When do consumers stand up for the environment?
Evidence from a large-scale social experiment to promote environmentally friendly coffee

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Abstract:

By conducting a social experiment, we investigate the appropriate marketing strategies to stimulate the purchase of environmentally friendly product (certified coffee). We contribute to the literature in the following three ways. First, our experimental scale is large, targeting more than 10,000 vending machines installed in the throughout Japan. Second, we distinguish the observations by the location of vending machines, such as open- and closed-spaces, and capture the actual purchase of certified coffee. Third, to rigorously identify the factors affecting the purchase of certified coffee, we use the prescreening regression approach to reduce the bias due to endogeneity and check the sensitivity of our results. The results show that the vending machines installed in the closed-space, such as factory, company and university, significantly increase the number of sales of certified coffee by providing the information regarding the certification system. Additionally, the information provision significantly increases the total sales of vending machines. These results suggest that the information provision in closed-space enhances users' purchase behavior for the certified coffee and successfully acquires the new customers. In contrast, none of the interventions have significant impact on the vending machines installed in the open-space, such as station and shopping mall.

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Keywords: marketing; social experiment; sustainability labels; coffee certification; impact evaluation

1 Introduction

To prevent and reduce global environmental degradation and pollution, sustainable consumption and production through eco-label certification schemes have been promoted in recent years [1]. Particularly, the coffee industry is viewed as a pioneer industry for eco-label certification systems [2]. The eco-label certified coffee is usually defined as sustainable coffee, including fair trade coffee, organic coffee, and shade-grown coffee (i.e., forest coffee). Because the eco-label coffee certification programs include environmental criteria, such as the harmonization with other species, the soil condition, water quality, and the amount of chemical application [3], the consumption of certified coffee directly contribute to the environmental conservation of production areas, i.e., mostly in developed countries. In fact, several empirical studies have found positive impacts of coffee certification programs on environmental conservation [3-8]. However, since most certified coffee is consumed in developed countries, the sustainability of coffee certification programs strongly depends on the consumption in developed countries.

In this respect, the recent market situation in most developed countries is quite encouraging. The total sales volume more than doubled from approximately 410 tons to 840 tons in between 2008 and 2012 [9]. In the United States, the sales of sustainable coffee in supermarkets grew 48 percent between 2010 and 2012, reaching 32 million dollars [10]. Furthermore, the consumers in North America and Europe find value in certified coffee. For example, Hainmueller et al. (2015) reported that carrying the fair trade label to the product package increased the sales by 10 percent [11]. In addition, consumers in the United States are willing to pay an extra 2.5-3.3 percent for certified coffee over regular coffee, according to willingness-to-pay (WTP) surveys [12]. In the case of Europe, the average WTP premium for fair trade coffee among Belgium consumers is 10 percent [13].

However, the situation in Asia is totally 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 fairly limited in Japan [14]. Figure 1 shows the per capita imported quantity of sustainable coffee. Although the import volume in Japan increased between 2004 and 2009, the volume in Japan is relatively low compared to that in other countries. In addition, Chinese coffee consumption has increased in recent year, whereas the awareness of sustainable coffee in China is still low [15]. The current market situation in Asian countries implies that certain obstacles limit

consumers' purchasing behaviors for certified coffee.

To identify the obstacles for certified coffee consumption in Asia, Takahashi, Todo, and Funaki (2017) used eye-tracking techniques and conducted the laboratory randomized experiment in Japan [16]. However, there is a significant shortcoming in this study. Although they carefully design the experiment to investigate actual purchasing behavior for the certified coffee, all the participants in their experiment are undergraduate students from one university. Hence, the findings of this study may not reflect the average consumer behavior and the determinants of consumer behaviors in Asia remain unclear.

To fill this empirical gap, we investigate the appropriate marketing strategies to stimulate the purchase of the certified coffee by conducting a social experiment in Japan. Our experiment is quite unique in that we collaborate with a beverage company (i.e., Apex corporation) which provides coffee and other beverage through the paper cup style vending machines (Figure 1). This collaboration makes it possible to identify how different marketing strategies affect the actual purchase of certified coffee, instead of examining the willingness-to-pay (WTP) based on hypothetical questions. In addition, because the company installs their vending machines almost throughout Japan (except Okinawa prefecture), our experimental scale becomes large. Furthermore, following the recent studies in the top field journals, we employ the prescreening regression approach to control for endogeneity biases and confirm the sensitivity of our results using Oster's sensitivity analysis. To the best of our knowledge, this is the first study to rigorously examine the determinants of purchasing behavior for sustainable products using a large scale social experiment.

2   Literature review and hypothesis

2.1   An overview and shortcomings of previous studies

The coffee industry was an early adopter of eco-label certification programs [2], and the determinants of purchasing behavior for certified coffee have been examined in the academic literature.

For example, Arnot et al. (2006) found that information of fair trade programs is an important factor of fair trade consumption [17]. A similar finding is raised in the study targeting certified organic apples, indicating that information provision increases the WTP [18]. In addition, Golding and Peattie (2005) and De Ferran and Grunert (2007) emphasized the importance of marketing strategies to increase the market share of fair trade coffee [19, 20], while other study showed that an interest in environmental issues and sustainability

is associated with consumers' decisions to purchase fair trade [21]. Furthermore, recent studies adopted the eye-tracking technology, commonly used in the marketing literature, and examine how visual attention to the certified coffee affected the purchasing behavior [22].

However, previous research has three major shortcomings. First, the previous studies' 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 programs or interests in environmental issues could enhance the consumption of certified products, whether consumers know information about certified products or concern toward environmental issues are endogenously determined by, for instance, their characteristics. If unobserved characteristics affect both receiving the information and consuming certified products, the estimated effect of information/interests captures the effect of unobserved characteristics and is overvalued. To eliminate biases due to endogeneity, one possible solution is the randomized control trail (RCT) which has been utilized extensively in the impact evaluation literature [23]. In an RCT, a particular treatment is provided to randomly selected subjects, and hence, the effect of the treatment can be accurately estimated. However, adopting the RCT method to the empirical study is sometimes difficult due to budget constraint and a lack of appropriate experiment collaborators. If the RCT method is not available, the alternative approach is the combination of the non-random experiment and rigorous econometric analysis. Although the treated subjects are not randomly selected, the effect of the treatment can be estimated by reducing the biases through the rigorous econometric techniques [24]. However, RCTs or non-random experiments combined with the rigorous econometric analysis are rarely used in the literature on the consumption of certified products.

Second, the measurement of purchasing behavior used in the previous literature may not be able to capture the actual purchasing behavior. The most common measurement method used in the previous studies is the WTP method under the laboratory experimental condition [13, 22, 25, 26]. However, the accuracy of such analyses may be seriously contaminated by measurement biases, and hence, whether the results from studies relying on WTP reflect actual consumers' behavior is unclear [27]. There are a few exceptional studies. For example, Arnot et al. (2006) and Takahashi, Todo, and Funaki (2017) conducted the experiment to capture the actual purchase for certified coffee. However, these studies conducted the experiment at only one university and the participants of the experiment were students or university staffs, which causes the

serious selection bias. Another study by Andorfer and Liebe (2015) implemented the interventions, such as the information provision, price reduction, and moral appeal, at three supermarkets in Germany [28]. Unfortunately, they implemented the all treatments to three supermarkets by taking three-week intervals. Although they set the three-week control period, the same customers are likely to receive the multiple treatments, and hence, the results of their study would be biased by the carry-over effects.

Finally, the previous empirical studies were mainly conducted in the Western countries and, as mentioned, the reasons of limited market share in Asia remain unclear. One exception is Takahashi, Todo, and Funaki (2017), who recently applied eye-tracking technology when conducting a choice experiment in Japan. Although this study has the significant limitations, such as all the participants in this study are students from one university, we believe their contribution is important for providing insight into the unclear situation in Asia. Therefore, we construct the hypothesis for the determinants of purchasing behavior for certified coffee in Asian counties by following their study, which specified in the next section.

To overcome the shortcomings in the literature, we utilize the social experimental approach and most recent econometric techniques. As we explain later in further detail, the combination of two methods enables us to more accurately estimate the effects of marketing strategies on the actual consumption of certified coffee.

2.2   Hypotheses of this study

In this study, we follow the study of Takahashi, Todo, and Funaki (2017) and develop hypotheses regarding the determinants of purchasing behavior for certified coffee [16]. In their study, they conducted the experiment using the eye tracker devices and identified the determinants of purchasing behavior under the experimental condition.

There are two major findings of their study. First, the visual attention to the certified coffee label is the key factor affecting the purchasing behavior for certified coffee. They found that changing the label design of the certified coffee increased the visual attention of the experiment participants and increased the willingness to purchase the certified coffee. However, unlike to the relationship between the visual attention to the label and purchasing behavior, the visual attention to the certification logo had no impact on the purchase of certified coffee.

Second, in addition to the visual attention to the label, the information provision of the certification system partially has significant effects on stimulating the purchases of certified coffee. In their experiment, they randomly provided the information about the certification system to estimate the effects of the information provision. However, their estimation results suggested that the information provision in general had no significant effect. In contrast, if they provide the information to the participants who have previously purchased certified coffee, then, those participants are likely to purchase certified coffee. Based on this result, they concluded that reinforcement of information across time is important to stimulate the purchasing behavior.

Although the two factors (i.e., the visual attention and information provision) are raised as the potential marketing strategies for the certified coffee from their study, we assume that the marketing strategies should be determined based on sales locations. In this study, we categorize sales locations into two groups, such as open-space and closed-space. The definition of open-space in this study is that the areas where unspecified general consumers can access and purchase the products. For example, the open-space areas are including the platform of train station and cafeteria within shopping mall. In contrast, we define closed-space as the areas where accessibility is limited for specified people and specified consumers regularly use or purchase the products. The break room within the factory and company/university's canteen are included as closed-space. Following the results of Takahashi, Todo, and Funaki (2017), we address the following hypotheses to promote the purchase of certified coffee in open- and closed-spaces.

First, as several empirical studies suggested, the visual attention to the product label is important factor affecting the purchasing behavior [16, 22, 29]. Particularly in open-space, it could be essential to get consumers' visual attention because most of consumers may not spend much time on searching the products to purchase. In fact, Grunert et al. (2010) reported that many shoppers in retail store only examined the front label of the food package, making their choices rather quickly; 40 percent of their respondents spent less than 15 seconds making such decisions [30]. To increase the visual attention to the label of certified coffee, Takahashi, Todo, and Funaki (2017) proposed to use the label design with the image of forest that visually links certified coffee and environmental conservation. If their assumption is correct, we may expect to promote the purchasing behavior of the open-space consumers by replacing the label design of certified coffee. This argument leads to the following hypothesis.

Hypothesis 1: In open-space, labels with advertising illustrations that highlight characteristics of certified coffee increase visual attention and further increase a consumer's probability of purchasing certified coffee.

Unlike to open-space, the closed-space consumers regularly use the same sales location, and hence, the probability of receiving the information for the closed-space consumers is higher than that of the open-space consumers. Because consumers' awareness of certification system may influence their food choices [12, 16, 31], the consumption level in closed-space would increase by the information provision of certification system. Therefore, the second hypothesis is provided below.

Hypothesis 2: In closed-space, the information provision of certification system increases the consumers' awareness of certified coffee and enhances their purchasing behavior.

Furthermore, we do not consider price in this study even though many studies noted that the high price of certified products would be a fundamental obstacle to purchasing behavior [32]. There are two reasons not including the price factor: (1) it is widely known that the price elasticity for certified coffee is high and that consumers place a high value on lower prices [22, 33, 34] and (2) the vending machine company collaborated with this experiment provides the cup coffee with and without the certification within the same vending machines at the same price, which we will discuss in the next section.

3   Experimental design and data collection

To test the two hypotheses addressed above, we conducted a social experiment in Japan. Our experiment is quite unique in that we collaborate with a beverage company (i.e., Apex corporation) which provides coffee and other beverage through the paper cup style vending machines (Figure 2). Because the company installs their vending machines almost throughout Japan (except Okinawa prefecture), our experimental scale becomes large.

This company provides the coffee called "*Brazil*" which contains coffee certified by the Rainforest Alliance, a major certification organization based in the United States. The certified products of the

Rainforest Alliance can be identified by the certification logo (i.e., the green frog). Although the company usually provides non-certified regular coffee together with the certified coffee in the same vending machine, the price of cup coffee with and without certification is same. By collaborating with the company, we assigned the different marketing strategies for certified coffee "*Brazil*" and examined how our interventions affected the sales of certified coffee. In this section, we describe the details of our interventions and data collection.

3.1   Intervention: Marketing strategies

In our experiment, we arranged the two types of marketing strategy for the certified coffee. The first intervention is that we change the label design for the certified coffee. Initially, the company adopts the simple green label design for the certified coffee "*Brazil*" (picture a in Figure 3). We define the original green label as the control label. Following the study by Takahashi, Todo, and Funaki (2017), we arrange the label design including a picture of shade grown coffee garden which aims to visually link certified coffee and environmental conservation in Brazil, presented in the picture b in Figure 3 (hereafter, "the new label"). Except the background image of the label, both label designs include exactly same information: the product name "*Brazil*", the place of origin, and the logo of the Rainforest Alliance (i.e., the green frog).

Second, to provide the information about the certification system, we prepared the sticker which includes a short statement about the contribution of certified coffee (hereafter, "the information sticker"). To ensure conciseness and understandability, the statement we used was "Environmentally Friendly Coffee: Purchasing the coffee certified by the Rainforest Alliance would contribute to forest conservation" (Figure 4).

We assume that the first strategy, such as replacing the control label to the new label, would increase the visual attention indicated as Hypothesis 1, while the second intervention can test the effect of information provision as explained in Hypothesis 2.

3.2   Target area of experiment

As mentioned, the collaborated company operates their vending machines at almost throughout Japan and the certified coffee "*Brazil*" is available in total 10,475 vending machines. In this study, we chose 9

cities as target areas for implementing the above marketing strategies. The names of selected cities are bellow (prefecture name is presented in parentheses): Koriyama (Fukushima), Shinagawa (Tokyo), Fuchu (Tokyo), Chiba (Chiba), Atsugi (Kanagawa), Kofu (Yamanashi), Tsu (Mie), Osaka (Osaka), and Hiroshima (Hiroshima). In these 9 cities, total 1,452 vending machines are installed, shown as dark dot in map a in Figure 5, and we use them as the treatment group. In contrast, we will not intervene to the remaining 9,023 vending machines, illustrated as light gray dot in map b in Figure 5, and use as the control group. In other words, those vending machines in the control group continuously use the control label and not posting the information sticker during the experimental period. Map c in Figure 5 is the location of vending machines in both the treatment and control groups.

As Figure 5 indicated, although our treated vending machines were widely located throughout main island of Japan (Honshu), the above 9 cities for the treatment group were not randomly selected. These cities were chosen because the branch offices in these cities are willing to cooperate to our experiment.

After selecting the target cities for the intervention, we randomly divided the 9 cities into 3 groups. The vending machines in the first group called "the new label group" will replace the control label to the new label during the experimental period, and the information sticker is not posted in these machines. In contrast, the second group vending machines (i.e., the information sticker group) use the control label together with the information sticker. Finally, we define the third group as the both group that the vending machines in this group use the new label and post the information sticker on the side or front of the machines. By including the both group, we can capture the combination effect of the new label and information provision.

The total number of observations in open- and closed-spaces for each group is presented in Table 1. Among the 1,452 vending machines in the treatment group, 317 machines are installed in open-space, while 1,135 are in closed-space. To estimate the effect of marketing strategies in open- and closed-spaces, we separately use the open-space vending machines (2,783 observations) and closed-space machines (7,692 observations) as the observation for the analysis.

3.3   Experimental period and data collection

The intervention of our experiment was carried out from June till September 2016. We define these 4 months as the experimental period. In addition to the experimental period, we included May for the data

collection to gauge the sales condition before the experiment. In this study, we decided to obtain the two years sales data for each vending machine to estimate the sales changes, and therefore, the sales data between May and September in 2015 and 2016 is collected.

The sales data collected in this study is followed: the number of cup sales for the certified coffee and total sales of vending machine. Although we can capture the number of cup sales for the certified coffee, the sales amount of certified coffee is unclear because we don't know the price of certified coffee which is varied according to the vending machines. In contrast, we can obtain the total sales of vending machines which include the sales amount of certified coffee and other beverages, such as the non-certified coffee, soft drink, and soup.

Since we obtained the above sales data between May and September in 2015 and 2016, we estimated the changes in cup sales/total sales of the vending machine for each month. In this study, we examined how each marketing strategy affects the changes in cup sales of certified coffee and total sales of vending machine and identified the appropriate sales strategies for certified coffee in open- and closed-spaces.

4   Estimation methodology

To rigorously identify the determinants of purchasing behavior for certified coffee, we estimate the panel data regressions of the impact of each marketing strategy. We begin with the following difference-in-differences (DID) specification:

$$Y_{im} = \alpha + \beta_1 Label_{im} + \beta_2 Sticker_{im} + \beta_3 Both_{im} + \gamma Treat_i + \sum_{m=6}^{9} \theta_m + \varepsilon_{im} \tag{1}$$

where Y_{im} is an outcome of interest (i.e., the change in the natural logarithm of the number of cup sales for certified coffee or total sales of vending machine) for vending machine i in month m. $Label_{im}$, $Sticker_{im}$, and $Both_{im}$ are the dummy variables which take a value of 1 if vending machine i receives the treatment of new label, information sticker, and both interventions in month m, respectively. $Treat_i$ denotes whether vending machine i is ever received any treatment during our experimental period and θ_m indicates monthly dummies. Standard errors are clustered at the city level to account for autocorrelation in the error term ε_{im}.

By employing the DID method, we can control any baseline-level differences in the outcome Y at the

group level. In addition to equation 1, we estimate the prefecture-level fixed effects model for the robustness check, which is specified as follows:

$$Y_{im} = \rho_i + \beta_1 Label_{im} + \beta_2 Sticker_{im} + \beta_3 Both_{im} + \sum_{m=6}^{9} \theta_m + \varepsilon_{im} \qquad (2)$$

where ρ_i is the prefecture-specific fixed effects for vending machine i, which reduces the unobserved time-invariant differences between the prefectures.

In both equations, β_1, β_2, and β_3 measure the average impact of each marketing strategy for certified coffee on the outcome Y. However, we cannot simply estimate the equations 1 and 2 due to endogeneity problems [24]. As mentioned, the 9 cities selected for the treatment group are not randomly selected. Therefore, because the assignment of marketing strategy is endogenously determined, the results of the equations 1 and 2 are likely to be biased under selection bias.

To reduce selection bias, one of the major analytical approach used in the study of impact evaluation is the propensity score matching (PSM) method [4, 5, 8, 35, 36]. However, recent study by King and Nielsen (2016) argues that the PSM approach increases imbalance in the empirical distribution even compared with the original data, which generates statistical bias [37]. Therefore, we follow the prescreening regression approach suggested by Crump et al. (2009) [38]. In the prescreening approach, we estimate a propensity score and drop observations with estimated propensity scores outside of the range [0.1, 0.9]. This prescreening procedure ensures that the regression is estimated based on the sample which covariate distribution overlaps for the treated and non-treated vending machines. The several studies show that the prescreening approach works well in estimating the treatment effects [39, 40].

To obtain the propensity scores, we use a probit model including the 10 independent variables: total sales of vending machine and number of cup sales for certified coffee between May and September in 2015. These variables would control the differences related to the initial sales condition of vending machine. After estimating the propensity scores and restricting to the range [0.1, 0.9], 821 observations are dropped from our sample (39 treated vending machines and 782 non-treated vending machines). Hence, total number of vending machines used for the prescreening regression is 9,654: 7,550 vending machines are located in the closed space and 2,104 are in the open space.

Although we control the selection bias by using the prescreening approach, there is still a possibility that the treatment effects may be contaminated by unobserved factors (hidden bias). To check the sensitivity of our results, we conduct sensitivity analysis developed in Oster (2014) [41]. Oster's sensitivity analysis is adopted in the recent empirical literatures [42-44]. In this analysis, we test whether unobservables can plausibly explain the results under the assumption that selection on observables and unobservables is proportional. Oster derives the coefficient of proportionality, specified as δ, necessary to cause the observed treatment effect spuriously. A large value of δ suggests that a high degree of correlated unobservable selection would be necessary to explain away the observed estimate, indicating robustness of the results. The benchmark coefficient is one (i.e., $\delta = 1$) which observables and unobservables are equally correlated with treatment [41, 45]. In contrast, a value of $\delta = 2$ would indicate that unobservables need to be twice as important as the observables to generate a treatment effect of zero. In this study, we calculate the value of δ which negates the observed treatment effect.

5   Estimation results

5.1   Effect of sales strategies in open- and closed-spaces

Table 2 shows the effect of sales strategies on the number of cup sales for certified coffee and total sales of vending machine in open-space, with columns 1 and 3 are the results of DID model and columns 2 and 4 are the prefecture fixed-effect model. Contrary to our expectations, the results of the cup sales estimations presented in columns 1 and 2 showed that none of the intervention dummies were significantly different from zero. Furthermore, we found that the three intervention dummies were insignificant in the results of the total sales of vending machine in open-space, shown in columns 3 and 4.

Although we are expecting the positive impact of new label on the sales of vending machines in open-space, the new label intervention fails to increase the sales of certified coffee and total sales of vending machines in open-space. Therefore, we reject Hypothesis 1.

The results of the closed-space vending machine are presented in Table 3. In contrast to the results in the open-space vending machine, we found that the sticker and both dummies had a significantly positive impact on the number of cup sales for certified coffee, while there is no significant effect from the new label dummy

(Columns 1 and 2). The value of the coefficient indicates that the information provision through posting the small sticker increases the sales of certified coffee by approximately 7 percent.

Moreover, the sticker and both dummies are also positive and significant in the results of the total sales of vending machine (columns 3 and 4). Although the coefficient of sticker dummy is higher than that of both dummy, there is no statistical difference between these variables. These results indicate that the information provision is positively associated with total sales of vending machine. Based on these results, we conclude that Hypothesis 2 is supported.

Finally, we check the sensitivity of our results by calculating the proportional selection δ. Since the results in open-space are insignificant, we only estimate the values in closed-space. The results in Table 4 indicate that the estimated values of δ for sticker and both dummies are negative for all estimations in closed-space. Negative values of δ mean that unobservables are negatively correlated with the controls to negate the estimate. Because positively correlated unobservables are the main threat to identification, the results of negative δs suggest that our estimated treatment effects are robust against hidden bias.

5.2   Discussion

Overall, our estimation results suggest that replacing the label to new design or presenting the information of certification program do not stimulate the purchase of certified coffee in open-space. One of the possible reason is that it is difficult to attract consumers' attention in open-space. In this study, we define open-space as the area where unspecified general consumers can access and purchase the product. For example, the platform of train station and cafeteria within shopping mall are included as open-space and the consumers in open-space have a purpose besides drinking coffee, such as on the way to another destination or purchasing new clothes. Because of that, the open-space consumers may not pay attention to the label design or information sticker, resulting in the insignificant coefficient.

In contrast, as expected, the information provision through the sticker successfully stimulates the purchase of certified coffee in closed-space. There are two possible explanations. The first possible explanation is the information diffusion through the network within closed-space. Since the closed-space consumers are regularly use the same vending machine, there is a high possibility that those consumers pay attention to the information and increase the awareness of certification system. We assume that those aware

consumers may become a source of information for certification system and the certification information is diffused to other consumers through the social network within closed-space. In fact, the importance of the information diffusion through the social network is pointed out in the field of network science [46-50].

Another explanation is the image motivation. It is well known that the image motivation, or signaling a good image to others, is the important factor to increase the donations [51, 52]. In recent years, the image motivation is identified as important factor to stimulate the environmentally friendly behaviors. For example, Delmas and Lessem (2014) conducted the experiment in the United Sates and found that the environmentally friendly reputation (green reputation) successfully decrease energy use [53]. In our case, the consumers in closed-space may purchase the certified coffee to send a signal of environmentally friendly person to other people in closed-space, such as co-workers, by holding a coffee cup from the vending machine, resulting in the increase of cup sales.

Furthermore, we found that the information provision in closed-space increased both the cup sales of certified coffee and total sales of vending machine. If the regular customers who purchase non-certified coffee from the vending machine before the experiment receive the information and change their preference to the certified coffee, then, the cup sales for certified coffee would increase but the total sales of vending machine should be constant because the consumers simply change the product within the same vending machine. However, it is clear that this is not the case in our study. The probable reason of increase in the total sales is due to acquirement of new customers. We assume that showcasing the environmental message through the sticker in closed-space enhances the corporate image among the consumers in closed-space, resulting in the increase of new customers. In fact, many studies indicate the association between the corporate image and profitability in the previous studies [54-56].

6   Conclusion

This paper investigates the appropriate marketing strategies to stimulate the purchase of certified coffee by conducting a social experiment in Japan. Particularly, this study focuses on how the visual impact (i.e., replacing the label to new design) and provision of information on certification system through small sticker affect the sales of certified coffee. We contribute to the literature by focusing on the consumers' actual purchasing behaviors by utilizing more than 10 thousand vending machines rather than using a WTP measure

with hypothetical questions. In addition, our study is unique in that we distinguish the observations based on the location of vending machines, such as open- and closed-spaces, and investigate the impact of marketing strategies on the sales of certified coffee and vending machine. Furthermore, we rigorously estimate the average treatment effects of the marketing strategies by using the prescreening regression approach.

We find that none of the interventions have significant impact on the cup sales of certified coffee and total sales of vending machine in the open-space area. In contrast, the information provision of certification system in closed-space is associated with both the cup sales of certified coffee and total sales of vending machine. Following the Oster's sensitivity analysis, we confirm that our estimated results are quite robust. These results suggest that the information provision in closed-space enhances users' purchase behavior for the certified coffee and successfully acquires the new customers.

We believe that these results could be useful information for the certification organizations and firms dealing with the certified products. One possible reason of the limited market share of certified coffee in Asia is that the certification organizations or firms may launch the publicity campaign for the certified products without considering the information diffusion. Our findings suggest that we may promote the purchase of certified products by utilizing the information diffusion network of closed-space and green reputation among the closed-space consumers.

Overall, our estimation results suggest that the provision of certification information to the consumers in the specific sales location (i.e., closed-space) could be the important factor stimulating the demand for certified coffee. However, there are several limitations. First, although we carefully estimate the impact of marketing strategies on the sales of certified coffee, the experimental design of this study is not based on the RCT design. Because an economic analysis based on a RCT would have the advantage of capturing the effectiveness of the intervention which should be free of selection bias, the empirical evidence based on the RCT is needed [57].

Second, in this study, we could not find the factor affecting the purchasing behavior for certified coffee in open-space. To promote the sustainable consumption in Japan and other Asian countries, it is essential to identify how to stimulate the purchase in the open-space areas. Therefore, further studies should conduct the experiment focusing on the determinants of purchasing behavior in open-space.

Third, although we proposed the interpretations for the results of closed space estimations, the actual

mechanism of the sales increase in closed-space is still unclear. To overcome this shortcoming, the theoretical studies or qualitative investigations are needed.

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Figure 1: Quantity of sustainable coffee imported per capita (grams)
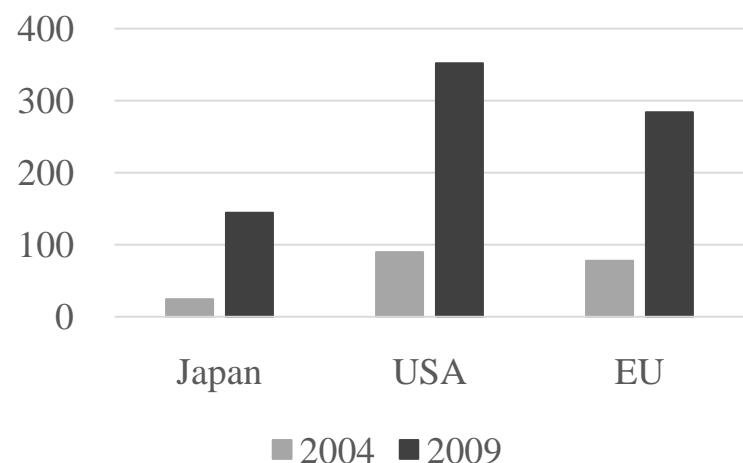
Figure 2: The paper cup style vending machine operated by the Apex corporation

Figure 3: Labels for the certified coffee used in the experiment—(a) the original (control) label and (b) the new a picture of shade grown coffee garden


(a)

(b)

Note: The labels written in Japanese are only available. Except the background image of the label, both label designs include exactly same information.

Figure 4: The explanation sticker of vending machines used in the experiment


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

Figure 5: The location of vending machines used in the experiment
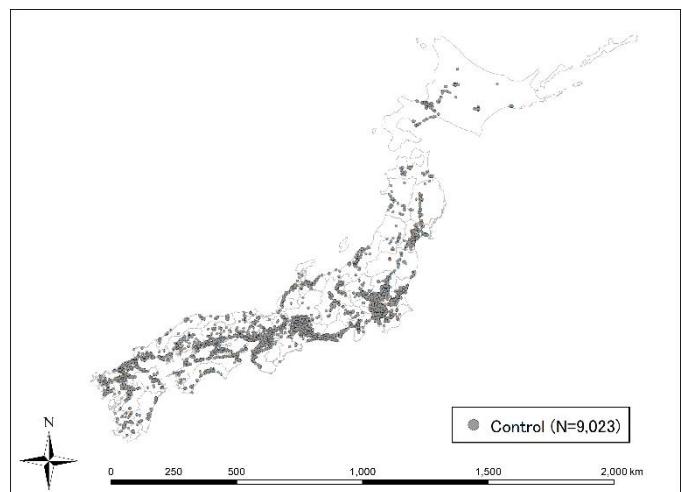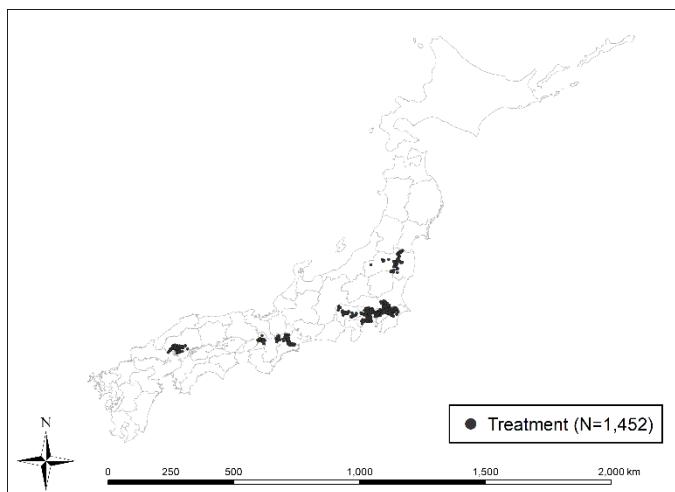
(a)

(b)
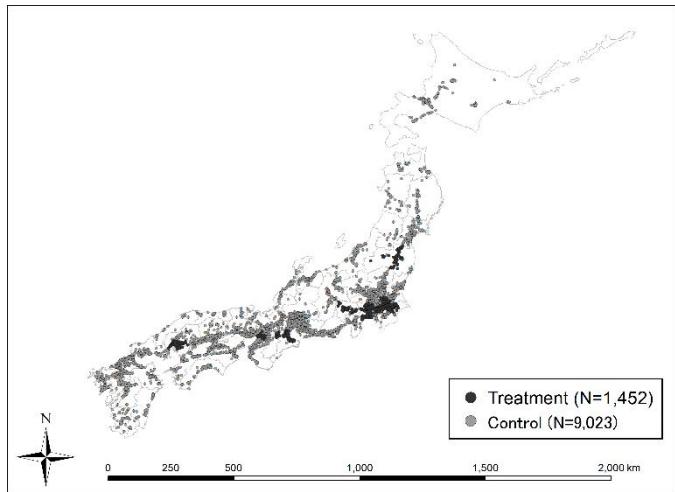
(c)

Table 1: The number of observations

Groups	Open-space	Closed-space	Total
Treatment Group	317	1,135	1,452
New label	122	274	396
Information sticker	106	388	494
Both new label and sticker	89	473	562
Control Group	2,466	6,557	9,023
Total (Treatment + Control)	2,783	7,692	10,475

Table 2: Effect of sales strategies on the number of cup sales for certified coffee and total sales of

vending machine in open-space

	Cup sales		Total sales	
	DID	Fixed effect	DID	Fixed effect
	(1)	(2)	(3)	(4)
New label dummy	0.005	-0.017	-0.002	-0.029
	(0.048)	(0.043)	(0.037)	(0.034)
Sticker dummy	0.070	-0.047	0.039	-0.025
	(0.042)	(0.056)	(0.032)	(0.028)
Both dummy	0.044	0.006	0.020	-0.007
	(0.056)	(0.067)	(0.031)	(0.040)
Constant	0.090***	0.090***	0.095**	0.095**
	(0.021)	(0.018)	(0.040)	(0.037)
Monthly fixed effect	YES	YES	YES	YES
Prefecture fixed effect	NO	YES	NO	YES
Observations	10,520	10,520	10,520	10,520
R−squared	0.016	0.031	0.015	0.026

Note: Standard errors are in parentheses; *, **, and *** indicate statistical significance at the 10, 5,

and 1 percent levels, respectively.

Table 3: Effect of sales strategies on the number of cup sales for certified coffee and total sales of vending

machine in closed-space

	Cup sales		Total sales	
	DID	Fixed effect	DID	Fixed effect
	(1)	(2)	(3)	(4)
New label dummy	0.023	0.053	0.018	0.013
	(0.040)	(0.047)	(0.028)	(0.027)
Sticker dummy	0.071**	0.063*	0.078**	0.064*
	(0.036)	(0.032)	(0.037)	(0.034)
Both dummy	0.070**	0.091***	0.049*	0.041**
	(0.029)	(0.030)	(0.025)	(0.019)
Constant	0.023*	0.023*	0.015	0.015
	(0.014)	(0.013)	(0.024)	(0.021)
Monthly fixed effect	YES	YES	YES	YES
Prefecture fixed effect	NO	YES	NO	YES
Observations	37,746	37,746	37,746	37,746
R−squared	0.008	0.019	0.010	0.046

Note: Standard errors are in parentheses; *, **, and *** indicate statistical significance at the 10, 5, and 1

percent levels, respectively

Table 4: Robustness to unobservable factors (Proportional selection δ)

	Cup sales		Total sales	
	DID	Fixed effect	DID	Fixed effect
	(1)	(2)	(3)	(4)
New label dummy	-0.004	-0.012	-0.004	-0.012
Sticker dummy	-0.014	-0.051	-0.019	-0.167
Both dummy	-0.014	-0.032	-0.012	-0.061

Note: Given R_{max} is equal to 1.