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**How can we motivate consumers to purchase environmentally friendly products?
Evidence from a laboratory randomized experiment using eye-trackers**

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How can we motivate consumers to purchase environmentally friendly products?

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Abstract

By conducting a laboratory experiment, we investigate how consumers' purchasing behavior for certified environmentally friendly forest coffee is affected by their interest in environmental issues, provision of information, and product labels. We contribute to the literature in the following three ways. First, we conduct a randomized controlled trial (RCT) to provide exogeneity to typically endogenous variables, most notably, knowledge of forest coffee. Second, we utilize eye-tracking devices to examine how different product labels result in different visual attention. The combination of an RCT and eye-tracking techniques is new in the literature on purchasing behavior for environmentally friendly products. Third, our experiment measures participants' purchasing behavior that incurs actual costs rather than examining their willingness-to-pay (WTP) based on hypothetical questions. We find that concerns regarding environmental issues do not promote purchases of certified forest coffee. Information about certification systems does not do so unless information is provided to prior purchasers of certified coffee. By contrast, illustrations of forests on certified coffee products' labels attracts participants' visual attention and further stimulates actual purchases of certified coffee, suggesting that a 1-second increase in visual attention increases the likelihood of purchasing certified coffee by 16 percent. Our results suggest that, to increase demand for environmentally friendly coffee, sustainable provision of information and visual marketing strategies are more influential than the promotion of interests in environmental issues.

Keywords: Eye-tracking; visual attention; social experiment; sustainability labels; coffee certification; shade grown

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1 Introduction

Climate change is a serious global problem that continues to progress, as many studies have shown (Bellard et al., 2012; Hansen et al., 2012; Kirchner et al., 2016; Rogelj et al., 2013). In recent years, sustainable consumption and production have been promoted to prevent and reduce environmental degradation and pollution (Nash, 2009). For example, shade-grown coffee certification programs (hereafter, “forest coffee certification”) have attracted increasing attention.

Traditionally, coffee is produced in the understory of shade trees, and the agroecosystems of shade-grown coffee (i.e., forest coffee) conserve forestlands and provide an important refuge for biodiversity (Mas and Dietsch, 2004; Moguel and Toledo, 1999; Perfecto et al., 1996; Toledo and Moguel, 2012). However, modern coffee production does not utilize shade trees to improve productivity and has led to deforestation in recent years (Jha et al., 2014). Forest coffee certification programs seek primarily to conserve forest areas under shade-grown coffee systems by providing economic incentives, such as premium prices.¹ As a result, several empirical studies have found positive impacts of forest coffee certification programs on forest conservation (Rueda et al., 2014; Takahashi, 2016; Takahashi and Todo, 2013).

While forest coffee certification programs have been rapidly adopted in many developing countries, the sustainability of such programs strongly depends on economic returns to certified producers (Perfecto et al., 2005; Philpott and Dietsch, 2003). Without sufficient financial incentives, certified producers would be incentivized to convert their forest coffee areas into other land uses, such as farmlands, which results in deforestation. Returns to certified producers are determined by certified coffee's price premium and market size in developed countries, where most certified coffee is consumed (Valkila and Nygren, 2010).

In this respect, the current situation in most developed countries is quite encouraging. Consumers in the United States are willing to pay an extra 3.1-11.5% for sustainable coffee over regular coffee, according to willingness-to-pay (WTP) surveys by Loureiro and Lotade (2005) and Van Loo et al. (2015). Moreover, the market size for certified forest coffee and other sustainable coffee in developed countries has increased from less than 4 billion US dollars in the early 1990s to over 11 billion US dollars in 2006 (Méndez et al., 2010). The total sales volume of forest coffee certified by the Rainforest Alliance, the largest institution providing sustainable coffee certifications, more than doubled from approximately 62 thousand tons in 2008 to 130

thousand tons in 2011 (Potts et al., 2014).

However, the situation in Asia is different from that in North America and Europe. For example, although Japan was the fourth-largest coffee-importing country in 2013 (Food and Agriculture Organization of the United Nations), the market share of certified coffee is limited (Giovannucci and Koekoek, 2003). As Figure 1 shows, the import volume of certified forest coffee in Japan is relatively low compared to that in other countries. In addition, Chinese coffee consumption has increased in recent years, whereas the awareness of sustainable coffee in China remains low (Yang et al., 2012). The current market situation in Asian countries implies that certain obstacles limit consumers' purchasing behaviors for certified forest coffee. However, due to the lack of rigorous empirical studies, the obstacles to purchases of certified forest coffee and determinants of consumer behaviors in Asia remain unclear.

There are at least three possible reasons why the consumption of certified forest coffee in Japan and other Asian countries is low. First, consumers may simply be uninterested in environmental issues. Second, they may not have enough information about certified forest coffee or, more precisely, about how consumption of forest coffee leads to forest protection. Finally, as marketing and branding significantly influence consumer behaviors, the low consumption level of forest coffee may reflect a lack of effective marketing strategies.

Using a laboratory experiment in Japan in which subjects were asked to choose their preferred coffee from different types of coffee, including forest coffee, this study examines whether each of the three channels actually hinders the consumption of forest coffee. Our experiment is quite unique in that we utilize both a randomized controlled trial (RCT) and eye-tracking techniques. More specifically, we provide information about forest coffee certification programs to only a randomly selected half of the subjects before they chose coffee. As a result, we are able to estimate whether information encourages their consumption of forest coffee without any bias due to an endogenous diffusion of information. Moreover, we show different types of product labels and advertising statements for forest coffee to the subjects in a random manner to test whether different marketing strategies affect consumer behaviors. For this purpose, we use eye-tracking devices in the laboratory, as often done in the marketing literature (Wedel and Pieters, 2008), and check how long subjects watched a given label and statement for forest coffee. The combination of RCT and eye-tracking techniques enables us to examine how different types of labels and statements attract subjects' eyes and then influence

their decisions differently. To the best of our knowledge, this is the first study to examine channels of consumers' preferences for sustainable products using both RCT and eye-tracking techniques.

2 Literature review and hypothesis

2.1 An overview and shortcomings of previous studies

The coffee industry was an early adopter of sustainability certification schemes (Reinecke et al., 2012), and forest coffee certification systems have attracted attention from conservation and development organizations that are interested in reducing deforestation and degradation (Fleischer and Varangis, 2002; Perfecto et al., 2005; Takahashi and Todo, 2014; Taylor, 2005).

Effects of sustainability certification schemes on consumer behavior have been examined in the academic literature. For example, Arnot et al. (2006) found that information about fair trade systems is an important determinant of fair trade coffee consumption. In addition, Bezençon and Blili (2011) showed that interests in environmental issues and sustainability are associated with consumers' decisions to purchase fair trade coffee. Furthermore, Golding and Peattie (2005) and De Ferran and Grunert (2007) emphasized the importance of marketing strategies to expand the market share of fair trade coffee.

However, the previous research has had three major shortcomings. First, empirical evidence that focuses on forest coffee certification is scarce. A large body of literature has examined consumer preferences for other sustainable certifications, especially fair trade certification (Cranfield et al., 2010; Hiscox et al., 2011; Kimura et al., 2012). Because the effect of certification programs may vary depending on their types, focusing on sustainable coffee certifications beyond fair trade certification and examining determinants of purchasing behavior for sustainable coffee are necessary to promote consumers' sustainable consumption.

Second, the literature's estimations of the determinants of the consumption of sustainable products are often biased due to the endogeneity of the determinants. As previously mentioned, although knowledge of certification systems could enhance the consumption of certified products (Arnot et al., 2006), whether consumers know information about certified products is endogenously determined by, for example, their characteristics. If unobserved characteristics such as interests in environmental issues affect both receiving the information and consuming certified products, the estimated effect of information captures the effect of

unobserved characteristics and is overvalued. To eliminate biases due to endogeneity, RCTs have been utilized extensively in the impact evaluation literature (Duflo et al., 2007). In an RCT, a particular treatment is provided to randomly selected subjects, and hence the effect of the treatment can be accurately estimated (Imbens and Wooldridge, 2009). However, RCTs are rarely used in the literature on the consumption of certified coffee.

Finally, visual marketing strategies for sustainability certification programs have not been fully examined. For example, Grunert et al. (2014) conducted an online survey of consumers in six European countries and collected data on consumer preferences for four different certification programs. Although they found that certain demographic characteristics, such as the gender and education level of the consumer, were major factors in the selection of certified products, how visual marketing strategies influence consumers' decisions to purchase certified coffee has not been examined. To determine the impact of visual marketing strategies, eye-tracking technology has become a useful and powerful tool in the marketing literature (Balcombe et al., 2015; Wedel and Pieters, 2008). However, it is rarely used in the context of the determinants of purchasing behavior for certified sustainable coffee. One exception is Van Loo et al. (2015), who recently applied eye-tracking technology when conducting a choice experiment in Arkansas in the United States. Based on a simple linear function model, they found that consumers' visual attention is positively correlated with the WTP for certified sustainable coffee.

Although the contribution of Van Loo et al. (2015) is important in terms of their application of eye-tracking technology, several limitations deserve consideration. First, and most importantly, although the analytical method used by Van Loo et al. (2015) showed a correlation between visual attention and product valuation, it did not clarify what determines visual attention. Without clarifying factors, including consumers' characteristics and marketing strategies, that influence visual attention to particular products, no policy implication about how we stimulate the consumption of certified coffee is generated. Second, in Van Loo et al. (2015), the subjects' revealed preferences in their experiment may not have been consistent with their actual preferences because subjects were asked their WTP for different types of certified coffee by hypothetical questions and were not asked to pay for their choices. In recent years, analyses based on the participants' WTP have been widely adopted to evaluate their preferences for certain products (Arnot et al., 2006; Basu and

Hicks, 2008; De Pelsmacker et al., 2005; Sirieix et al., 2013). However, the accuracy of such analyses may be seriously contaminated by measurement biases (Cookson, 2003); hence, whether the results from studies relying on WTP reflect actual consumers' behavior is unclear. Finally, the number of experiment participants in their study, 81, is limited. They stated that their participants outnumbered those in other studies using the eye-tracking method (ranging from 10 to 71 participants). However, the accuracy of these results may not be reliable if the number of observations was limited.

To overcome the shortcomings in the literature, we utilize RCT and eye-tracking technology in a laboratory experiment for consumer choices. As we will explain later in further detail, our unique methodology enables us to more accurately estimate the effects of consumer characteristics, knowledge, and visual marketing strategies on the consumption of certified coffee.

2.2 Hypotheses of this study

In this study, we follow the study of Grunert (2011) and develop hypotheses regarding the determinants of purchasing behavior for certified forest coffee. Grunert (2011) discussed six major barriers to choosing sustainable food production. Among these six barriers, we focus on three possible obstacles to purchasing certified forest coffee, i.e., a lack of awareness, a lack of motivation, and failures to notice eco-friendly labels, and address the following three hypotheses.²

First, consumers who are very interested in environmental issues will likely have a positive attitude toward purchasing certified forest coffee. However, if consumers are not aware of the forest coffee certification system or the certification logos, they may not be motivated to purchase certified coffee. In fact, a survey investigating 9,000 coffee-related firms in North America found that the awareness of and sales volume for certified forest coffee are fairly low compared with other sustainable coffee certifications (Giovannucci, 2001). Therefore, we hypothesize the following.

Hypothesis 1: Consumers' awareness of forest coffee certification will enhance their purchasing behavior.

In addition to consumers' awareness, their motivation to be sustainable or environmentally friendly may influence their food choices. As Grunert (2011) mentioned, consumers may prefer non-certified coffee if they have no interest or knowledge related to sustainability and environmental issues. However, if this assumption

is true, consumers who are concerned about environmental issues and sustainability will be likely to choose certified products. Hence, the second hypothesis is provided below.

Hypothesis 2: A high level of interest in environmental issues should have significantly positive impacts on the purchase of certified forest coffee.

Furthermore, different visual marketing strategies may affect consumers differently. In this study, we particularly focus on product labels and advertising statements for certified coffee. Grunert et al. (2010) investigated consumer behavior in six European countries and reported that many shoppers only examined the front label of the food package, making their food choices rather quickly; 40 percent of their respondents spent less than 15 seconds making such decisions. Moreover, using an eye-tracking method, Van Loo et al. (2015) found that visual attention to sustainable coffee labels was associated with the consumer's higher valuation of sustainability. These studies imply that, although food choices are made very rapidly, consumers who spend more time viewing sustainable coffee labels may consume more sustainable coffee. This argument leads to the following hypothesis.

Hypothesis 3: Labels with advertising statements and illustrations that highlight characteristics of certified forest coffee attract more attention and further increase a consumer's probability of purchasing certified coffee.

3 Experimental procedures and data collection

To test the three hypotheses addressed above, we conducted a laboratory experiment in Tokyo, Japan in which subjects were requested to choose their preferred type of coffee among several types, including forest coffee. Subjects were randomly classified into several groups, depending on what type of labels and advertising statements for forest coffee were shown and whether information on forest coffee was given before making a choice. Throughout the process of choosing, what part of labels subjects were watching was traced by eye-tracking devices. In this section, we describe the participants and the procedure used in our experiment in detail.

3.1 Recruitment process

We recruited students from Waseda University, a private university located in Tokyo, for the experiment. We called for experiment participants on the university's student job website. A total of 285 students applied to be included the experiment; we randomly selected 254 of these students for our experiment. The experiment was conducted in November 2015 in the economics laboratory room of Waseda University, and each participant was given 1,310 Japanese yen (i.e., approximately US\$12.50) for their participation. Because we failed to capture their eye movements, eight participants were excluded from our dataset. Therefore, 246 observations were used for the analysis.

As mentioned above, an advantage of this study is its sample size. Likely as a result of time and budget constraints, the number of participants in previous eye-tracking studies was less than 100: 81 in Van Loo et al. (2015), 71 in Ares et al. (2014), 53 in Ares et al. (2013), 51 in Vidal et al. (2013), 50 in Varela et al. (2014), and 40 in Balcombe et al. (2015). Compared with past eye-tracking studies, we established an extensive eye-tracking dataset, which allows us to conduct a rigorous empirical analysis.

3.2 Procedures of the experiment

Because the economics laboratory room of Waseda University has only four eye tracking devices, four participants were invited to each round of the experiment. At the beginning of each round, participants received brief instructions regarding the experiment, including the experiment's purpose, i.e., to identify consumer preferences for coffee products. However, any information or terms related to the certification were excluded from these instructions because this information was provided to only a randomly-selected half of the participants as we will explain later.

After the participants were given instructions, the eye-tracking device was individually calibrated using the nine-point calibration method. In this study, we used a single-screen type of remote eye-tracking device (Tobii T60, Tobii Group, Sweden) to capture the participants' visual attention and decision making. Following the calibration process, one warm-up question was presented. In this question, labels for three types of juice and a no-buy option were presented on the screen, and the participants chose their preference by clicking one juice label or the no-buy option.³

After the warm-up question, we showed labels for three different coffee varieties, i.e., forest coffee, regular coffee, and mocha coffee, as well as the no-buy option, on the screen. For this study, we selected forest coffee certified by the Rainforest Alliance. Figure 2 shows an example of the screen that we showed the participants. The top-left and bottom-left labels are for regular and mocha coffee, respectively. The forest coffee label is shown in the top-right corner. To avoid a positioning effect, we randomly changed the locations of the coffee labels on the screen. Finally, the no-buy option always appeared in the bottom-right corner.

In our experiment, the participants were asked to choose their preferences twice.⁴ For the first preference choice (hereafter, “first selection”), we asked each participant to select his or her preference from the four options on the screen and explained that we would not charge a fee if they chose to purchase the coffee.

After the first selection, we showed the exact same screen to the participant and asked him or her to select his or her preference again, i.e., the second selection. The difference between the first and second selections was that, if the participant chose to purchase the coffee in the second selection, we actually provided them with the selected coffee variety after the experiment. By contrast, for the participants who selected the no-buy option, we added 100 Japanese yen (i.e., approximately US\$1) to their participation fee. Although the participants did not lose their money by selecting the coffee, the participants actually paid a cost of 100 Japanese yen by choosing the buy option for their second selection. Therefore, this experimental design allowed us to capture the participants’ actual purchasing behavior from the second selection, while the purchase in the first selection measured WTP.

After completing this preference experiment, we conducted a short questionnaire survey that collected the following information: the participants’ socio-demographic characteristics, their previous awareness of the certification system, their past purchase experiences with certified coffee, their general attitudes toward coffee, and their attitude toward environmental issues. Each round of the experiment took approximately 30 minutes.

3.3 Random classifications of participants

We randomly classified participants into eight groups by using the following two procedures (Figure 3). First, in addition to offering brief instructions at the beginning of the experiment, we provided a detailed explanation of the forest coffee certification system to half of the participants through random selection. The

explanation included the following information: (1) the relationship between shade-grown coffee and forest conservation; (2) the purpose of the forest coffee certification system; (3) the logo of a certification organization used in this study, as we will explain later, i.e., the Rainforest Alliance; and (4) the impact of the certification system on forest conservation. Because awareness of the forest coffee certification system is extremely limited in Japan, we can create a knowledge gap regarding the certification system between the treatment and control groups. If consumer awareness is an important factor affecting purchasing behavior, as assumed in Hypothesis 1, the participants who were given information on forest coffee should purchase more certified coffee than the participants who were not.

In addition, each participant was shown a particular label for forest coffee that was randomly selected from four different labels. Figure 4 shows the four designs for the forest coffee label used in the experiment. As shown in Figure 4, the four labels have three common elements: the certification logo (i.e., the green frog), the name of the “forest coffee” variety, and a coffee cup logo on the left side. We chose the logo of the Rainforest Alliance because forest coffee of the Rainforest Alliance is most consumed in Japan, which is where we conducted our experiment. The Rainforest Alliance has a green frog in its logo, which can be used if a product contains at least 30 percent certified coffee.

In addition to the common elements, the labels also included different elements. The first label (a) simply consists of the three common elements. The second label (b) additionally includes a short statement about the contribution of certified coffee (hereafter, “explanation label”). To ensure conciseness and understandability, the statement we used was “one cup of coffee saves the forest.” The visualization label (c) includes an illustration of a forest to visually link forest coffee and forest conservation. Finally, the last label (d) is a mixed label that includes the explanation and the illustration. By incorporating the illustration and statement to highlight the contribution of forest coffee separately, we can distinguish the effects of informational statement and visual illustration marketing strategies.

3.4 Identifying areas of interest using eye trackers

Using these labels, we identified the visual attention that the participants paid to the forest coffee label and the certification logo. To obtain eye-tracking data, we first defined the areas of interests (AOIs) that

corresponded with the target areas for collecting visual data. Using eye-tracking devices, we identified how long each participant looked at an AOI, or the total fixation duration at the AOI. In our case, we created two AOIs. The first AOI is for the forest coffee label illustrated as a dashed red frame in Figure 2. The second is particularly for the certification logo shown as a solid red frame in Figure 2. Although the logos of certification programs are likely to be important signs for consumers that ensure eco-friendly products, Grunert et al. (2014) reported that consumers did not pay much attention to logos when they made food choices. To examine whether this is in fact the case, we used this AOI to investigate the relationship between the visual attention given to certification logos and purchasing behavior. Although some labels include either or both the statement and illustration to highlight characteristics of forest coffee (panels [b], [c], and [d] in Figure 4), to simplify the analysis, we did not distinguish between the statement and illustration and the other area of the label when we defined the AOI.

3.5 Summary statistics

The participants' socio-demographic characteristics are listed in Table 1. About half (47 percent) of the participants were female. Because we recruited university students, the average age was 21 years. Approximately 86 percent of the participants answered that they occasionally drank coffee, whereas 30 percent of the participants answered that they drank coffee every day (defined as "coffee lovers").

We asked the participants to indicate their interest in environmental issues based on a 5-point scale, ranging from "(1) Not at all interested" to "(5) Extremely interested". In this study, we defined participants who scored 5 as those who had a high level of environmental interest, which accounted for approximately 11 percent of the sample participants.

In addition to the participants' interest in the environment, we investigated whether they were actively involved with environmental issues because active involvement can be associated with the purchase of sustainable coffee. We evaluated the participants' active involvement through their experiences as environmental volunteers or participants in environmental events, such as the Candle Night, Earth Day, and Earth Garden. The summary statistics show that approximately 18 percent of the participants were classified as environmentally active participants.

The visual attention data captured by the eye-tracking devices are presented in Table 2. On average, the participants spent 9 seconds on the first selection, while they spent 12 seconds on the second selection, even though the exact same choices and designs were presented to them. The length of time required to choose a product was comparable to that in Grunert et al. (2010). The difference between the first and second selections suggests that consumers require more time to make a decision when actual costs are incurred than when only a hypothetical question based on a WTP survey is asked.

Similar characteristics were observed for the total duration of fixation on the certification label and logo. The visual attention paid to the certification label increased from 2.8 seconds in the first selection to 3.9 seconds in the second selection. In addition, although most participants paid less attention to the certification logo, the total fixation duration increased from 0.3 in the first selection to 0.6 in the second selection.

As mentioned previously, total fixation time may be a good indicator of the participants' attention. However, the decision time varied between participants: some participants made their decisions quickly, while others needed more time. If we simply use the total fixation time as the indicator of the participants' level of attention, we may incorrectly interpret our observation by considering that participants with quick responses to pay less attention than other participants. To avoid this problem, we use the proportion of total fixation time on the label or the logo as the indicator of attention, as shown in the bottom part of Table 2. The average proportion of total fixation time on the certification label and the logo are 30 percent and 4 percent, respectively.

Moreover, Table 3 presents the decision time and total fixation duration for the four label designs. During the first selection, we observed the differences in the decision times for the label designs. In particular, the averages for the control labels and mixed labels are significantly different at 7.7 seconds and 10.2 seconds, respectively. However, the mean difference was insignificant in the second selection. Similarly, among the label designs, we did not observe any significant differences in the total fixation duration on the certification label and logo for the second selection.

Finally, Figure 5 shows the proportion of the participants' choices in the first and second selections. During the first selection, most participants were willing to purchase coffee: approximately 45 percent, 20 percent, and 24 percent of the participants chose certified forest coffee, mocha coffee, and regular coffee,

respectively. Only 10 percent of the participants chose not to buy any coffee in the first selection. However, this proportion drastically increased to 36 percent in the second selection. As Figure 5 clearly indicates, the large number of participants who chose mocha and regular coffee in the first selection changed their purchasing behavior in the second selection and decided to receive an additional 100 Japanese yen. This is an interesting and important finding because these changing behaviors suggest that, under the experimental condition, the participants' WTP and actual purchasing behaviors were quite different. In other words, to understand consumer purchasing behavior for forest coffee, observing actual consumer purchasing behavior, not WTP, is crucial. Therefore, in this study, we used the participants' purchasing behavior only in the second selection for our analysis.

4 Estimation methodology

To examine the purchasing behavior for certified forest coffee, we estimated a linear probability regression model. Our benchmark model can be defined as follows:

$$Purchase_i = \alpha + \beta_1 Label_i + \beta_2 Logo_i + \beta_3 Info_i + \beta_3 X_i + \varepsilon_i \quad (1)$$

where *Purchase* denotes a dummy variable for purchasing forest coffee, which takes a value of 1 if participant *i* purchases forest coffee in the second selection. We included two variables related to visual attention, i.e., *Label* and *Logo*, which reflect the proportion of the total fixation duration on the certification label and logo, respectively. *Info_i* represents an information dummy variable, which takes a value of 1 if participant *i* receives information about the certification system at the beginning of the experiment. *X_i* in Equation 1 indicates a set of demographic variables for participant *i*, including the following: the female participant dummy (1 = Female), the coffee lover dummy (1 = Yes), the certification awareness dummy (1 = Yes), the purchase experience dummy (1 = Yes), the high environmental interest dummy (1 = High), the environmentally active participant dummy (1 = Active), and the interaction term between the treatment dummy and the purchase experience dummy. The error term is represented by ε_i .

Because Hypothesis 1 relates consumers' decision to their awareness of forest coffee certification, we tested this hypothesis by examining the impacts of a dummy variable for the random provision of information

on forest coffee and a dummy for prior awareness of forest coffee certification programs on purchasing behavior. These two dummies are expected to have a positive impact.

Hypothesis 2, which claims a positive association between the participant's environmental interest and purchasing behavior, was tested by using a dummy variable for the highest level of interest in environmental issues and another for active participation in environmental activities. Positive coefficients on the two dummies support Hypothesis 2.

In addition, we tested Hypotheses 3 by examining the effects of the greater visual attention given to the label, as measured by fixation duration or the length of time spent on it. However, as implied in the hypothesis, the fixation duration on the label and logo are endogenously determined and may be correlated with unobserved consumer characteristics. To control for possible biases due to endogeneity, we employed an instrumental variable (IV) approach, using the three dummy variables for random assignments of label designs, i.e., the label for the statement on forest coffee, the dummy for the illustration of a forest, and the dummy for both the statement and the illustration. Because one of the four labels (including the one without either the statement or the illustration) was randomly assigned to each participant, the dummies should not be correlated with the error term in Equation 1. However, which label was shown to the participant may affect the fixation duration on the label and logo. By using 2-stage least squares (2SLS) estimations, we corrected for endogeneity biases and, moreover, estimated the indirect effect of the statement and the illustration on the labels by promoting visual attention.

To determine the validity of the instruments, we employed the Sargan test of overidentifying restrictions. The null hypothesis of the Sargan test is that instruments are orthogonal to the error term. In addition, the Cragg-Donald F statistic and Stock and Yogo's (2005) critical values were used to test whether the instruments used are weak. We concluded that the instruments are not weak if F statistic exceeds the 25 percent maximal IV size reported in Stock and Yogo (2005).

5 Results

5.1 Purchasing behavior for certified forest coffee

As we explained in Section 3, because the time spent on decision making is different between the first choice – when WTP was assessed – and the second – when the actual payment was required – we focused on how participants chose the preferred type of coffee in the second choice. The results of the first-stage estimations in column 2 of Table 4 indicate that visual attention given to the certification logo decreases when the labels with the statement about forest coffee but without the illustration of a forest and with both the statement and the illustration are presented. A possible reason for this is that the participants may focus more on the statement and, thus, less on the logo. By contrast, column 1 shows that presenting either the label with the illustration or that with both the statement and the illustration positively affect the proportion of the total fixation duration on the forest coffee label, indicating that the illustration of a forest increases the participants' visual attention to the label.

The first column of Table 5 presents the results from estimations of purchasing behavior for certified forest coffee.⁵ Surprisingly, we found that the provision of information on forest coffee did not have a significant impact on the purchasing behavior for certified forest coffee. Similarly, participants' awareness of and purchase experience for certified forest coffee have no effect on their purchasing behavior. These results suggest that consumers' awareness of forest coffee certification does not enhance their purchasing behavior for certified forest coffee.

However, as we experimented with several interaction terms between the independent variables, we found that the interaction term between the dummy for information provision and the dummy for prior experience of purchasing forest coffee has a positive and significant effect on choosing forest coffee. Note that the dummy for prior experience does not have a significant effect, as we argued earlier. That is, although consumers who have previously purchased certified coffee do not necessarily continue to purchase certified coffee, they are more likely to purchase it if they receive information. Therefore, our results conditionally support Hypothesis 1.

Next, column 1 of Table 5 shows that the effects of the dummy for interest in environmental issues and that for active participation in environmental activities are not statistically insignificant. These results indicate that the level of interest in environmental issues does not affect consumers' purchase of forest coffee, rejecting Hypothesis 2.

By contrast, we found in Table 5 that the proportion of the total fixation duration on the labels of forest coffee had a significantly positive effect on choosing forest coffee. The coefficient indicates that when the total fixation duration increases by 10 percent or by approximately 1 second at its mean, the probability of purchasing forest coffee increases by 16 percent (while the average probability is 36 percent). Moreover, as we found in Table 4 that the labels with illustration of forests increase the total fixation duration on the labels, we can conclude that visual advertisement can promote purchases of forest coffee by attracting more visual attention. However, no statistical association was found between the proportion of the total fixation duration on the certification logo and purchasing behavior. It is thus indicated that, although the certification logo is an important element that guarantees eco-friendly products, consumers are not very interested in the logo when they determine their purchasing behavior. These results support Hypothesis 3 in terms of labels and reject it in terms of the logo.

5.2 Validity of instruments and robustness check

In order to check the validity of our instruments, we investigated the possibility of biases due to non-orthogonal or weak instruments. According to the Sargan statistic presented at the bottom of column 1 of Table 5, we do not reject the null hypothesis that the instruments are orthogonal to the error term, indicating that the instruments in the benchmark 2SLS estimation are valid. However, the Cragg-Donald F statistic to test weak instruments is 1.94 and smaller than its critical value at the 25 percent maximal IV size reported in Stock and Yogo (2005), 5.45, although two of the three instruments have a highly significant effect in the first-stage regression (Table 4). This result suggests that the instruments may be weak, so our benchmark results may be biased. To alleviate the weak instrument problem, we dropped the independent variables that have no significant effect in the second stage, including the total fixation duration on the logo of certified forest coffee. Then, the Cragg-Donald F statistic becomes 7.33 and larger than its critical value, 7.25. Moreover, the instruments are found to be valid from a Sargan test. The results of the second stage from this alternative specification are presented in column 2 of Table 5. The estimated parameters are virtually the same as those in the benchmark estimation in column 1 of Table 5. Therefore, we conclude that the results of the benchmark estimation are not largely biased due to the weak instrument problem.

6 Discussion and conclusion

This paper investigates the determinants of purchasing behavior for certified forest coffee by using a laboratory experiment in which participants are asked to choose one type of coffee among four. We contribute to the literature by focusing on the participants' actual purchasing behaviors that incur monetary costs to the participants rather than using a WTP measure with hypothetical questions. Furthermore, we combine a randomized experiment and eye-tracking techniques to identify the effects of the provision of information on forest coffee and the visualization of product labels on consumers' purchase of certified forest coffee.

We find that information on the certification system or concern toward environmental issues does not significantly affect consumers' purchasing behavior for certified forest coffee. Although puzzling, these results are not unique to our case. For example, Kimeldorf et al. (2006) reported that consumers' awareness about the certification of good working conditions in developing countries was not associated with their purchase of certified garments in the United States. However, we also found a positive effect of information provision on consumers who had prior experience in purchasing certified forest coffee and, thus, should have had some knowledge about it. This finding implies that reinforcement of information across time may be necessary to purchase certified products and is consistent with Centola (2010), who found that reinforcement of the same information from multiple sources is crucial to the diffusion of human behaviors. Hence, although Van Loo et al. (2015) highlighted the importance of educating consumers about the meaning of sustainable labels to add value to certified sustainable coffee, our results indicate that such information should be provided repeatedly over the a long term so that consumers can fully realize the role of certified coffee in conserving forests.

Our findings also suggest that a visual illustration of a forest on product labels promotes consumers' purchases of certified forest coffee. The importance of visual emphasis is confirmed by the fact that labels with the illustration of a forest attract more visual attention. These results are consistent with the finding of Van Loo et al. (2015) that more attention given to sustainable coffee labels is associated with a higher valuation of certified coffee. According to the 2SLS estimators, inclusion of the illustration increases the fixation duration on the labels by 7-9 percentage points, which, in turn, increase the probability of purchasing forest coffee by 11-14 percentage points. This effect is substantial in size, as the share of participants who

chose forest coffee was 40 percent. These results clearly suggest that marketing strategies are quite important to increase demand for certified forest coffee in Japan and potentially in other Asian countries. The substantial effect of marketing strategies should be emphasized because information provision in general or interest in environmental issues had no significant effect.

In addition, we find that visual attention to the logo of the certification program or a marketing statement does not influence consumers' choices. The former finding is consistent with that of Grunert et al. (2014) that consumers places less value on the appearance of a logo on the food label.

Overall, our estimation results suggest that the lack of sustainable provision of information and effective marketing strategies for certified forest coffee may be major obstacles to demand for certified forest coffee in Japan. However, one caveat of this study should be noted. Although we carefully designed our experiment to investigate actual purchasing behavior, all the participants in this experiment were students from one university. Therefore, the findings of this study may not reflect the average consumer behavior in Japan. To overcome this shortcoming, further studies should conduct the experiment in the real world rather than under experimental conditions.

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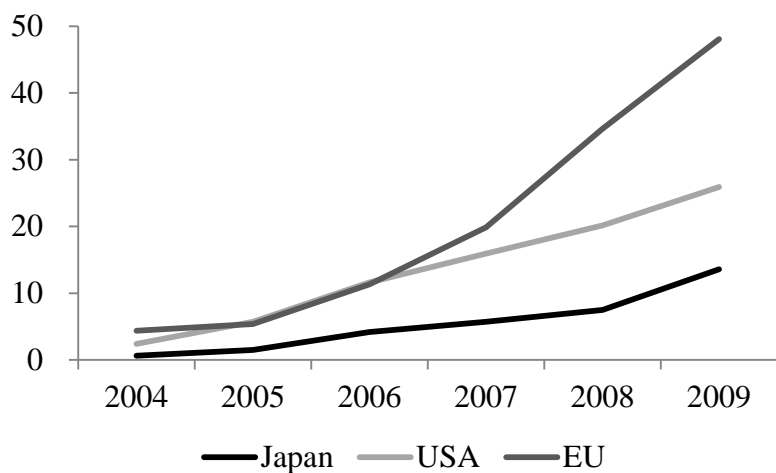
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Figure 1: The import volume of forest coffee certified by the Rainforest Alliance (1,000 tons)



Note: Data are obtained from the “Sustainable Coffee Report” by the International Institute for Sustainable Development

Figure 2: Example of the screen used in the experiment and the areas of interest (AOIs)



Note: The language in the figure is translated into English from Japanese. The top-left and bottom-left labels are for regular and mocha coffee, respectively. The label for certified coffee is shown in the top-right corner. The bottom-right box is the no-buy option. The dashed red frame indicates the AOI for the certification label, and the solid red frame is the AOI for the certification logo.

Figure 3: Random classification of eight groups

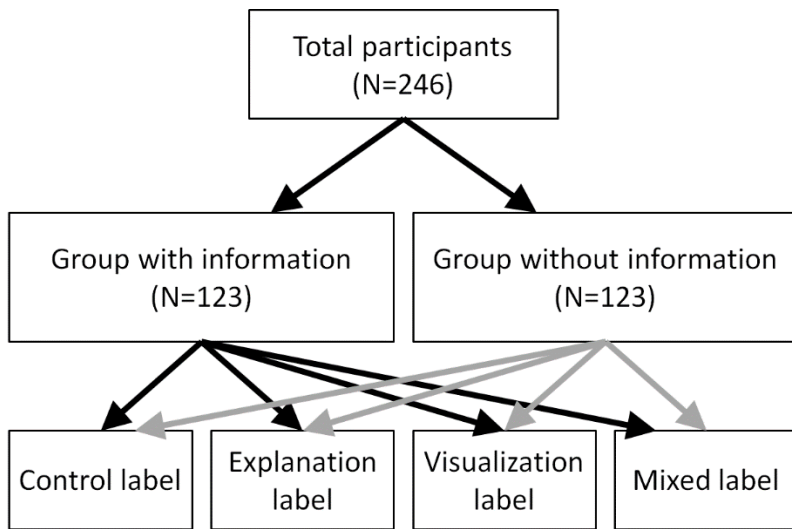


Figure 4: Labels for the certified coffee in the experiment—(a) the control label, (b) the label with a statement, “one cup of coffee saves the forest”, (c) the label with an illustration of forests, and (d) the label with both the statement and the illustration



(a)



(b)



(c)



(d)

Note: The language in the figure is translated into English from Japanese.

Figure 5: The proportions of the choices of participants in the treatment and control groups during the first and second selections

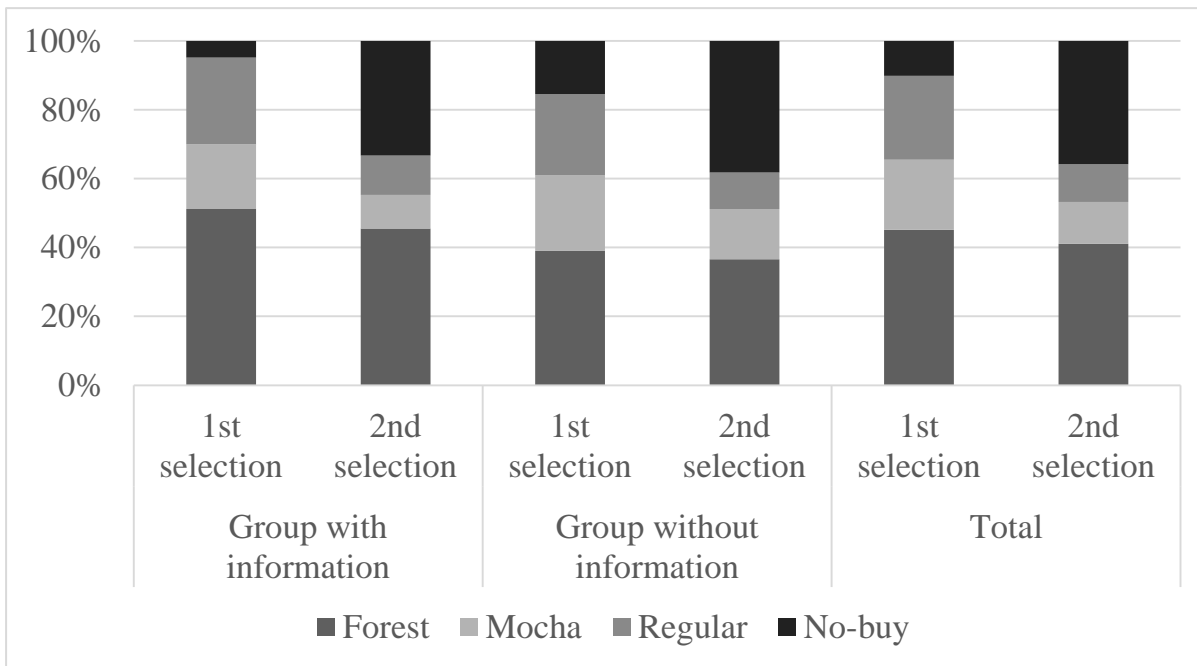


Table 1: Participants' socio-demographic characteristics in terms of the groups with and without the provision of information

	Group with information	Group without information	Total
	(1)	(2)	(3)
Number of participants	123	123	246
Proportion of female participants	41	53	47
Average age	20.9	21.4	21.1
	(1.7)	(4.3)	(3.2)
Proportion of coffee drinkers (%)	89.4	82.9	86.2
	(30.9)	(37.8)	(34.6)
Proportion of coffee lovers (%)	31.7	28.5	30.1
	(46.7)	(45.3)	(46.0)
Proportion of participants with a high environmental interest (%)	12.2	8.9	10.6
	(32.9)	(28.7)	(30.8)
Proportion of environmentally active participants (%)	17.1	19.5	18.3
	(37.8)	(39.8)	(38.7)

Note: Standard deviations are presented in parentheses.

Table 2: Visual attention paid to the certification label and logo by the groups with and without the provision of information

Selection:	Group with information		Group without information		Total	
	First (1)	Second (2)	First (3)	Second (4)	First (5)	Second (6)
Decision time (<i>sec</i>)	8.65 (5.42)	11.67 (12.58)	8.99 (5.00)	12.14 (9.45)	8.82 (5.21)	11.91 (11.11)
Total fixation duration (<i>sec</i>)						
Certification label	2.76 (2.34)	3.96 (5.36)	2.75 (2.33)	3.81 (4.15)	2.76 (2.33)	3.89 (4.79)
Certification logo	0.33 (0.68)	0.52 (1.77)	0.26 (0.49)	0.62 (1.50)	0.30 (0.59)	0.57 (1.64)
Proportion of total fixation duration (%)						
Certification label	30.41 (13.42)	30.27 (15.89)	29.59 (14.23)	29.54 (15.80)	30.00 (13.81)	29.90 (15.82)
Certification logo	3.35 (4.39)	3.16 (4.68)	2.67 (4.64)	3.92 (5.63)	3.01 (4.52)	3.54 (5.18)

Note: Standard deviations are presented in parentheses.

Table 3: Visual attention paid to the certification label and logo on the four label designs

	Control Label (1)	Explanation Label (2)	Visualization Label (3)	Mixed Label (4)	Significant difference (5)
Decision time (<i>sec</i>)					
1 st selection	7.73 (4.28)	9.15 (4.75)	8.25 (5.60)	10.15 (5.85)	1–4
2 nd selection	11.99 (14.90)	11.86 (9.03)	11.21 (11.33)	12.56 (8.12)	
Total fixation duration (<i>sec</i>)					
Certification label (1 st selection)	2.12 (1.97)	2.38 (1.60)	2.88 (2.37)	3.65 (2.92)	1–4, 2–4
Certification label (2 nd selection)	3.41 (5.53)	3.55 (3.43)	4.20 (6.25)	4.37 (3.27)	
Certification logo (1 st selection)	0.47 (0.93)	0.18 (0.28)	0.33 (0.56)	0.20 (0.35)	1–2
Certification logo (2 nd selection)	0.87 (2.50)	0.32 (0.51)	0.74 (1.90)	0.35 (0.66)	

Note: Standard deviations are presented in parentheses; the paired numbers in Column 5 are statistically significant at the 10 percent level.

Table 4: Results of the first-stage estimations from the instrumental variable model

	1 st stage	1 st stage
	Label	Logo
	(1)	(2)
Dummy for the label with the statement	2.431 (2.834)	-2.020** (0.925)
Dummy for the label with the illustration	6.979** (2.833)	0.113 (0.925)
Dummy for the label with the statement and the illustration	9.222*** (2.856)	-1.622* (0.932)
Dummy for information provision	0.817 (2.164)	-0.419 (0.706)
Dummy for female	0.141 (2.020)	0.510 (0.659)
Dummy for coffee lovers	-0.895 (2.233)	-0.022 (0.729)
Dummy for prior awareness of coffee certification programs	2.297 (5.816)	-1.515 (1.898)
Dummy for prior purchasers of certified coffee	-4.507 (4.330)	1.645 (1.413)
Dummy for a high level of environmental interest	-5.321 (3.303)	-2.201** (1.078)
Dummy for participation in environmental activities	6.643** (2.634)	2.676*** (0.860)
Dummy for information provision *	0.807 (3.270)	-0.294 (1.067)
Dummy for prior purchasers of certified coffee		
Constant	24.512*** (2.543)	4.117*** (0.830)
Observations	246	246
R-squared	0.09	0.10

Note: Standard errors are presented in parentheses; *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 5: Determinants of purchasing behavior for certified forest coffee

	2nd stage of		
	benchmark estimation (1)	Robustness Check (2)	OLS (3)
Proportion of total fixation duration on the label (%)	0.016* (0.008)	0.015** (0.008)	0.016*** (0.002)
Proportion of total fixation duration on the logo (%)	0.037 (0.031)		0.001 (0.006)
Dummy for information provision	0.054 (0.065)		0.035 (0.059)
Dummy for female	-0.027 (0.060)		-0.012 (0.055)
Dummy for coffee lovers	0.021 (0.066)		0.022 (0.060)
Dummy for prior awareness of coffee certification programs	-0.107 (0.176)		-0.167 (0.158)
Dummy for prior purchasers of certified coffee	0.016 (0.130)		0.054 (0.117)
Dummy for a high level of environmental interest	0.120 (0.133)		0.046 (0.090)
Dummy for participation in environmental activities	0.010 (0.129)		0.108 (0.073)
Dummy for information provision *	0.183* (0.095)	0.208*** (0.081)	0.179** (0.089)
Dummy for prior purchasers of certified coffee			
Constant	-0.248 (0.284)	-0.050 (0.284)	-0.128* (0.073)
Observations	246	246	246
R-squared	0.17	0.29	0.30
First stage <i>F</i>	1.942	7.33	
Over-identifying test (Sargan statistics)	0.133	0.518	
<i>p</i> -values of Sargan statistics	0.716	0.472	

Note: Standard errors are presented in parentheses; *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

¹ Certified forest coffee is usually defined as sustainable coffee, together with other eco-label certified products, such as fair trade coffee and organic coffee (Rice, 2003). Although other certification programs include environmental criteria for certification, their main goals are different (Giovannucci and Ponte, 2005; Jha et al., 2014; Ponte, 2004). For example, the main purpose of fair trade certification is to guarantee a price floor for marginal producers in less-developed countries (Basu and Hicks, 2008). Forest coffee certification is the only certification program to focus primarily on forest conservation.

² Although Grunert (2011) noted that the high price of sustainable products would be a fundamental obstacle to purchasing behavior, we do not consider price in this study because it is widely known that the price elasticity for sustainability coffee is high and that consumers put a high value on lower prices (Cicia et al., 2010; Galarraga and Markandya, 2011; Van Loo et al., 2015).

³ Although we showed the three juice labels to the participants, the participants were shown the instruction of the experiment on the screen after the warm up question. Therefore, we believe that the warm up question would not be affecting the participants' choice.

⁴ The participants were not informed how many times they have to choose their preferences beforehand.

⁵ When using various specifications, we found that the results were virtually the same as the benchmark results.