply a knowledge gap for consumers. Therefore, we provide consumers with information about the ecolabels, extending the findings in earlier consumer studies (e.g. Uchida, Onozaka, et al., 2014).

Roosen et al. (2011) and Uchida, Onozaka, et al. (2014) designed different information treatments in their studies and found that information can affect individuals' preferences. Two additional studies, which explored consumer preferences for seafood, also highlight information effects (Asche & Bronnmann, 2017; Bronnmann & Hoffmann, 2018). In this study, we provide consumers with one of three different information treatments to investigate the impacts of information on consumer preferences for eco-labeled restaurants. As elaborated in Table 2, only minimal information is given to describe the MSC ecolabel in the first treatment group. The second information treatment group receives a detailed description of the sustainability of the MSC ecolabel in addition to the information received by the first group. In the last treatment group, a description of the traceability of the MSC ecolabel is added to what the first treatment group receives. These

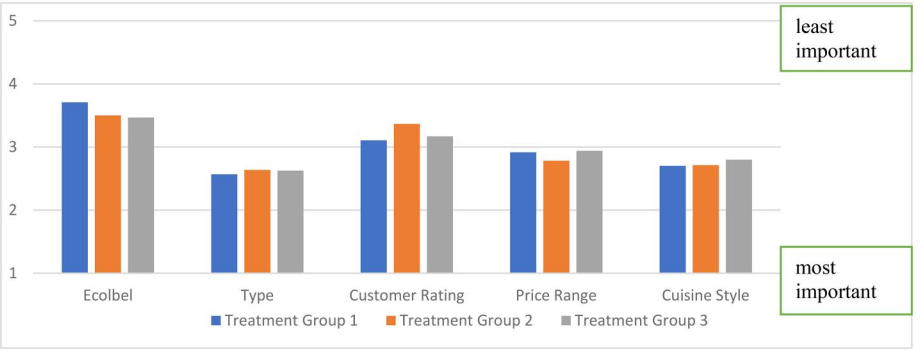

Figure 2. Consumer preferences for restaurants' features between three treatment groups (average ranks by respondents in that treatment group, from 1 representing the most important to 5 representing the least important).

treatments help test whether different aspects of MSC ecolabel affect consumer preferences for eco-labeled restaurants, and details are attached in Appendix 1.

With different information provided, respondents in the three treatment groups are asked to rank the importance of the features of restaurants to their dining choices away from home from 1 to 5, with 1 as the most important. The five features are: (1) the presence of eco-labeled food; (2) the type of the restaurants, for instance, fast food, casual dining, and fine dining restaurants; (3) customer rating for the restaurants; (4) price range of the expenditure spent in the restaurants; and (5) cuisine style of the restaurants, for instance, American or Chinese restaurants, etc. Figure 2 shows the average importance scores of the features by information treatment.[4] Furthermore, this question investigating the features show that the top three features are related to the type of restaurant, the cuisine style, and the price range of the restaurants, and eco-labeling is the least important factor. It is thus interesting to understand factors that can significantly affect consumers' premiums in eco-labeled restaurants under the setting that they do not value this attribute of the restaurant as the most important feature when they eat away from home.

We used the payment card method (PCM) to estimate consumer WTP for eco-labeled restaurants. PCM is an effective tool, both practically and statistically, to reduce the gap between willingness to accept and WTP (Drichoutis et al., 2016; Kerr, 2001; Voltaire et al., 2013). Past research shows no evidence indicating this method will generate range bias or mid-

[4]To test the significance of treatment effect, we compared the differences of consumer WTP in eco-labeled restaurants among the three groups of respondents. The results are consistent with the regression results in the model with the interactive variable of information treatment and consumer preferences for different features of restaurants. To test the effects of information treatment on other variables, we conduct tests on interactive variables with other demographic variables (age, gender, and income) in the model. The regression does not show significant estimates, therefore, is excluded from our final model report.

point bias (Covey et al., 2007; Hu et al., 2011; Martínez-Carrasco et al., 2015). The data were collected by asking the respondents to select the maximum premiums from a list of the number (in percentage) they are willing to pay for dishes (varying in a range from 0% to 100%) in ecolabel-certified restaurants over the dishes in uncertified restaurants. To make the scenarios close to reality, we provide respondents with the average dish prices (in dollars) at uncertified restaurants.[5] Besides, respondents were randomly shown one of the seven average dish prices at the uncertified restaurants[6] to minimize the impacts of different types of restaurants on consumer WTP.

Consumers are found to have a positive attitude toward eco-labeled restaurants. In the experiments, the average WTP for eco-labeled restaurants is 26.1%, indicating that consumers are willing to spend 26.1% more at eco-labeled restaurants than dining at uncertified restaurants. Comparing the respondents' WTP by different treatment groups, the average premiums for eco-labeled restaurants are 26.4%, 25.0%, and 26.8%, respectively. The difference in the WTPs among respondents treated with three information sources is small and insignificant, indicating that information on ecolabels does not influence consumer preference for eco-labeled restaurants. Also, 91 respondents (8%) show no interest in paying extra for the ecolabels of the restaurants, with a WTP of zero.

Method and model specification

A hurdle model is used to determine the factors affecting consumers' premiums for eco-labeled restaurants and examine the effects of different factors on consumers' WTP. The hurdle model assumes that respondents make decisions based on different explanatory variables and must overcome hurdles to be willing to purchase a product (Cragg, 1971; Newman et al., 2003; Zhang et al., 2008). The hurdle model has been used to investigate purchase behavior for discrete and continuous data in the studies of food consumption at home under different categories and food expenditures away from home for some specific types of food (Dong et al., 2004; Newman et al., 2003; Yen & Huang, 1996). Most studies applied hurdle models as consumers face the first hurdle to participation decision and other hurdles in their decision stage while purchasing the product for a positive premium (Burke et al., 2015; Ricker-Gilbert et al., 2011). Different

[5]Our question asks participants how much they are willing to pay for a restaurant with eco-label certification compared to a regular restaurant with an average cost per person being at certain price range.

[6]The questions include the average dish price in restaurants by seven different levels: less than $10, $11–$20, $21–$30, $31–$40, $41–$50, $51–$60, and more than $60. To ensure consistency, we designed seven price levels based on the market's provided menu and asked consumers to make decisions within a hypothetical consumption setting. Actual price calculation was not performed.

factors are usually used to model each decision process, with a participation stage (closely related to the probit model) and a consumption stage (expenditure level, which is determined by a tobit part) (Blundell and Meghir, 1987).

In our study, respondents have to overcome the hurdle to report a positive premium for the eco-labeled restaurant. In the first stage of the decision processes, respondents decide whether or not to pay premiums for dining at eco-labeled restaurants. In the second stage, they decide the amount of premiums paid in the eco-labeled restaurants. The hurdle model differentiates this two-step decision process for consumers and allows variations between consumers who do not want to pay premiums in the eco-labeled restaurants and those who are willing to pay positive premiums (Aristei & Pieroni, 2008; Batte et al., 2007; Dong & Kaiser, 2008; House et al., 2003; Zhang et al., 2008).

The first stage (participation stage) is governed by a binomial probability distribution (Lin & Milon, 1993) and investigates what causes respondents to pay premiums for ecolabels. The model specification is given as follows:

$$y_{i1}^{*} = X_i\alpha + \varepsilon_i, \tag{1}$$

where y_{i1}^{*} describes respondent i's decision to visit eco-labeled restaurants in the market for sustainable seafood. When $y_{i1}^{*} = 1$, the respondent is a potential participant, and $y_{i1}^{*} = 0$ indicates that this individual has no interest in paying extra for the ecolabels of the restaurants. X_i is a vector of variables influencing whether consumers are willing to pay premiums for eco-labeled restaurants.

In the second stage (consumption stage), after consumers overcome the first hurdle, they consider how much they are willing to pay to dine at eco-labeled restaurants. In this setting, the truncated-at-zero conditional decision to pay premiums for eco-labeled restaurants (WTP $>$ 0) is expressed as:

$$y_{i2}^{*} = Z_i\beta + \mu_i, \tag{2}$$

where y_{i2}^{*} is the WTP for the eco-labeled restaurants, and Z_i is a vector of variables that can influence the amount of consumer WTP.

To test the factors that may affect the consumers' WTP in the eco-labeled restaurants, the selection of the independent variables (including interactive terms) is based on the significance tests for individual variables.[7] The formula that corresponds to the hurdle model is as follows:

[7]The initial models have tested variables in addition to the reported model, such as whether the respondents had heard of these ecolabels, whether they live close to the coast, the number of adults in household, and some interactive terms. The interactive variables that was excluded include Knowledge*whether heard of these ecolabels, Inf*Gender, Inf*Age, Inf*Income, Inf*Features, and Knowledge*EvCon, which is involved with each of the environmental concerns' questions.

$$y_{h_j} = \beta_0^{h_j} + \beta_1^{h_j}(Features) + \beta_2^{h_j} Freq + \beta_3^{h_j} EvCon + \beta_4^{h_j} Knowledge + \beta_5^{h_j} Price + \beta_6^{h_j} Gender + \beta_7^{h_j} Age + \beta_8^{h_j} Edu + \beta_9^{h_j} Race + \beta_{10}^{h_j} Area + \beta_{11}^{h_j} Kids + \beta_{12}^{h_j} Income + \beta_{13}^{h_j} Inf + \delta, \quad \delta \sim N(0, \ \sigma^2) \tag{3}$$

where the $h_j = 1,2$, representing the participation stage h_1 and consumption stage h_2.y_{h_j} were adjusted by taking the square root of the premiums in eco-labeled restaurants for the model analysis, being denoted as WTP in the later section.[8] The explanatory variable descriptions are shown in Table 3. Other than demographic variables such as gender (*Gender*), age (Age), education (*Edu*), race and ethnicity (*Race*), annual household income (*Income*), regions the respondents live (*Area*), number of kids in the household (*Kids*), the explanatory variables also include features of the restaurants (*Features*), frequency of eating away from home (*Freq*), environmental concerns (*EvCon*), knowledge of ecolabels, such as MSC and ASC (*Knowledge*), information treatment group (*Inf*), and average dish prices in uncertified restaurants (*Price*) in the payment card questions. The features variables investigate consumer preferences for different characteristics of restaurants and collect information on what matters to them the most when they eat in restaurants. Descriptions of the Features variable are attached in Table 3. Four levels of average dish prices (average price of $15, $25, $50, and $70) were classified to reflect the variation of expenditures at restaurants by different types, such as fast-food restaurants, casual dining restaurants, premium casual restaurants, and fine dining restaurants. Our model with the original seven price levels indicates that some price levels have the same effect on consumer WTP, and this classification is sufficient.

The assumption that the errors between the two stages are independent and normally distributed is based on Cragg's (1971), and the log-likelihood function for the decision framework in the hurdle model is represented by:

$$lnL(\beta, \sigma) = \sum_{y_i^* = 0} \ln\left[1\text{-}\Phi(X_i\beta^{h_1})\phi\left(\frac{X_i\beta^{h_2}}{\sigma}\right)\right] + \sum_{y_i^* > 0}\left[\Phi(X_i\beta^{h_1})\phi\left(\frac{y_i^* - X_i\beta^{h_2}}{\sigma}\right)\frac{1}{\sigma}\right] \tag{4}$$

[8]The adjustment for the premiums by taking the square root of the original data is to meet the normality assumption for both hurdle model and tobit model.

Table 3. Variable descriptions.

	Variable type	Variable descriptions
Dependent variables		
y_{h_j}	Consumers' willingness to pay for eco-labeling certification, binary in the first stage, continuous variable in the second stage.	In stage 1, y_{h_1} is denoted as 0, when not willing to pay for premiums at ecolabeled restaurants; 1, otherwise. In stage 2, y_{h_2} is derived from payment card questions, where directly measures the WTP. Our sample data indicates that the estimated premium falls within the confidence interval of 24.48–27.65.
Independent variables		
Features	This vector includes 5 variables describing the features of restaurants, including: Preference for ecolabel certification, preference for restaurant type, preference for customer rating of restaurants, preference for price range of restaurant, and cuisine style of the restaurants.	The corresponding variables are "preference for ecolabel certification" (mean = 3.56), "preference for restaurant type" (mean = 2.61), "preference for customer rating of restaurants" (mean = 3.21), and "preference for price range of restaurant" (mean = 2.88) in Table 4. We use "cuisine style of the restaurants" (mean = 2.74) as the base.
Freq	A scalable variable that indicates the frequency of eating away from home.	Here, 1 (minimum) represents consuming food away-from-home daily, and 8 (maximum) means almost never eat away-from-home. The corresponding variable is "Frequency for food away from home" (mean = 4.60) in Table 4.
EvCon	A scalable variable that takes means of related environmental questions as the final score to measure the level of concerns with respect to environmental issues.	This is represented by "Environmental concerns" (mean = 4.04) in Table 4
Knowledge	A scalable variable that measures the knowledge about ecolabels, such as MSC and ASC.	Here, 1 as the minimum indicates not knowledgeable at all and 7 as the maximum indicates very knowledgeable. This corresponding variable is "Knowledge of ASC & MSC" (mean = 1.92) in Table 4.
Price	A factor variable that reveals the average food expenditure per person spent in the restaurants.	The corresponding variables are "Average Price $25," "Average Price $50," "Average Price $70" in Table 4 with "Average Price $15" as the base.
Gender	A factor variable that includes female (=0) and male (=1).	The corresponding variable is "Gender" in Table 4.
Age	This is a numerical variable, giving participants options to choose from seven age groups.	The corresponding variable is "Age" in Table 4.
Edu	A factor variable that shows the education level.	This includes variables as high school (base), college, master and above

(*continued*)

Table 3. Continued.

	Variable type	Variable descriptions
Race	This variable shows the information of race and ethnicity.	This variable includes White/ Caucasian (base), African American, Hispanic, Native American, Asian, and Other.
Area	A factor variable that shows where the respondents live.	This variable includes "suburban area," "small town," "rural area", and "major town/city," where "major town/city" is the base.
Kids	The number of kids in the household.	This is represented by "No. kids" (mean = 0.73) in Table 4.
Inf	A factor variable that reveals the impacts of information treatment as described in Section 2.	Table 4 reports "Information 2" and "Information 3" with the first group as the base.
Income	Household annual income.	This is represented by "Income" (mean = 4.19) in Table 4.
	Variable type	**Variable descriptions**
Dependent variables		
y_{h_j}	Consumers' willingness to pay for eco-labeling certification, binary in the first stage, continuous variable in the second stage.	In stage 1, y_{h_1} is denoted as 0, when not willing to pay for premiums at ecolabeled restaurants; 1, otherwise. In stage 2, y_{h_2} is derived from payment card questions, where directly measures the WTP. Our sample data indicates that the estimated premium falls within the confidence interval of 24.48–27.65.
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Gender	A factor variable that includes female (=0) and male(=1).	The corresponding variable is "Gender" in Table 4.

(*continued*)

Table 3. Continued.

	Variable type	Variable descriptions
Age	This is a numerical variable, giving participants options to choose from seven age groups.	The corresponding variable is "Age" in Table 4.
Edu	A factor variable that shows the education level.	This includes variables as high school (base), college, master and above
Race	This variable shows the information of race and ethnicity.	This variable includes White/Caucasian (base), African American, Hispanic, Native American, Asian, and Other.
Area	A factor variable that shows where the respondents live.	This variable includes "suburban area", "small town", "rural area" and "major town/city", where "major town/city" is the base.
Kids	The number of kids in the household.	This is represented by "No. kids" (mean = 0.73) in Table 4.
Inf	A factor variable that reveals the impacts of information treatment as described in Section 2.	Table 4 reports "Information 2" and "Information 3" with the first group as the base.
Income	Household annual income.	This is represented by "Income" (mean = 4.19) in Table 4.

Table 4. Parameter estimates, hurdle model.

	Participation stage		Consumption stage	
	Estimate	Std. error	Estimate	Std. error
Constant	3.194***	0.847	0.956***	0.192
Preference for ecolabel certification	−0.415***	0.079	−0.125***	0.014
Preference for restaurant type	−0.044	0.065	−0.039*	0.016
Preference for customer rating of restaurant	−0.046	0.060	−0.049***	0.014
Preference for price range of restaurant	0.088	0.063	−0.011	0.015
Frequency for food away from home	−0.050	0.042	−0.022*	0.011
Environmental concerns	0.071	0.075	0.050*	0.020
Knowledge of ASC & MSC	0.072	0.052	0.076***	0.010
Average Price $25	−0.385	0.215	−0.054	0.047
Average Price $50	−0.407	0.223	−0.098*	0.050
Average Price $70	−0.522*	0.244	−0.146*	0.058
Gender	0.020	0.126	0.036	0.033
Age	0.001	0.052	−0.068***	0.013
College	−0.149	0.201	−0.081*	0.044
Master's degree/above	−0.549*	0.242	−0.085	0.060
African American	0.157	0.260	0.152**	0.055
Hispanic	0.000	0.335	0.084	0.078
Native American	4.277	139.670	−0.176	0.130
Other	−0.474	0.318	0.002	0.089
Asian	0.108	0.285	0.044	0.066
Suburban area	0.086	0.158	−0.118**	0.041
Small town	0.018	0.197	−0.110*	0.053
Rural area	0.291	0.225	−0.059	0.052
No. kids	−0.014	0.065	0.007	0.016
Income	0.049	0.028	0.007	0.007
Information 2	0.099	0.149	−0.004	0.039
Information 3	0.085	0.148	−0.005	0.038
Sd.sd			0.492***	0.011
Log-likelihood			−981.3	

*, **, *** indicates that the corresponding coefficients are significant at the level of 10%, 5%, and 1%.

Empirical results

This section will show the findings from our empirical analysis applying the hurdle model followed by discussions on the impacts of marginal changes of explanatory variables on the WTP for eco-labeled restaurants.

Regression results

Table 4 shows the results of the hurdle model. In the participation stage, findings show that most factors do not significantly impact consumers' decisions to pay premiums for eco-labeled seafood restaurants, which has been observed in earlier studies. For instance, Grebitus et al. (2013) argue that traditional demographic variables perform poorly in influencing participants' environmental preferences. Our results show that consumers with a strong preference for ecolabel certification are more likely to choose an eco-labeled restaurant[9] than those who think cuisine style is the most crucial factor for their restaurant choice, consistent with the conclusions from Grebitus et al. (2013). Although at a 10% significance level, the only other significant parameters are having an M.S. degree or above and the restaurants with the highest average dish price. Respondents with an M.S. degree or above tend to be less likely to pay premiums for eco-labeled restaurants than those with a high school education. People who eat in restaurants with an average expenditure of $70/person or higher are less likely to pay premiums for eco-labeled restaurants than those who pay $15/person on average for food in restaurants. This finding is broadly consistent with the literature as income/education does not affect preferences for eco-labeled seafood (Ankamah-Yeboah et al., 2016; Brécard et al., 2009; Bronnmann & Asche, 2017) or in general (Grebitus et al., 2013). While there are no directly comparable studies related to the impact of the average dish prices on the preference for ecolabels, the observed price premium associated with ecolabels is the lowest or disappears with higher price levels retailers. This is a phenomenon that has also been observed in retail as Asche et al. (2015) show that premiums associated with the MSC-ecolabel largely disappear at English high-end retailers. Asche et al. (2021) also show that the premium associated with the ASC-ecolabel is declining as the average price level of the retail chain is increasing in Germany.

In the consumption stage (second stage), consumers have overcome the hurdle of paying premiums for ecolabels when dining at restaurants and are considering how much more to pay for eco-labeled restaurants. Many factors are found to be relevant. The importance of all restaurant features except for price leads to a higher WTP for eco-labeled restaurants. This indicates that consumers who think ecolabel certification, restaurant type, or customer ratings are more important than cuisine style are willing to spend more at eco-labeled restaurants. In addition, the frequency of eating out has a significant positive effect on the WTP for eco-labeled

[9]In this survey, the higher the number of the respondents gives for the rank, the less important role that feature plays in consumers' choices of restaurants. A negative parameter indicates that the feature is a more important one than the feature "cuisine style of the restaurant" for respondents when they choose the restaurants.

restaurants.[10] This contrasts with literature that experienced consumers tend to be more likely to trust their judgment than external information such as ecolabels (Kecinski et al., 2017; Lange et al., 2002).[11] However, this may not be too surprising as consumers who frequently eat away from home may have higher food expenditures and are less sensitive to price.

As generally reported in the literature (Harms & Linton, 2016; Sánchez et al., 2016), the preference for eco-labeled restaurants is even more important for respondents who know the ecolabels. The WTP also sometimes changes with the average price level of the restaurants. The consumer WTP for eco-labeled restaurants does not differ between restaurants with an average price of $15/person and $25/person. However, this variation disappears when consumers dine at restaurants with an average price of $50/person and $70/person or higher. In these cases, consumers are willing to pay significantly lower premiums than dining at a restaurant of $15/person. The higher the restaurant's average dish price, the lower premiums consumers are willing to pay for the ecolabel certification. Again, this result is consistent with the finding of previous research that the premium associated with ecolabels becomes lower or disappears with higher price levels of retailers (Asche et al., 2015). The results indicate that it is hard for ecolabel certification to obtain a higher price premium at high-end seafood restaurants. At high-end restaurants, consumers are likely to pay increasing attention to other attributes, such as the restaurant's physical environment, and human interactions with service staff that can meet their psychological needs (Lee and Hwang, 2011; Lin & Mattila, 2010).

Several demographic variables are significant in influencing consumption behavior at the second stage. The WTP is lower in the older respondents, which aligns with many studies reporting a higher WTP for environmental amenities among younger people, including seafood (Brécard et al., 2009). However, this imposes a challenge for sustainable seafood demand as seafood consumption tends to be higher among older people. People from large cities or urban areas are likely to have a higher WTP for eco-labeled restaurants than people from small towns or suburban areas. It is also worth noting that income is an insignificant factor in influencing the consumers' premiums for eco-labeled restaurants.

When it comes to the preference for ecolabels, while this favor seems to increase somewhat due to more information introduced (Figure 2), it does

[10]There are eight levels in the question to measure the frequency that respondents are eating away from home. A larger number indicates a situation with lower frequencies. Hence, a negative sign in the result means that the more frequently eating away from home respondents have higher premiums for eco-labeled restaurants.

[11]There are of course a number of other attributes that can be important such as origin, a feature that can be unclear for seafood (Asche, Yang, et al., 2022), production technology (Uchida, Onozaka, et al., 2014; Uchida, Roheim, et al., 2014; Bronnmann & Asche, 2017; Asche, Eggert, et al., 2022), and product form (Love, Asche, et al., 2022).

not appear to be strong enough to conclude that information treatments can change the WTP. Thus, information on seafood ecolabels provided in our study does not have any measurable effect on the expenditure in eco-labeled restaurants, which contrasts with studies such as Uchida, Onozaka, et al. (2014). A potential explanation is that the consumption settings differ by surveys. Although Uchida, Onozaka, et al. (2014) found that consumers' WTP varies significantly by their information, they also noticed that information treatment is only effective for consumers who find it interesting or credible. The information we use in this study may not be strong enough to change consumers' insights into eco-labeled restaurants. Therefore, it does not necessarily nudge behavioral changes. It is also acknowledged that the PCM we applied has limits in estimating consumers' WTP, possibly affecting our current conclusions that are based on the derived estimates.

Marginal effect of explanatory variables

To shed more light on the strength of the preferences for eco-labeled restaurants, we applied the estimators derived from the second stage of the hurdle model to get the consumer WTP for eco-labeled restaurants. The fitted values of WTP are computed of the base case with an addition of variation in a single variable, while the rest variables are controlled at the mean values.[12] These results are reported in Table 5. It shows that consumers who eat away from home daily in $25 average expenditure/person restaurants are estimated to pay around $1.5 more for eco-labeled restaurants than uncertified restaurants at such price level restaurants. The WTP for the eco-labeled restaurants decreases to $0.73 at the high-priced restaurants with $75 average expenditure/person. Moreover, the WTP for eco-labeled restaurants declines with the frequency of eating away from home and is relatively close to zero for infrequent restaurant patrons.

As one would expect, consumers with different levels of concern for the environment have different WTP for eco-labeled restaurants. The WTP for the eco-labeled restaurants is close to zero for consumers with weak environmental concerns when food expenditure per person is close to $25. The WTP becomes insignificant at more expensive restaurants. For consumers with strong environmental concerns,[13] the premium is about $1.16 in $25 average expenditure/person restaurants, which reduces to $0.36 at $75 average expenditure/person restaurants. The result is in line with what is

[12]The fitted values used here are conditional WTP, given the assumption that consumers have overcome the hurdle and are willing to pay premiums for eco-labeled restaurants. Adjustment of taking the square root of the premiums for the model is reverted to get the values in Table 5. The significance level of 5% is tested by the t-statistics obtained from the fitted values and the sample mean.

[13]We use three levels (low, medium, and high) to reflect various consumers' concerns for the environment, and this category is based on our survey questions.

Table 5. Estimated premiums for eco-labeled restaurants with different characteristics of consumers by different food expenditure at restaurants.

	Average expenditure/person at the restaurants		
	$25	$50	$75
Frequency			
Daily	$1.496*	$1.078*	$0.730*
	(0.192)	(0.192)	(0.193)
4–6 times/week	$1.244*	$0.784	$0.445
	(0.193)	(0.193)	(0.193)
2–3 times/week	$1.015*	$0.537	$0.231
	(0.197)	(0.195)	(0.195)
Once a week	$0.809	$0.337	$0.086
	(0.200)	(0.197)	(0.197)
2–3 times/month	$0.626	$0.183	$0.011
	(0.203)	(0.200)	(0.200)
Once a month	$0.467	$0.075	$0.007
	(0.207)	(0.203)	(0.203)
Less than once a month	$0.331*	$0.015	$0.072
	(0.211)	(0.207)	(0.207)
Almost never	$0.218*	$0.001	$0.207
	(0.216)	(0.216)	(0.211)
Environmental concerns			
Weak environmental concerns	$0.005*	$0.351	$1.307
	(0.193)	(0.193)	(0.193)
Medium environmental concerns	$0.328	$0.014	$0.074*
	(0.196)	(0.196)	(0.196)
Strong environmental concerns	$1.158*	$0.689*	$0.359*
	(0.196)	(0.201)	(0.201)
Knowledge to ecolabels			
Not knowledgeable	$0.745*	$0.280*	$0.053*
	(0.193)	(0.193)	(0.193)
Neither nor knowledgeable	$2.632	$2.569	$2.389*
	(0.194)	(0.194)	(0.194)
Knowledgeable	$5.671*	$7.162*	$8.181*
	(0.195)	(0.195)	(0.195)
Age			
18–24 years old	$3.324*	$3.560*	$3.585*
	(0.194)	(0.194)	(0.194)
25–34 years old	$2.198*	$1.974*	$1.699*
	(0.196)	(0.196)	(0.196)
35–44 years old	$1.304	$0.853	$0.509*
	(0.199)	(0.199)	(0.199)
45–54 years old	$0.643*	$0.195*	$0.015*
	(0.203)	(0.203)	(0.203)
55–64 years old	$0.213*	$0.002*	$0.217*
	(0.208)	(0.208)	(0.208)
65 years old and over	$0.015*	$0.271	$1.114*
	(0.213)	(0.213)	(0.213)

*Denotes that the estimates are significant at the level of 5%.
Numbers in parentheses are standard errors.

reported for retailers in that premiums tend to be the highest for the most inexpensive retailers (Asche et al., 2015, 2021; Sogn-Grundvåg et al., 2019). Those authors interpret that consumers at more expensive outlets already assume the seafood is good quality and sustainable. Therefore, there is no reason to pay an additional cost for ecolabels (Asche et al., 2015, 2021; Sogn-Grundvåg et al., 2019). This is likely to be the case also here.

The premiums for eco-labeled restaurants vary with different knowledge levels with respect to ecolabels as well as the price range of the restaurants. Consumers who have more knowledge of ecolabels are willing to pay more for sustainable seafood than those who have less knowledge, and this gap increases with the increase of food expenditure at restaurants. It is also worth noting that consumers who know little about ecolabels have a very low WTP, ranging from $0.75 at the $25 average expenditure/person restaurants to $0.05 at the $75 average expenditure/person restaurants. For consumers knowledgeable of ecolabels, the premiums of ecolabels are $5.67 at the $25 average expenditure/person restaurants, and it increases to $8.48 at the $75 average expenditure/person restaurants. The premiums for eco-labeled restaurants also vary strongly with age groups. In general, older people tend to be willing to pay less given the same price range of restaurants, and in several age groups, the WTP is close to zero.

Conclusions

The impacts of seafood ecolabels are controversial at the consumer level and on the water regarding improved production practices (Roheim et al., 2018). There is substantial evidence for the existence of price premiums for many, but not all, sustainably sourced seafood products and eco-labeled products generally consumed at home. However, there is also significant discussion with respect to how the premiums get transmitted in the supply chain and to what extent they provide producers to engage in more sustainable production practices (Blomquist et al., 2019; Stemle et al., 2016; Bronnmann et al., 2023). In addition, there is evidence of small or no premiums for some species, and questions also exist as to whether consumers are sufficiently informed about specific ecolabels to warrant their provision (Grunert et al., 2014).

That ecolabels are used only to a very limited extent in the restaurant sector adds to the heterogeneity of market incentives and is a significant policy challenge for the sustainable seafood movement given the size of the sector, as it provides a significant market for not labeled seafood. This can be a factor in reducing incentives for some producers to improve production practices. The fact that the restaurant sector is more important for some species (e.g. shrimp) (Love et al., 2021) and that mislabeling is a challenge in the restaurant sector (Kroetz et al., 2020) adds to the nuanced incentives.[14]

[14]Nonetheless, the number of fisheries certified, the number of ecolabels that producers can choose between, and products sold with an ecolabel has risen rapidly in recent years (Alfnes et al., 2018; Amundsen et al., 2019; Osmundsen et al., 2020). This has also led to several alternative explanations for why ecolabels are popular (Roheim et al., 2018). These vary from positive perspectives suggesting that the ecolabel, even without a price premium, encourages more sustainable production practices to more cynical observations opining that the

The under-emphasized role of the restaurant sector in seafood eco-labeling is a potential challenge for a sustainable food production system. Our results indicate that consumers have a significant interest and WTP to spend more at seafood restaurants that are certified sustainable. We find that the average premiums for eco-labeled seafood restaurants are high (around 26%), which is somewhat higher than the findings for the premiums of eco-labeled seafood products at the retail level (Bittmann et al., 2020; Bronnmann & Asche, 2017; Roheim & Zhang, 2018). The positive consumer preferences for eco-labeled restaurants imply that policies to increase the number of restaurants that supply eco-labeled seafood have a significant likelihood of being at least partly successful. As such, the recent trend in increased use of ecolabels in restaurants is positive and may contribute to increasing the incentives of fishers and fish farmers to join certification programs. However, consumer heterogeneity may limit the effect as some restaurant segments still prefer cheaper un-labeled seafood. Moreover, while it is relatively easy to target the retail sector due to the importance of relatively few larger chains with significant investments in their reputation and brand (Roheim et al., 2018), initiatives and policies targeting the restaurant sector can be more challenging given its more fragmented nature.

Our results indicate that the positive WTP for MSC-certified restaurants varies significantly by consumer characteristics. Not surprisingly, the strongest preference for eco-labeled restaurants is among young, environmentally conscious respondents with knowledge about ecolabels. Results also suggest that successful adoption of an ecolabel by restaurants depends on the characteristics of the restaurants' patrons. The expenditure level of restaurants can significantly affect consumers' premiums for eco-labeled restaurants, especially if they eat away from home daily or are sensitive to the knowledge of ecolabels. The variation of WTP for eco-labeled restaurants is also significant at different price levels among the younger population.

There have been many discussions regarding the impacts of information, knowledge, and income/education on changing consumers' choices (Ankamah-Yeboah et al., 2016; Bronnmann et al., 2021; Bronnmann & Asche, 2017; Uchida, Onozaka, et al., 2014). Overall, our results find that education, and income do not significantly affect consumer WTP for eco-labeled restaurants. The insignificant information treatments in this study also indicate that the information we provided is not influential enough to

proliferation of ecolabels reflect a race to the bottom where retailers claim sustainability with the cheapest label possible. The actual workings of the labels then become an empirical question. Examples of positive impacts not manifested by a premium include Roheim and Zhang (2018), who provide evidence that ecolabels change substitution patterns; Sogn-Grundvåg et al. (2019), who show that an ecolabel may reduce supply chain costs; and Amundsen and Osmundsen et al. (2019) who show that the certification process increases the production efficiency.

change consumers' perspectives on eco-labeled restaurants and influence their choices. However, it does not imply that initiatives and policies promoting eco-labeling programs and increasing consumers' awareness of sustainable seafood in the restaurant sector are unnecessary. Instead, our results show the importance of policymakers and the seafood industry identifying efficient information and methods to improve consumer knowledge that is strong enough to nudge the change in consumer preference for sustainable seafood.

The implications of this study are not limited to seafood restaurants. The insights are also likely to be applicable to other types of restaurants and restaurant chains, given increased concern about the environmental impact of food production. In addition, given the heterogeneity in the seafood sector, this is an important topic for future research on various food groups in different countries.

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ORCID

Yingkai Fang http://orcid.org/0000-0002-8226-0417
Zhifeng Gao http://orcid.org/0000-0003-2984-8278
Xumin Zhang http://orcid.org/0000-0001-6419-7349

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