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Do green nudges affect“green curtains”? Results from a field experiment in Japan

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Do green nudges affect "green curtains”? Results from a field experiment in Japan

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Abstract

In Japan, households are required to save more electricity in response to electricity supply shortages after the Great East Japan Earthquake and meet the 66% greenhouse gas reduction target in the residential sector under the Paris Agreement. This study examines the effects of providing information to promote the implementation of *green curtains*, a summer electricity-saving behavior at home, using a randomized controlled trial for residents in Japan. Green curtains are made by growing annual vines, like curtains on a net stretched across a window or a wall, and have the effect of reducing room temperature by providing shade. Based on their characteristics, being visible to others and a low implementation rate, we examine the effects of the perceptions and cognitions of the implementation of green curtains in the city (subjective descriptive norm) and the information provided on the trends in green curtain implementation in neighboring districts (objective descriptive norm) on the respondents' willingness to implement. The results show that subjective descriptive norms influence the willingness to implement. Further, the information about neighboring districts with slightly higher green curtain implementation rates is more effective than information about neighboring districts with significantly higher rates. This examination of the comprehensive influence of descriptive norms and the effect of the dynamic and relatively comparative forms of providing descriptive norm information have implications for studies in other fields on promoting prosocial behaviors visible to others and with low implementation rates.

Keywords: social comparison, descriptive norm, green curtains, information provision, energy-saving behaviour, randomized controlled trial

1. Introduction

In Japan, growing green curtains is a way to keep cool at home. Green curtains are made of annual vines, such as morning glory, loofah, and bitter gourd, which are grown like curtains on a net stretched across a window or wall (Fig. 1). The shading effect lowers the room temperature and reduces the cooling demand, thereby saving electricity. According to a review by Abe et al. (2020), the indoor temperature reduction effect of green curtains ranges from 0.7–4.1°C. In response to the power shortage caused by the accident at the Fukushima Daiichi Nuclear Power Plant following the Great East Japan Earthquake in 2011, the Ministry of the Environment and the Ministry of Land, Infrastructure, Transport, and Tourism promoted green curtains, and many local governments implemented promotional activities. However, even in Fukuchiyama City in Kyoto Prefecture, which had promoted green curtains before the earthquake and aimed to be the No.1 city in green curtain implementation rate, the implementation rate of green curtains remains 11.7%.[1]

< Fig. 1>

Most studies on green curtains have focused on examining their effectiveness in lowering room temperature; no studies exist on information provision measures that promote their implementation that would be beneficial for local governments. Many studies have used the Home Energy Report (HER) as an information provision measure to promote energy-saving behaviors (Allcott, 2011; Allcott and Rogers, 2014; Brandon et al., 2019; Andor et al., 2020). These studies used randomized controlled trials (RCTs) to examine the effect of providing information about the difference in electricity consumption between one's own household and neighboring households to promote energy conservation. However, most of them have examined the effect of reducing electricity consumption (kWh) by presenting the electricity consumption of neighboring households as an objective descriptive norm (Cialdini et al., 1991). Nor have many studies examined the effect on specific electricity conservation behaviors (McAndrew et al., 2021). Therefore, to propose information provision measures promoting the adoption of green curtains, it is necessary to examine the effect of objective descriptive norm information about green curtains (e.g., X% of households in district Z implement green curtains) on their implementation by using RCTs.

Unlike indoor energy-saving behaviors such as limiting the use of air conditioners and lighting, green curtains are outdoor energy-saving behaviors that are visible to others outside the family. Therefore, social learning based on the perceptions and cognitions of green curtains implemented by others in the city may influence the decision to implement green curtains. The incentives for behaviors aimed at acquiring signal values, such as reputation and social status, are expected to be higher than those for indoor energy-saving behaviors. This suggests that not only the objective descriptive norm information provided in the RCT but also the subjective descriptive norm of each person's perceptions and cognitions of others' green curtain implementation may influence its overall implementation. Examining the effects of subjective descriptive norms of green curtains

[1] Calculated as number of households implementing green curtains/total households. These figures are for the summer of 2017, when this study was conducted and based on a visual survey conducted by the staff of the Fukuchiyama City Environmental Council.

visible to others may reveal drivers that are different from those that promote indoor energy-saving behavior.

This study aims to examine the provision of information to promote the implementation of green curtains using an RCT. Specifically, it examines the effects of perceptions and cognitions about the implementation of green curtains in the city (subjective descriptive norms of green curtains) and the information provided in the RCT about the implementation rate in neighboring districts (objective descriptive norms of green curtains), and the money saved by implementing green curtains, on the willingness to implement. In Japan, the shortage of electricity supply since the Great East Japan Earthquake in 2011 has led to the need to reduce maximum electricity consumption (kW) in the summer. In addition, based on the Paris Agreement, the target for the household sector is a 66% reduction in greenhouse gas emissions by 2030 over 2013,[2] which requires a further reduction in household electricity consumption (kWh). To this end, we believe that building specific power-saving behaviors is an effective measure and focus on promoting the implementation of green curtains in this study. In addition to promoting power-saving behaviors visible to others, which are unique to each country and region, the results of this study will also have implications for research on promoting environmentally conscious behaviors visible to others, such as buying environmentally labeled products and organic vegetables in stores, using "my bag" and "my mug," and participating in environmental organizations and environmental projects.

This study comprised two experiments. Although the implementation of green curtains results in electricity savings, it is time-consuming to grow plants outdoors. It is also unclear whether people perceive it as an effective electricity-saving behavior. Therefore, it is necessary to examine the general drivers of energy-saving behavior, namely, economic incentives and descriptive norms. In Experiment 1, we test whether information about the amount of money saved as an economic incentive to implement green curtains increased the willingness to implement among residents of two municipalities with different levels of green curtain promotion measures. In addition, we identify the factors that promote green curtain adoption, including the influence of perceptions and cognitions regarding such implementation in the city (subjective descriptive norms). In Experiment 2, we test the robustness of the green curtain promotion factors presented in Experiment 1, and whether information about green curtain implementation rates in neighboring districts (objective descriptive norms) increases the willingness to implement.

By conducting an analysis based on the two characteristics of green curtains, visibility to others and low implementation rate, the study contributes to two research areas. First, as a study on energy conservation promotion using social comparison (Festinger, 1954) and descriptive norms (Cialdini et al., 1991), it reveals the effects of both subjective and objective descriptive norms. Compared with studies based on objective descriptive norms using HER (Allcott, 2011; Allcott and Rogers, 2014; Brandon et al., 2019; Andor et al., 2020), this study's novelty lies in its exploration of the comprehensive influence of descriptive norms. Second, it reveals the effect of the dynamic and relative comparative form of providing descriptive norm information that can promote behaviors in

[2] Headquarters for Promotion of Global Warming Countermeasures in Japan (2021).

case of low implementation rates. The results of this analysis provide a possible solution to the problem in which the provision of low-descriptive norm-level information generates negative effects (Frey and Meier, 2004; Cialdini et al., 2006).

The paper is structured as follows. Section 2 presents the focus and uniqueness of the study based on a review of the literature, Section 3 presents the design of the two experiments and their analytical models, Section 4 outlines and analyses the results, and Section 5 concludes with the policy implications.

2. Literature review

2.1 Green curtains as an indirect green façade

Green curtains are implemented in public facilities and educational institutions, such as kindergartens, primary and secondary schools, shops, offices, and homes. They improve the indoor thermal environment and save electricity by shielding the heat energy of solar radiation and suppressing radiant heat through the transpiration of leaves. The relationship between the functions of green curtains and electricity savings is shown in Fig. A1. This information was presented to respondents in our questionnaire survey. Climatically, the seeding season is from late April to late May, and the green curtains reduce the room temperature from July to September during the growing season and are removed at the end of September when the summer heat wanes.

Green curtains are classified as indirect green façades in the vertical greenery systems (VGS) (Safikhani et al., 2014; Manso and Castro-Gomes, 2015). Most studies on VGS and indirect green façades have focused on large-scale systems in which entire building walls are covered with perennial grasses. The effectiveness of improving the thermal environment of city blocks and building units as a heat island countermeasure has been examined and cultivation techniques and methods have been studied (Perez et al., 2014; Ascione et al., 2020; Oquendo-Di Cocola et al., 2022; Susca et al., 2022). Studies have also been conducted on the effects of green curtains with annual plants in reducing indoor temperatures in detached dwellings, mainly in Japan and China (Hoyano, 1988; Koyama et al., 2013; Kato et al., 2013a; Abe et al., 2020; Zheng et al., 2020; Zhang et al., 2022). Although there are differences in the scale of indirect green facades, most studies have examined the effectiveness of improving the thermal environment, and few have identified the factors that promote the implementation of such facades. Because green curtains use annual plants, implementation decisions are made once a year during the early spring planting season. Compared with perennial plants, opportunities for decision-making are more; therefore, it is important to clarify the provision of information to motivate implementation.

2.2 Influence of subjective descriptive norms on PV interest and adoption

To test the effects of social comparison (Festinger, 1954) and descriptive norms (Cialdini et al., 1991) on household CO_2 reduction, studies on promotion of the adoption of solar PVs, a renewable energy device, have examined whether perceptions and cognitions of PV systems owned by neighboring households, as the subjective descriptive norms, influence the decision to adopt PV

systems. These studies can be broadly divided into two categories: those that use objective data on descriptive norms, and those that use residents' awareness of descriptive norms.

Studies using objective data identify the location and timing of household PV installations based on information from GIS, zip codes, and subsidy programs and examine the distance and range (0 km, regional/district level, zip code level, street level, etc.) at which peer effects occur (Bollinger and Gillingham, 2012; Müller and Rode, 2013; Graziano and Gillingham, 2015; Rode and Weber, 2016; Kosugi et al., 2019; Barton-Henry et al., 2021; Irwin, 2021). Studies using residents' awareness captured through questionnaires have confirmed the neighborhood and peer effects of perceptions and cognitions of PVs owned by neighboring households on interest in and adoption of PVs (Woersdorfer and Kaus, 2011; Rai and Robinson, 2013; Palm, 2017; Wolskea et al., 2017; Curtius et al., 2018; Mundaca and Samahita, 2020; Hansen et al., 2022). As green curtains use annual plants, there are no objective data on the location and timing of implementation, such as for PV. Therefore, this study measures the perceptions and cognitions of green curtains as subjective descriptive norms using a questionnaire. As green curtain implementation is cheaper and easier than PV implementation, it may be influenced more by subjective descriptive norms; however, this has not yet been tested.

Subjective descriptive norms are not always perfect information; these are based on the subjectivity of each individual, which leads to heterogeneity (Allcot, 2011). Nyborg et al. (2006) find, as did Tversky and Kahneman (1973), that the purchase of green consumer goods is influenced by the perceived purchase status of others as an availability heuristic. Further, some people may have incentives to acquire signals such as reputation and social status. In addition to the objective descriptive norm information presented as an RCT, we examine the effect of evaluations of others' implementation status as subjective descriptive norms on willingness to implement green curtains.

2.3 Reference group setting and form of presenting descriptive norms

In the case of a majority behavior, providing information about the situation is likely to encourage it. Therefore, providing information with a high level of descriptive norms is significant (Cialdini et al., 1990, 1991; Cialdini, 2003; Schultz et al., 2007). Green curtains are minor behaviors with low descriptive norms. Therefore, it is vital to devise a reference group setting and a form for presenting descriptive norms based on previous studies.

First, regarding the reference group setting, some studies have examined the effectiveness of the proximity of the reference group. Hallsworth et al. (2017) find that in situations where tax payment rates as descriptive norm levels are equal at the country and local area levels, presenting tax payment rate information at the local area level increases tax payment rates more than at the national level. Goldstein et al. (2008) reveal that presenting the information that the towel reuse rate of hotel guests in the room they used was 75%, increased towel reuse more than presenting the information that the overall towel reuse rate of guests was 75%. However, Czajkowskia et al. (2019) find that providing country-level information is more effective in increasing the willingness to recycle at home than city-level information, at the same level of the descriptive norm presented.

In the field of electricity conservation, Brülisauer et al. (2020) use RCT to examine the difference in the impact of electricity consumption feedback of residents in the same apartment as the subject and that of residents in a different apartment on the subject's electricity conservation behavior but do not find a statistically significant difference. Similarly, Shen et al. (2016) examine the differences in the impact of electricity consumption feedback between neighborhoods, streets, and next-door neighbors on a subject's electricity-saving behavior, yet find that the most significant effect was on street-level feedback and not next-door neighbor-level feedback. In addition, descriptive norm levels differ across intervention groups in these studies, and the effects of descriptive norm levels and proximity were not tested separately. By contrast, Hallsworth et al. (2017) and Goldstein et al. (2008) set the descriptive norm level equally across intervention groups but targeted major behaviors with high implementation rates. In other words, the effects of proximity on behaviors with low descriptive norm levels in the field of power saving have not been fully examined. Additionally, the effect of proximity on behaviors easily visible to others has not been tested. Therefore, this study examines the effect of reference group proximity on power-saving behavior that is highly visible to others and has a low implementation rate.

Next, we present the descriptive norms. For behaviors with low levels of descriptive norms, providing information at that level can backfire (Frey and Meier, 2004; Cialdini et al., 2006; de Groot and Schuitema, 2012; Kormos et al., 2014; Kalch et al., 2021). Therefore, recent studies have examined whether presenting dynamic descriptive norms as levels that change over time, rather than as static levels, can promote prosocial behavior. For example, water conservation behavior during tooth brushing in Mortensen et al. (2017), reduced meat consumption in Sparkman and Walton (2017) and de Groot et al. (2021), and reduced sugary drink consumption in Sparkman and Walton (2019) and Loschelder et al. (2019) aimed to promote the use of reusable mugs.

However, most studies differ from static descriptive norms by adding messages such as "~ has increased in recent years" or "Recent surveys show that ~" or "In the last three years ~"; few show specific level changes. Mortensen et al. (2017) examine the effect of the presentation form "increased from 37% to 48% in two years" as trending minority norms. However, this study only provides information on changes in descriptive norms and does not include a social comparison perspective. As studies using HER have shown, the effect of showing the relative difference between own behavior and others' is likely to be significant. Czajkowskia et al. (2019) present recycling behavior rates as a descriptive norm for one's own neighborhood and other neighborhoods together as relative versus absolute norms and examine the behavior change effect; however, their form of presentation is static. Against these, this study examines the effect of dynamic and relative comparative forms by presenting information on changes in green curtain implementation rates in the respondent's district and its neighboring districts, making respondents aware of intragroup solidarity and intergroup competition.

3. Methodology

3.1 Research design

The price-based information intervention was conducted in RCT Experiment 1 in September 2017 and the descriptive norm information intervention was conducted in RCT Experiment 2 in September 2018. Each experiment was conducted using a questionnaire to examine the effects of different information provisions. Their subjects were different, too. Using screening questions, the study subjects were those who had not implemented green curtains in the summer of the current year, and who were subscribers to Kansai Electric Power Co., and residents of detached houses. [3] These were based on the experimental details described in the following subsections. In both experiments, information was randomly provided as an intervention after obtaining the respondents' demographics and other information. Willingness to implement green curtains the following summer was measured.

3.1.1 Experiment 1

We examine whether providing information about the amount of money saved by implementing green curtains increased willingness to implement green curtains. To this end, we established two intervention groups, Own and Others, with different reference points (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991) to examine whether the same amount of savings but different framing made a difference in the willingness to implement.

The specific information provided to the three groups (own, others, and control) is presented in Fig. 2. The power-saving effects of implementing green curtains are presented in the text, and different graphics are inserted for each group. The amount of money saved by the Own and Others groups was approximately 300 yen/month (approximately $2.7/month).[4] If the green curtain works for approximately three months (from July to September), it will save about 900 yen.

< Fig. 2 >

- Information provided to own group: A household with standard electricity consumption (260 kWh/month)[5] subscribing to Kansai Electric Power Co.[6] will save approximately 300 yen/month by implementing green curtains (top of Fig. 2).
- Information provided to the others group: A household with standard electricity consumption subscribing to Kansai Electric Power Co. will save about 300 yen/month by

[3] Implementing green curtains in apartments is relatively difficult, and the relative lack of interest among residents of apartments could have led to bias in the responses. Therefore, we limited our sample to residents of detached houses.

[4] Calculated using the September 2017 exchange rate of $1=110.71 yen.

[5] Japanese households can confirm their electricity consumption and electricity charges from their monthly meter readings. Each major electricity power company publishes the monthly electricity charge for a household with standard electricity consumption (260 kWh/month) on its website. To examine the information provision by local governments, we present household electricity charges with standard consumption as information easily collected by local governments and understood by consumers.

[6] Japan's electricity retail market was fully liberalized in April 2016. The survey subjects, residents of Fukuchiyama City and Kameoka City in Kyoto Prefecture, received electricity from Kansai Electric Power Co. prior to April 2016. Therefore, the survey subjects were subscribers of Kansai Electric Power Co., and had not changed power companies as of September 2017, the time of the survey.

implementing green curtains, equal to the difference in electricity charges for a household with standard electricity consumption contracted by Chubu Electric Power Co.,[7] which has a lower electricity unit price (middle part of Fig. 2).

- Information provided to the control group: The three-month trend in electricity charges paid by a household with standard electricity consumption that subscribed to Kansai Electric Power Co. (bottom of Fig. 2).

The purpose of establishing the Others group is as follows. Other information indicates a difference in the amount of electricity charges paid by others who contract with Chubu Electric Power Co., which has a lower price per unit, even though their electricity consumption is the same. We hypothesize that behavioral change is more likely to occur due to inequity aversion (Fehr and Schmidt, 1999) related to social comparison. We test whether Others information as the reference point, rather than the simple amount saved in Own information, further increases the willingness to implement green curtains.[8]

3.1.2 Experiment 2

We examine which forms of objective descriptive norm information about the implementation of green curtains can motivate people to implement green curtains, and therefore, the effects of proximity and different levels of descriptive norms.

The specific information provided to the three groups (modest, high, and control) is presented in Fig. 3. The study subjects were residents of Sasabe district in Fukuchiyama City (Fig. A2, A3). We show the trend of the implementation rate of green curtains in the Sasabe district, and the trend in the implementation rate in the reference districts, which differs from group to group. The Sasabe, Seijin, and Senkyo Districts are adjacent to each other[9] (Fig. A3).

< Fig. 3 >

- Information provided to the modest group: Trends in the implementation rate of green curtains in Sasabe and adjacent Seijin districts over the past three years (top of Fig. 3).
- Information provided to the high Group: Trends in the rate of implementation of green curtains in Sasabe and adjacent Senkyo districts over the past three years (middle part of Fig. 3).
- Information provided to the control group: Trends in the implementation rate of green curtains in Sasabe district and Fukuchiyama City over the past three years (Figure 3, bottom panel).

[7] We use the data for Chubu Electric Power Co., Japan's third largest power company after Tokyo Electric Power Company and Kansai Electric Power Co. It was a major power company before the full liberalization of the electricity retail market in April 2016, and thus highly recognized by consumers. Before the deregulation, this company's electricity service area was adjacent to that of Kansai Electric Power Co.

[8] We also analyze the willingness to change electricity companies as an objective variable (see, Appendix C).

[9] As of the 2015 census, the number of ordinary households living in residences was 1,408 in Seijin and 1,859 in Senkyo district. Sasabe district has 3,385 households and Fukuchiyama City has 31,115 households.

The effect of proximity was clarified by comparing the control and modest groups. The level of and trend in the implementation rate of green curtains in Fukuchiyama City in the control group and in Seijin District in the modest group were almost the same. Similar to Hallsworth et al. (2017) and Goldstein et al. (2008), we test whether the effect of information in the Seijin district is larger.

To examine the effect of different levels of descriptive norms, we select Senkyo District, which has a relatively high rate of green curtain implementation, as the high group. This is because higher descriptive norm levels are more likely to promote behavioral change, as suggested by Cialdini et al. (1990, 1991), Cialdini (2003), and Schultz et al. (2007).

However, according to Festinger (1957), an object too far removed from one's own situation is not subject to social comparison. Ashraf and Bandiera (2018) review the difference between horizontal (peers at the same level) and vertical (individuals at different levels) peer effects in their discussion of social incentives. In a study on goal setting in electricity conservation, Lazaric and Toumi (2022) used an RCT to examine the difference in the impact of ambitious and modest goals on electricity consumption reduction. Harding and Hsiaw (2014) show that setting realistic electricity conservation goals reduced consumption more than when unrealistically high goals were set. These studies suggest that if the goal level is too high, people may become demotivated and not change their behavior. This study aligns the proximity of two districts and examine whether a high or affordable level of information is more effective as a target for social comparison.

3.2 Setting up the survey subjects

The target area should be an area where green curtains are implemented to the extent that people can see them, even if they are not strongly aware of them. Therefore, we selected areas based on the level of activity of local governments' green curtain promotion policies. We assume that if a promotion policy is active, there will be many green curtains in the city, and selected Fukuchiyama City in the Kyoto Prefecture as it has been promoting green curtains since 2007 with the goal of becoming Japan's No.1 city for green curtains. The city has created a character named "Goya Sensei" (Bitter Melon Teacher) and conducted various activities, such as holding green curtain seminars, distributing seedlings, and advertising on how to grow green curtains in public relations magazines and newspapers. In addition to public facilities and schools, many green curtains were installed in businesses and stores and the rate of implementation in each district was measured. The following describes the selection method of the survey subjects for Experiments 1 and 2.

3.2.1 Experiment 1

Another municipality has a level of green curtain implementation different from that of Fukuchiyama City. Kameoka City (Fig. A2), also in Kyoto Prefecture, was selected as a municipality that implemented green curtain promotion policies to some extent, though less than in Fukuchiyama City. The selection was based on a survey of the literature and websites of municipalities near Fukuchiyama City that have similar climate and other factors. This was done to verify the robustness of the perceptions and cognitions regarding the implementation in the city to influence the willingness to implement green curtains.

Next, we selected the areas in each municipality where the questionnaire was to be distributed. In Fukuchiyama City, we selected several areas known to have a large number of green curtains, based on the results of a survey on the implementation rate of green curtains for the past three years provided by Fukuchiyama City and documents from the executive committee of the Fukuchiyama Environmental Conference that conducts the survey. Similarly, in Kameoka City, based on the results of the green curtain Model Project[10] for the past nine years provided by the City, we selected areas where the facilities that had conducted the project for the past five consecutive years were located. The target areas in both cities were those where green curtains had been visible for several years without a strong awareness. Questionnaires were randomly distributed to the residents of these areas designated mail[11] and collected by mail.

3.2.2 Experiment 2

In Experiment 2, we examine the differences in the effect of the objective descriptive norm information on willingness to implement green curtains. The participants were residents of Sasabe district in Fukuchiyama City. Questionnaires were randomly distributed to and collected from the residents by the designated delivery area by mail.[12] In Kameoka City, no surveys were conducted on the green curtain implementation rate.

3.3 Analytical frames and models

The analytical model for Experiment 1 is validated using ordinary least squares (OLS):

$$Y2018_i = \alpha + \beta 1\ Own_i + \beta 2\ Others_i + \beta 3\ X_i + \varepsilon_i \quad (1)$$

$Y2018_i$ is respondent i's willingness to implement green curtains next summer (2018) measured using a 6-point Likert scale. The questionnaire, including other variables, is presented in Table A1. Own_i is a dummy variable that takes the value of 1 if respondent i is in the own group and $Others_i$ is a dummy variable that takes the value of 1 if respondent i is in the Others group. $\beta 1$ and $\beta 2$ measure the average treatment effect (ATE) for each information provision on outcome Y2018. X_i is the vector of control variables for the socioeconomic characteristics of respondent i and other information on respondent i from the questionnaire survey. ε_i is an individual-specific error term.

X includes respondent characteristics such as age, sex, children under 18 living at home, solar power at home, and gardening practices at home (growing flowers and vegetables).

We also set subjective descriptive norms for green curtains (two) and awareness of electricity conservation (three). The subjective descriptive norms for green curtains were: perceptions and cognitive status of green curtains in public facilities and schools in the city, and perceptions and cognitive status of green curtains in residences in the city. We distinguished and examined the behaviors that were affected. Awareness of electricity conservation was divided into: money saving

[10] A model project to distribute seedlings to nursery schools, kindergartens, elementary and junior high schools, and nursing homes willing to implement and grow green curtains.

[11] A service provided by Japan Post that delivers to all households in a specified zip code. Envelopes containing one of three types of information provided by RCT were mixed and brought to the Fukuchiyama and Kameoka post offices for delivery; 1,623 letters were distributed in Fukuchiyama City and 1,781 in Kameoka City.

[12] After randomly selecting zip codes within the Sasabe district, 2,099 letters were sent.

as an economic incentive, contribution to global warming prevention as environmental awareness, and awareness of the electricity-saving status of others around them as a social norm.

The following analytical model was chosen for Experiment 2 and validated using OLS.

$$Y2019_i = \alpha + \beta 1\ Modest_i + \beta 2\ High_i + \beta 3\ X_i + \varepsilon_i \quad (2)$$

$Y2019_i$ is respondent i's willingness to implement green curtains next to summer (2019). $Modest_i$ is a dummy variable that takes the value of 1 if respondent i is in the Modest group; $High_i$ is a dummy variable that takes the value of one if respondent i is in the High group; X_i is the vector of control variables for the socioeconomic characteristics of respondent i and other information on respondent i from the questionnaire survey; ε_i is an individual-specific error term; and X contains the same indicators as in Models (1).

4. Results and discussion

4.1 Experiment 1

Descriptive statistics are presented in Table B1 for Fukuchiyama City and Table B2 for Kameoka City, respectively. The sample sizes are 237 and 333 in Fukuchiyama and Kameoka, respectively, the latter being larger because of the large number of residents who did not implement green curtains that year. The mean and standard deviation for Y2018 in Fukuchiyama City were 3.034 and 1.200, respectively, while those in Kameoka City were 3.021 and 1.226, respectively. The results of the balance test by the difference of means test showed significant differences at the 5% level in Money-saving awareness in Fukuchiyama City, PV ownership, and Environmental awareness in Kameoka City. These variables are included in the model as control variables.

The results of the analysis of model (1) with Y2018 as the objective variable are presented in Table 1 for Fukuchiyama. The average treatment effect is shown in Columns (1) and (2), and none of the coefficients of Own and Others are significant. Cognition of public facilities is significant in Column (2), and the adjusted R2 is improved from that in Column (1). These results confirm the influence of perceptions and cognitions regarding the implementation of green curtains in public facilities and schools in the city on the willingness to implement green curtains. In column (2), the coefficients of Children, Gardening, and Awareness of their surroundings are positive and significant, whereas PV ownership is negative and significant.

< Table 1 >

Next, we examine the heterogeneity. We examine the interaction between subjective descriptive norms and information provision in Columns (3) and (4). The results show that all four coefficients are negative and significant. This implies that those who perceive and recognize green curtains in public facilities, schools, or residences in the city are less willing to implement green curtains when receiving information about the amount of money saved by green curtains.

Table 2 presents the results for Kameoka. The average treatment effect is shown in Columns (1) and (2), and the coefficients of Own and Others are insignificant. Cognition in residences is significant in Column (2), and the adjusted R2 improved from that in Column (1). These results confirm the influence of perceptions and cognitions of the implementation of green curtains in

residences in the city on the willingness to implement green curtains. In column (2), Gardening is positive and significant.

< Table 2 >

Regarding heterogeneity, we examine the interaction between awareness of electricity conservation and information provision in Columns (5)–(7), and Own × Awareness of surroundings is negative and significant. This implies that those who are aware of the power-saving status of their surroundings are less willing to implement green curtains when they receive Own information.

Based on the above analysis of both cities, two points are clear. The first is the influence of subjective descriptive norms and their differences in both cities. Fukuchiyama was more active than Kameoka in administrative measures for promoting green curtains. As shown in Tables B1 and B2, the levels of cognition in the public facilities in Fukuchiyama City are higher than those in Kameoka City. Therefore, the green curtains implemented by the government have a stronger influence on the willingness to implement in Fukuchiyama City.

The second concerns the lack of an effect and backfire in the savings information of green curtain implementation. The effect of Own and Others information on the willingness to implement green curtains does not seem to exist. Savings compared to the cost of growing plants outdoors cannot influence the willingness to implement green curtains, even with a different framing. Nor is monetary saving awareness effective. Especially in Kameoka City, the other energy conservation awareness variables, environmental awareness, and awareness of surroundings were not significant. Furthermore, one's Own × Awareness of surroundings has a negative effect. In Kameoka City, green curtains are not considered an energy-saving behavior but an extension of gardening. This may be due to the low government promotions in Kameoka City.

In Fukuchiyama City, many green curtains have been implemented in schools because of the promotion policy, and families with children may be highly interested in implementing green curtains at home as part of their environmental learning. The negative and significant PV ownership in Fukuchiyama City needs to be verified, but this may be due to moral licensing (Miller and Effron, 2010; Tiefenbeck et al., 2013), in which people do not take other environmental measures because they have already adopted PV adoption. However, Children and PV ownership were not significant in Experiment 2, as discussed below. Therefore, the results are not necessarily robust.

In Fukuchiyama City, negative effects were observed at the intersection of subjective descriptive norms and information provision. Fukuchiyama City has an active promotion policy, but it focuses on providing information on how to grow green curtains, functional aspects related to lowering room temperature, and environmental aspects related to preventing global warming, but not on economic aspects, such as the amount of money saved on electricity. Therefore, those more aware of green curtains because of their perception and cognition of green curtains were the first to recognize the small amount of money saved, leading to a decrease in their willingness to implement.

4.2 Experiment 2

The descriptive statistics are presented in Table B3. The mean and standard deviation for Y2019 are 3.000 and 1.361, respectively. The results of the balance test using the difference of means test

show significant differences at the 5% level for money-saving awareness, cognition in public facilities, and cognition in residences. These variables were included in the model and analyzed as control variables.

Table 3 presents the results of the analysis of Model (2) with Y2019 as the objective variable. Similar to the results for Fukuchiyama City in Experiment 1 (Table 1), Cognition in public facilities is significant in Column (2), and the adjusted R2 improved compared to that in Column (1). As for the average treatment effect, the modest coefficient is significant in Column (2). As in Experiment 1, the coefficient of the awareness of surroundings is positive and significant.

< Table 3 >

Next, the heterogeneity results are presented. Columns (3) and (4) show the interaction between objective and subjective descriptive norms. The test was conducted to determine whether positive evaluations of subjective descriptive norms could compensate for the influence of lower levels of objective descriptive norms. None of the results are statistically significant. Columns (5)–(7) show the interaction between awareness of electricity conservation and objective descriptive norms. Modest × Money-saving awareness is negative and significant in Column (5), and High × Awareness of surroundings is positive and significant in Column (7). This implies that those who are aware of the money saved are less willing to implement green curtains when they receive modest information, and those who are aware of their surroundings' energy-saving status are more willing to implement green curtains when they receive high information.

Based on the results of the analysis, three points are derived. The first is the robustness of the results of cognition in public facilities and awareness of their surroundings, whose results are similar to those of Experiment 1 in Fukuchiyama City. The results for cognition in public facilities suggest that the effect of the implementation of green curtains by the government spreads beyond areas with many green curtains, such as in Experiment 1. The results on awareness of surroundings suggest that respondents aware of the power-saving status of their surroundings understand that others who are implementing green curtains are doing so as a power-saving behavior and that becoming aware of their implementation increases respondents' motivation to implement green curtains.

The second factor is the effect of proximity. Information about Seijin District helped increase the willingness to implement green curtains more than the information about Fukuchiyama City, with almost the same level and trend. The results of this proximity effect are similar to those reported by Hallsworth et al. (2017) and Goldstein et al. (2008). While Czajkowskia et al. (2019) found no proximity effect at low descriptive norm-level behaviors, this study confirms the proximity effect by providing dynamic and relative comparative information.

The third inference is the effects of modest information and the presence of heterogeneity. An average treatment effect is observed for modest information, indicating that it increased the willingness to implement green curtains. In the context of Festinger's (1957) discussion of social comparison, modest information is more appropriate as a reference. However, it has a negative effect on residents conscious of saving electricity for money. Given the results of the savings factors in Experiment 1, one possible interpretation of the results is that respondents with a conservation

mindset for money-saving purposes thought that the reason for the implementation level in Seijin district not being high was that green curtains could not lead to large savings. However, a high level of information has a positive effect on respondents aware of the energy-saving status of others. This could be because of the benchmarking of others with higher implementation levels. The finding that higher descriptive norm levels are more likely to promote behavioral change (Cialdini et al., 1990, 1991; Cialdini, 2003; Schultz et al. 2007) is confirmed only for those who were aware of the power-saving status of others around them.

5. Conclusions and policy implications

To examine the information provision for promoting the implementation of green curtains, this study examines the effects, on the willingness to implement, of perceptions and cognitions of green curtain implementation in a city (subjective descriptive norm), of information provided on the trends in the implementation rate of green curtains in neighboring districts (objective descriptive norm), and of information provided on the amount of money saved. The results of the analysis, based on the two characteristics of green curtains – visibility to others and low implementation rate – are expected to contribute to the literature on the comprehensive influence of descriptive norms and the effect of a dynamic and relative comparative form of providing descriptive norm information. These results have implications for studies on the promotion of prosocial behaviors that are visible to others and have low implementation rates.

The policy implications are presented in terms of subjective and objective descriptive norms. First, regarding subjective descriptive norms, it is desirable for local governments to promote green curtain policies and their own green curtain implementation evidence easily visible to residents: green curtain seminars, presentation of growing methods in public information magazines, distribution of seeds and seedlings to places where many people gather (commercial, entertainment, cultural, sports facilities, etc.), apart from in individual households, public facilities, and schools. Such efforts would raise the level of perception and cognition of green curtains among residents. The adoption of green curtains may then spread in a cascade, influenced by subjective descriptive norms and by residents aware of their neighbors' energy-saving status.

Next, regarding objective descriptive norms, it is preferable to provide information on the implementation rate of green curtains in neighboring districts rather than any other municipality average. Furthermore, it is desirable to provide information on districts with implementation rates not much higher than those of residential districts.

However, this objective descriptive norm information requires the following attention. It is necessary to verify the extent of the proximity effect. Experiment 2 shows that information on districts adjacent to the respondents' residential districts is more effective than information on Fukuchiyama City. If the spatial size of Fukuchiyama City impairs social proximity as a reference group, it is possible that the same effect could be obtained not only from information on adjacent districts but also from information on non-adjacent neighboring districts, slightly distant districts, and distant districts. This verification, depending on the results, could lead to less time and effort to prepare information provision.

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Fig. 1 Green curtains

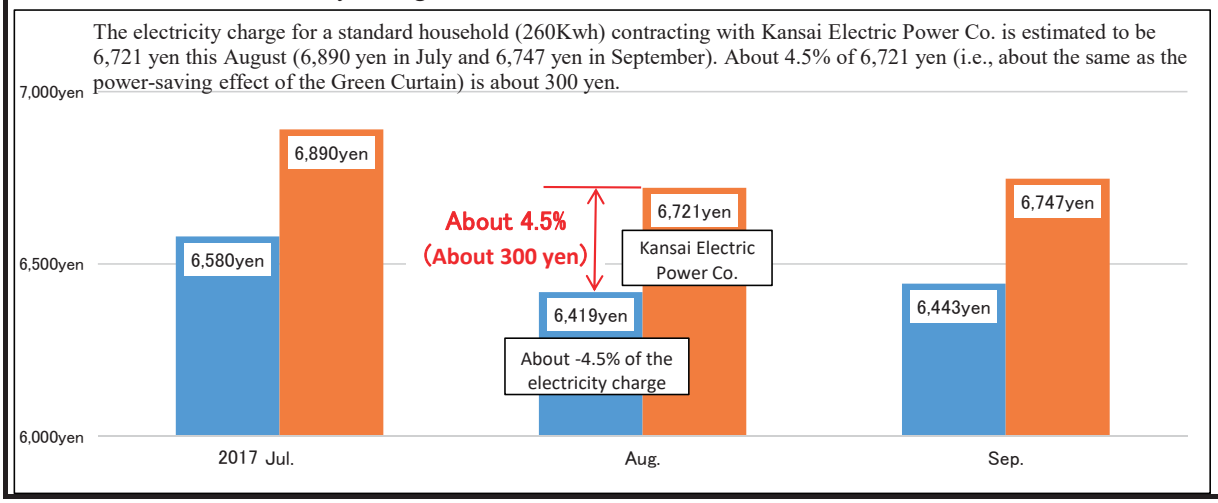
Own group

■Effects of green curtains on electricity saving

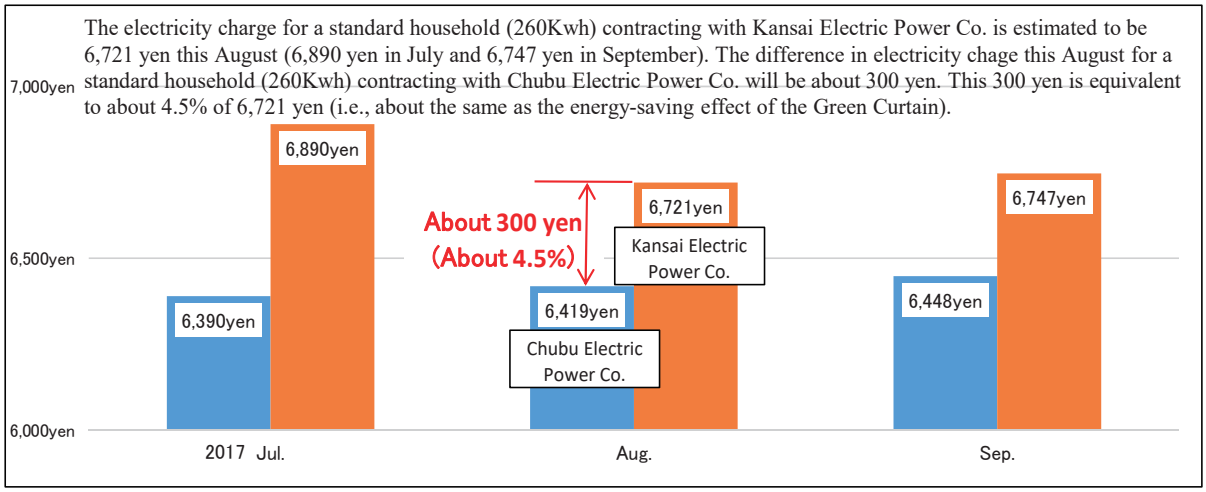
・Green curtains reduce summer electricity consumption by 4.5% on average.

(Results of a questionnaire survey of 187 green curtains implementers in Hamamatsu City, Shizuoka Prefecture *)

【Reference】Electricity charges



Graphics in the Others group



Graphics in the Control group

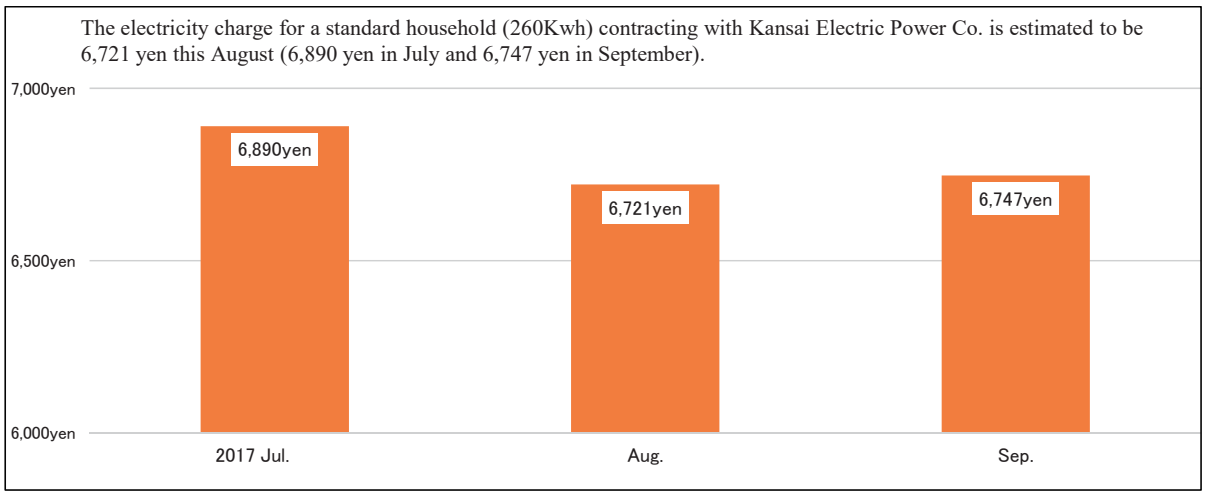
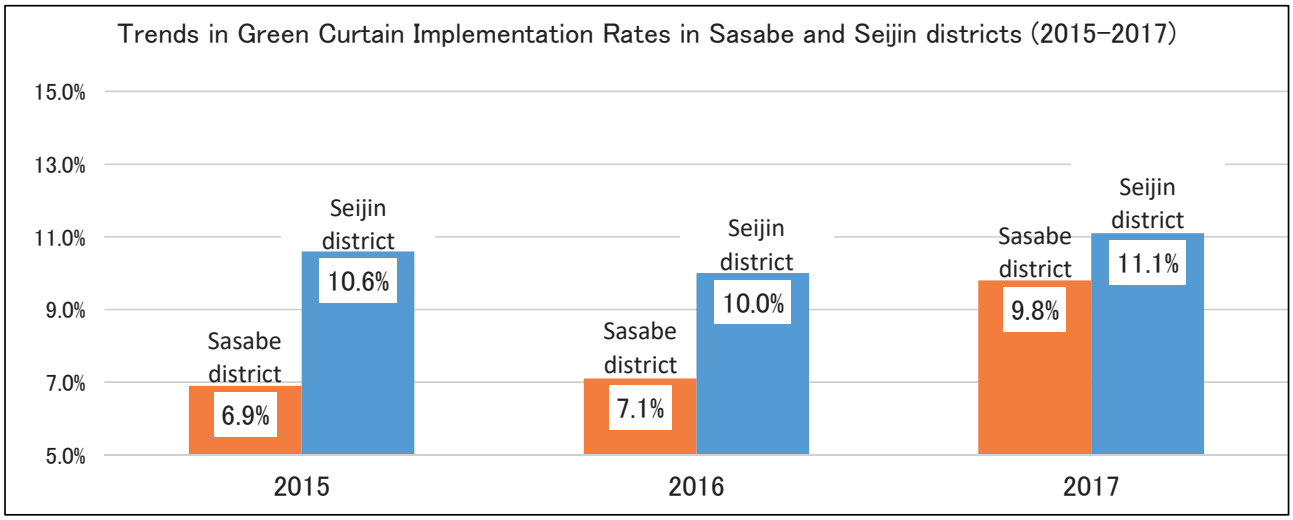


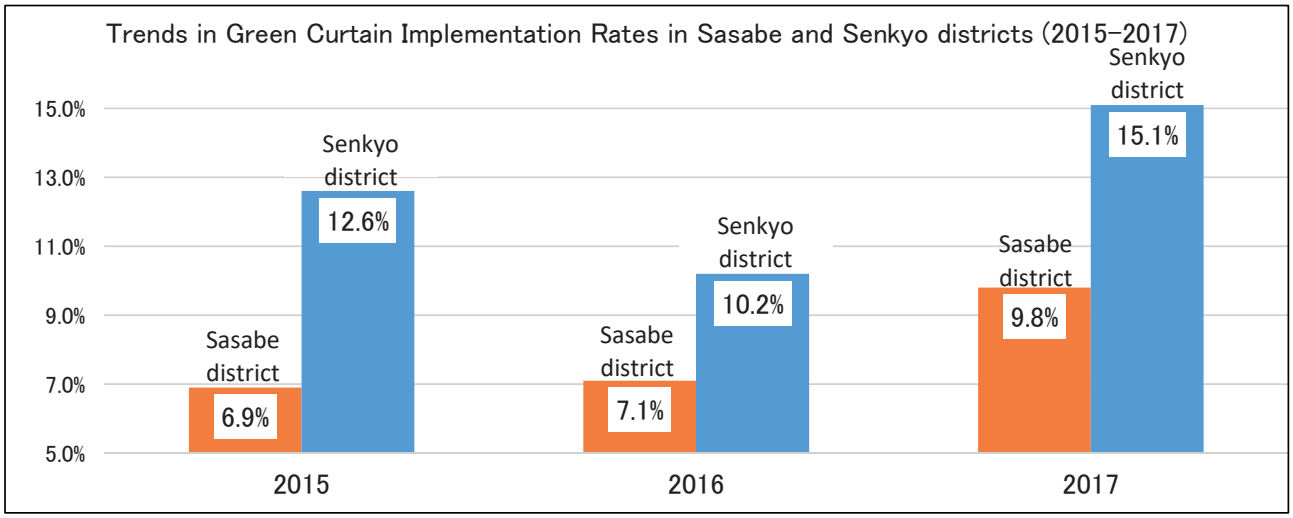
Fig. 2 The specific information provided for the three groups in Experiment 1

In the information provided to the Others group and Control group, the Own group graphic at the top is replaced by the respective graphic. The results of these questionnaires are shown outside of these frames to be based on Kato et al. (2013b).

Modest group



High group



Control group

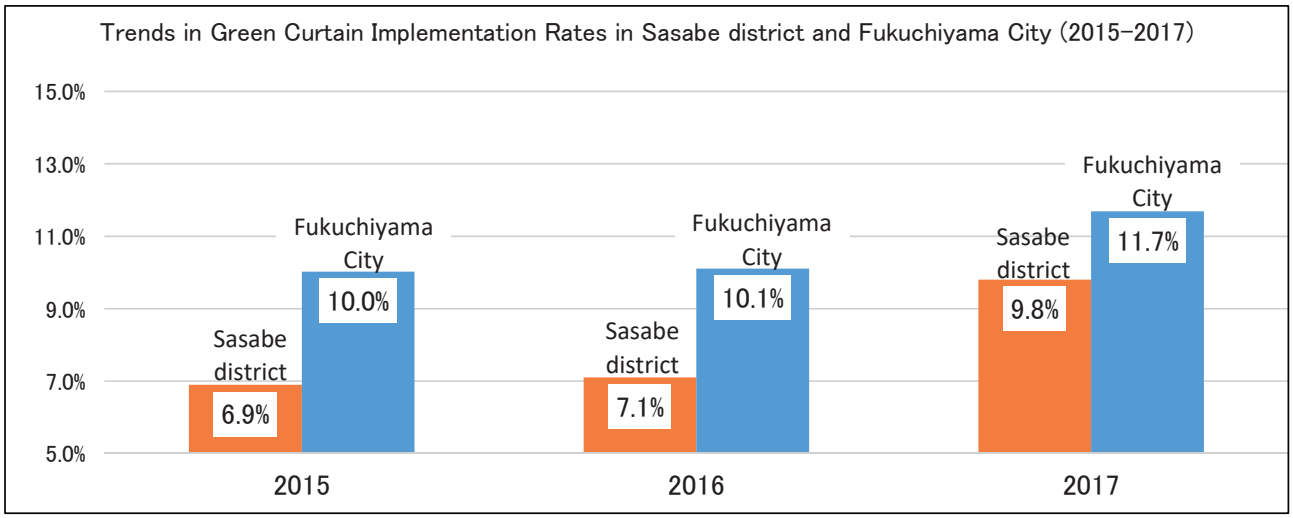


Fig. 3 The specific information provided for the three groups in Experiment 2

The source of the data is indicated outside these frames as "Source: Fukuchiyama City Environmental Policy Office".

Table 1 Analysis results in Experiment 1 (Fukuchiyama City).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own	0.092	0.072	1.081 *	1.421 **	-0.066	0.090	0.095
	(0.190)	(0.179)	(0.550)	(0.556)	(1.198)	(0.802)	(0.552)
Others	0.012	-0.053	1.176 *	1.158 *	-0.716	-1.112	0.066
	(0.178)	(0.176)	(0.623)	(0.613)	(1.129)	(0.769)	(0.511)
Age	0.089	0.071	0.057	0.071	0.069	0.067	0.071
	(0.062)	(0.058)	(0.059)	(0.057)	(0.059)	(0.058)	(0.058)
Female	-0.031	-0.117	-0.163	-0.104	-0.118	-0.102	-0.117
	(0.150)	(0.145)	(0.147)	(0.144)	(0.144)	(0.143)	(0.145)
Children	0.399 **	0.402 ***	0.394 **	0.444 ***	0.399 **	0.396 **	0.401 ***
	(0.155)	(0.153)	(0.153)	(0.154)	(0.154)	(0.153)	(0.154)
PV ownership	-0.412	-0.447 *	-0.417 *	-0.444 *	-0.448 **	-0.427 *	-0.455 **
	(0.257)	(0.228)	(0.227)	(0.233)	(0.227)	(0.231)	(0.229)
Gardening	0.448 **	0.400 **	0.372 **	0.398 **	0.407 **	0.412 **	0.401 **
	(0.191)	(0.183)	(0.178)	(0.176)	(0.183)	(0.181)	(0.182)
Money-saving awareness	0.006	-0.003	0.000	0.010	-0.054	-0.001	-0.002
	(0.112)	(0.106)	(0.103)	(0.103)	(0.158)	(0.106)	(0.106)
Environmental awareness	0.143 *	0.078	0.084	0.082	0.075	-0.011	0.080
	(0.079)	(0.081)	(0.080)	(0.077)	(0.082)	(0.127)	(0.082)
Awareness of surroundings	0.261 ***	0.202 ***	0.203 ***	0.192 ***	0.201 ***	0.195 ***	0.215 **
	(0.069)	(0.070)	(0.069)	(0.068)	(0.070)	(0.070)	(0.107)
Cognition in public facilities		0.172 **	0.333 ***	0.161 **	0.176 **	0.172 **	0.173 **
		(0.072)	(0.083)	(0.074)	(0.073)	(0.072)	(0.073)
Cognition in residences		0.121	0.138	0.377 ***	0.119	0.131	0.120
		(0.086)	(0.084)	(0.121)	(0.087)	(0.086)	(0.087)
Own×Cognition in public facilities			-0.244 *				
			(0.127)				
Others×Cognition in public facilities			-0.293 **				
			(0.139)				
Own×Cognition in residences				-0.379 **			
				(0.152)			
Others×Cognition in residences				-0.339 **			
				(0.159)			
Own×Money-saving awareness					0.025		
					(0.235)		
Others×Money-saving awareness					0.131		
					(0.222)		
Own×Environmental awareness						-0.005	
						(0.167)	
Others×Environmental awareness						0.222	
						(0.157)	
Own×Awareness of surroundings							-0.006
							(0.157)
Others×Awareness of surroundings							-0.034
							(0.143)
Constant	0.413	0.019	-0.635	-0.896	0.310	0.443	-0.036
	(0.657)	(0.615)	(0.630)	(0.670)	(0.917)	(0.762)	(0.684)
Adj.R^2	0.147	0.200	0.212	0.217	0.194	0.201	0.193
N	237	237	237	237	237	237	237

Robust standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, 10% level, respectively.

Table 2 Analysis results in Experiment 1 (Kameoka City).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own	0.087	0.136	0.020	-0.342	0.758	0.080	0.950 *
	(0.162)	(0.158)	(0.511)	(0.509)	(0.989)	(0.832)	(0.487)
Others	0.044	0.035	-0.127	-0.017	0.359	0.670	0.388
	(0.157)	(0.155)	(0.481)	(0.554)	(1.132)	(0.791)	(0.434)
Age	0.063	0.036	0.036	0.034	0.039	0.036	0.043
	(0.056)	(0.056)	(0.056)	(0.057)	(0.056)	(0.056)	(0.056)
Female	0.043	-0.075	-0.070	-0.077	-0.069	-0.073	-0.062
	(0.142)	(0.146)	(0.146)	(0.145)	(0.146)	(0.145)	(0.145)
Children	0.215	0.234	0.237	0.235	0.240	0.226	0.224
	(0.156)	(0.155)	(0.154)	(0.155)	(0.153)	(0.154)	(0.154)
PV ownership	-0.234	-0.325	-0.329	-0.361	-0.332	-0.324	-0.334
	(0.237)	(0.239)	(0.239)	(0.241)	(0.240)	(0.236)	(0.241)
Gardening	0.511 ***	0.449 ***	0.447 ***	0.454 ***	0.445 ***	0.468 ***	0.446 ***
	(0.154)	(0.152)	(0.153)	(0.152)	(0.151)	(0.152)	(0.152)
Money-saving awareness	-0.033	-0.042	-0.041	-0.046	0.024	-0.041	-0.037
	(0.103)	(0.103)	(0.103)	(0.104)	(0.146)	(0.102)	(0.103)
Environmental awareness	0.083	0.071	0.071	0.069	0.069	0.116	0.067
	(0.082)	(0.087)	(0.088)	(0.087)	(0.086)	(0.138)	(0.088)
Awareness of surroundings	0.052	0.040	0.039	0.037	0.039	0.044	0.141
	(0.059)	(0.058)	(0.058)	(0.058)	(0.058)	(0.059)	(0.090)
Cognition in public facilities		0.056	0.031	0.055	0.055	0.054	0.059
		(0.075)	(0.098)	(0.076)	(0.075)	(0.074)	(0.075)
Cognition in residences		0.218 **	0.215 **	0.160	0.222 **	0.213 **	0.222 **
		(0.092)	(0.094)	(0.134)	(0.092)	(0.092)	(0.092)
Own×Cognition in public facilities			0.033				
			(0.141)				
Others×Cognition in public facilities			0.046				
			(0.131)				
Own×Cognition in residences				0.154			
				(0.159)			
Others×Cognition in residences				0.016			
				(0.166)			
Own×Money-saving awareness					-0.123		
					(0.197)		
Others×Money-saving awareness					-0.063		
					(0.219)		
Own×Environmental awareness						0.014	
						(0.172)	
Others×Environmental awareness						-0.135	
						(0.162)	
Own×Awareness of surroundings							-0.244 *
							(0.134)
Others×Awareness of surroundings							-0.103
							(0.124)
Constant	1.719 ***	1.220 **	1.318 *	1.460 **	0.868	0.994	0.805
	(0.625)	(0.616)	(0.699)	(0.721)	(0.847)	(0.796)	(0.659)
Adi.R^2	0.026	0.064	0.059	0.062	0.060	0.062	0.069
N	333	333	333	333	333	333	333

Robust standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, 10% level, respectively.

Table 3 Analysis results in Experiment 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Modest	0.250	0.341 *	0.376	-0.010	2.242 **	0.730	0.273
	(0.202)	(0.200)	(0.624)	(0.687)	(1.126)	(0.907)	(0.644)
High	0.213	0.236	0.254	-0.238	0.492	-0.120	-0.746
	(0.199)	(0.196)	(0.778)	(0.792)	(0.960)	(0.802)	(0.621)
Age	0.060	0.060	0.060	0.060	0.059	0.055	0.039
	(0.068)	(0.068)	(0.069)	(0.067)	(0.067)	(0.069)	(0.068)
Female	0.059	0.032	0.032	0.038	0.045	0.026	0.006
	(0.165)	(0.166)	(0.168)	(0.165)	(0.166)	(0.167)	(0.165)
Children	-0.008	-0.087	-0.087	-0.094	-0.086	-0.108	-0.142
	(0.181)	(0.181)	(0.181)	(0.181)	(0.180)	(0.185)	(0.182)
PV ownership	-0.093	-0.093	-0.092	-0.103	-0.085	-0.109	-0.112
	(0.239)	(0.238)	(0.241)	(0.240)	(0.236)	(0.241)	(0.233)
Gardening	0.329 *	0.260	0.260	0.256	0.317 *	0.300	0.227
	(0.172)	(0.175)	(0.176)	(0.174)	(0.181)	(0.184)	(0.173)
Money-saving awareness	0.064	0.050	0.050	0.055	0.220	0.060	0.052
	(0.105)	(0.103)	(0.104)	(0.104)	(0.158)	(0.101)	(0.098)
Environmental awareness	0.248 ***	0.216 **	0.216 **	0.217 **	0.212 **	0.212	0.206 **
	(0.085)	(0.085)	(0.085)	(0.086)	(0.085)	(0.158)	(0.083)
Awareness of surroundings	0.260 ***	0.231 ***	0.231 ***	0.232 ***	0.236 ***	0.229 ***	0.139
	(0.080)	(0.080)	(0.080)	(0.079)	(0.080)	(0.081)	(0.133)
Cognition in public facilities		0.185 **	0.191	0.189 **	0.197 **	0.189 **	0.197 **
		(0.091)	(0.150)	(0.092)	(0.093)	(0.091)	(0.091)
Cognition in residences		0.037	0.036	-0.044	0.017	0.030	0.043
		(0.110)	(0.111)	(0.176)	(0.110)	(0.109)	(0.107)
Modest×Cognition in public facilities			-0.009				
			(0.154)				
High×Cognition in public facilities			-0.004				
			(0.191)				
Modest×Cognition in residences				0.095			
				(0.190)			
High×Cognition in residences				0.128			
				(0.213)			
Modest×Money-saving awareness					-0.384 *		
					(0.227)		
High×Money-saving awareness					-0.057		
					(0.198)		
Modest×Environmental awareness						-0.083	
						(0.196)	
High×Environmental awareness						0.076	
						(0.176)	
Modest×Awareness of surroundings							0.020
							(0.173)
High×Awareness of surroundings							0.290 *
							(0.173)
Constant	-0.136	-0.615	-0.635	-0.349	-1.446 *	-0.617	-0.152
	(0.629)	(0.623)	(0.753)	(0.755)	(0.854)	(0.813)	(0.742)
Adj.R^2	0.148	0.172	0.165	0.166	0.178	0.167	0.178
N	227	227	227	227	227	227	227

Robust standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, 10% level, respectively.

Appendix A.

Table A1 Model variables.

Variable names	Definition
Dependent variable	
Y2018	I would like to implement green curtains in summer 2018(6 = strongly agree to 1 = not at all agree)
Change Company	I would consider changing my power supplier (6 = strongly agree to 1 = not at all agree)
Y2019	I would like to implement green curtains in summer 2019 (6 = strongly agree to 1 = not at all agree)
Independent variable	
Age	Age in years
Female	Male = 0, Female = 1
Children	Children under 18 years old living with me (No = 0 , Yes = 1)
PV ownership	Solar power generation at home (No = 0 , Yes = 1)
Gardening	Gardening at home (growing flowers or vegetables in my yard) (No = 0 , Yes = 1)
Money-saving awareness	Saving electricity saves money for my household (6 = strongly agree to 1 = not at all agree)
Environmental awareness	Saving electricity contributes to reducing global warming (6 = strongly agree to 1 = not at all agree)
Awareness of surroundings	I save electricity because (I think) people around me save electricity (6 = strongly agree to 1 = not at all agree)
Cognition in public facilities	I often see green curtains in public facilities and schools in the city (6 = strongly agree to 1 = not at all agree)
Cognition in residences	I often see green curtains at residences in the city (6 = strongly agree to 1 = not at all agree)

■What are green curtains?

・Green curtains are curtain-like covers made of vines, such as bitter gourd, morning glory, and loofah, by crawling them under a net.

・Grow seedlings or seeds in a planter near a window or wall. (For bitter melon, sow seeds from late April to late May)

■Functions of green curtains

(1) Prevents sunlight from shining through the window (shading effect).

・The large number of leaves blocks direct sunlight from entering through the window, thus suppressing the rise in indoor temperature.

・The curtains cut about 80% of the heat energy of solar radiation (50 to 60% for bamboo screen, 55% for high performance shading glass).

(2) It suppresses the temperature around the house (cooling effect by transpiration).

・Plants absorb water from their roots and evaporate it from their leaves, which removes radiant heat from the ground and walls near the window.

・This leads to a decrease in the body temperature, which makes you feel cooler.

Fig. A1. Green curtains Information in the Questionnaire

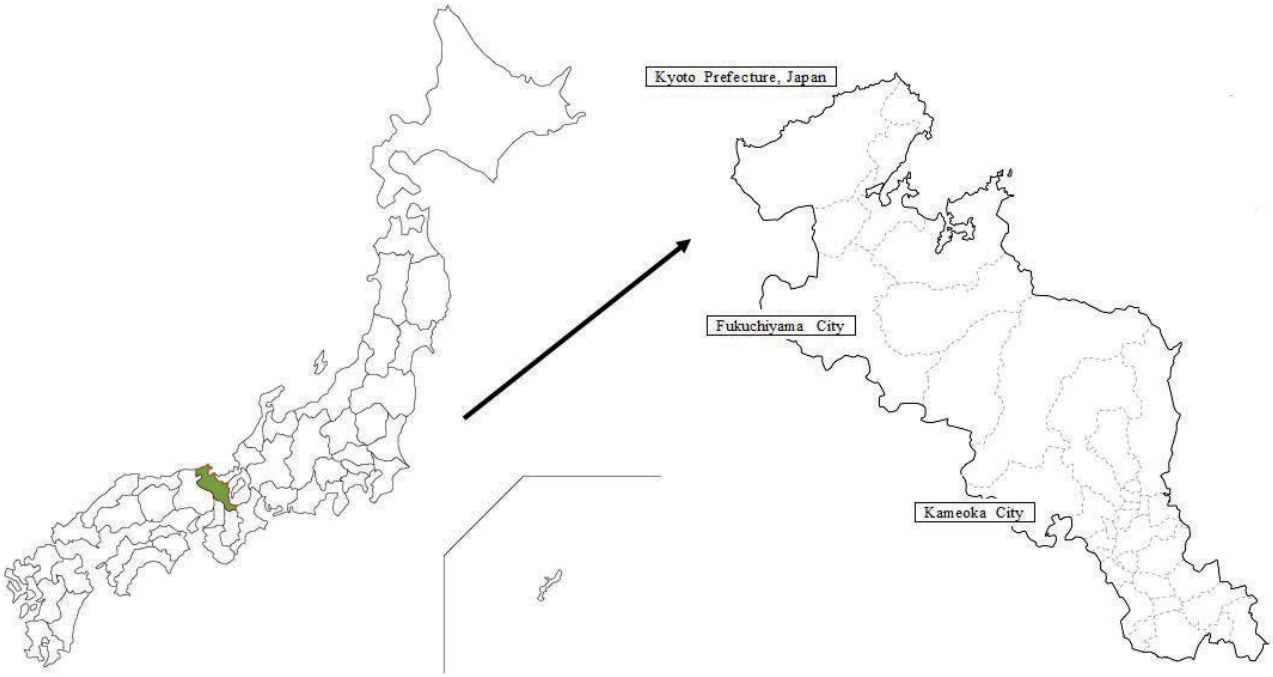


Fig. A2. Location of Fukuchiyama City and Kameoka City in Kyoto Prefecture, Japan

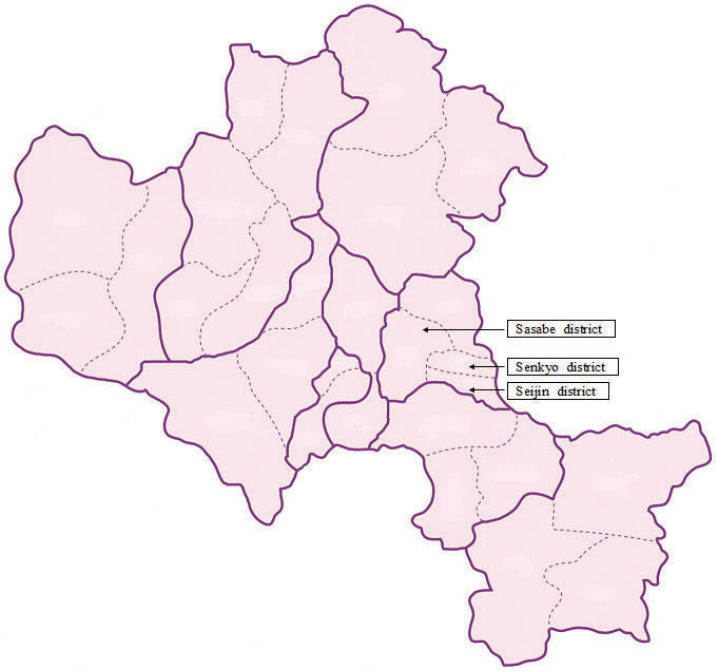


Fig. A3. Location of Sasabe, Seijin and Senkyo districts in Fukuchiyama City

Source: Fukuchiyama City website

Appendix B.

Table B1 Descriptive statistics and balance tests on independent variables in Experiment 1 (Fukuchiyama City).

	Total	Control group	Own group	Others group	P-value (C-Own)	P-value (C-Others)
Age	5.848	6.041	5.750	5.771	0.174	0.188
	(1.303)	(1.287)	(1.355)	(1.262)		
Female	0.426	0.486	0.388	0.410	0.219	0.337
	(0.496)	(0.503)	(0.490)	(0.495)		
Children	0.392	0.351	0.338	0.482	0.858	0.098
	(0.489)	(0.481)	(0.476)	(0.503)		
PV ownership	0.101	0.095	0.113	0.096	0.717	0.970
	(0.302)	(0.295)	(0.318)	(0.297)		
Gardening	0.751	0.770	0.700	0.783	0.326	0.848
	(0.433)	(0.424)	(0.461)	(0.415)		
Money-saving awareness	5.051	5.216	4.988	4.964	0.061	0.038
	(0.752)	(0.763)	(0.738)	(0.740)		
Environmental awareness	4.768	4.824	4.750	4.735	0.627	0.582
	(0.983)	(0.970)	(0.921)	(1.060)		
Awareness of surroundings	3.489	3.473	3.563	3.434	0.637	0.835
	(1.152)	(1.219)	(1.123)	(1.128)		
Cognition in public facilities	4.203	4.203	4.138	4.265	0.753	0.766
	(1.249)	(1.385)	(1.166)	(1.211)		
Cognition in residences	3.646	3.514	3.625	3.783	0.535	0.129
	(1.105)	(1.113)	(1.107)	(1.094)		
N	237	74	80	83		

Standard deviations in parentheses.

Table B2 Descriptive statistics and balance tests on independent variables in Experiment 1 (Kameoka City).

	Total	Control group	Own group	Others group	P-value (C-Own)	P-value (C-Others)
Age	5.517	5.449	5.629	5.482	0.365	0.853
	(1.405)	(1.369)	(1.558)	(1.290)		
Female	0.580	0.602	0.581	0.555	0.755	0.474
	(0.494)	(0.492)	(0.496)	(0.499)		
Children	0.511	0.576	0.457	0.491	0.076	0.198
	(0.501)	(0.496)	(0.501)	(0.502)		
PV ownership	0.093	0.051	0.152	0.082	0.014	0.352
	(0.291)	(0.221)	(0.361)	(0.275)		
Gardening	0.790	0.788	0.800	0.782	0.828	0.908
	(0.408)	(0.410)	(0.402)	(0.415)		
Money-saving awareness	5.054	5.127	4.962	5.064	0.146	0.579
	(0.866)	(0.790)	(0.887)	(0.921)		
Environmental awareness	4.721	4.890	4.657	4.600	0.102	0.040
	(1.088)	(0.923)	(1.159)	(1.167)		
Awareness of surroundings	3.330	3.449	3.267	3.264	0.279	0.280
	(1.263)	(1.318)	(1.195)	(1.268)		
Cognition in public facilities	3.514	3.534	3.476	3.527	0.727	0.969
	(1.253)	(1.238)	(1.225)	(1.304)		
Cognition in residences	3.177	3.229	3.057	3.236	0.209	0.953
	(1.004)	(0.947)	(1.073)	(0.995)		
N	333	118	105	110		

Standard deviations in parentheses.

Table B3 Descriptive statistics and balance tests on independent variables in Experiment 2.

	Total	Control group	Modest group	High group	P-value (C-Modest)	P-value (C-High)
Age	5.587	5.685	5.439	5.684	0.252	0.998
	(1.445)	(1.332)	(1.451)	(1.542)		
Female	0.575	0.630	0.531	0.579	0.193	0.526
	(0.495)	(0.486)	(0.502)	(0.497)		
Children	0.437	0.425	0.449	0.434	0.753	0.907
	(0.497)	(0.498)	(0.500)	(0.499)		
PV ownership	0.158	0.123	0.153	0.197	0.577	0.220
	(0.365)	(0.331)	(0.362)	(0.401)		
Gardening	0.753	0.795	0.735	0.737	0.362	0.409
	(0.432)	(0.407)	(0.444)	(0.443)		
Money-saving awareness	4.960	4.795	5.082	4.961	0.040	0.269
	(0.919)	(0.881)	(0.916)	(0.944)		
Environmental awareness	4.696	4.699	4.694	4.697	0.975	0.994
	(1.063)	(0.953)	(1.030)	(1.211)		
Awareness of surroundings	3.405	3.397	3.429	3.382	0.868	0.936
	(1.222)	(1.175)	(1.276)	(1.211)		
Cognition in public facilities	3.935	4.123	3.724	4.026	0.033	0.609
	(1.225)	(1.117)	(1.306)	(1.189)		
Cognition in residences	3.534	3.781	3.327	3.566	0.005	0.215
	(1.054)	(1.044)	(1.023)	(1.063)		
N	227	73	78	76		

Standard deviations in parentheses.

Appendix C.

In September 2017, a little over a year after the deregulation, the share of electricity sold by new entrants to the market was only 7.1%, indicating a low awareness of the liberalization of the retail electricity market and the prices of other companies. Therefore, we assume that the provision of prices of other electricity companies could have an effect on the willingness to change electricity companies. Model (3) was set up with the objective variable of willingness to switch electricity suppliers and examined using OLS.

$$\text{Company change}_i = \alpha + \beta 1\ \text{Own}_i + \beta 2\ \text{Others}_i + \beta 3\ X_i + \varepsilon_i \quad (3)$$

Company change i represents respondent i's willingness to change electricity companies. This was also tested because the experiment provided information on the electricity prices of Chubu Electric Power Co., lower than those of Kansai Electric Power Co. with which the respondent has a contract. We examine whether there was a secondary effect on their willingness to switch electricity companies.

Table C1 shows the results for Fukuchiyama City and Table C2 for Kameoka City, respectively. The mean and standard deviation for company changes in Fukuchiyama City are 2.477 and 1.156, respectively, and 2.694 and 1.233, respectively, in Kameoka City. No effect of information provision was observed in either city and nor was any effect of intersection terms confirmed.

Murakami and Ida (2019) find that Japanese households did not change electricity providers even if a 5% cost reduction was realized from it, which they attributed to a status quo bias. The 4.5% cost reduction achieved by switching to Chubu Electric Power Co. in this experiment was found to have no effect on the willingness to switch electricity providers.

Table C1 Analysis results in Experiment 1 (Dependent variable; Company change, Fukuchiyama City).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own	0.052	0.056	0.236	0.405	-0.088	-0.227	0.260
	(0.177)	(0.176)	(0.573)	(0.528)	(1.135)	(0.793)	(0.564)
Others	0.269	0.272	0.742	0.845	-0.381	-0.809	0.329
	(0.191)	(0.195)	(0.700)	(0.649)	(1.315)	(0.816)	(0.578)
Age	-0.163 **	-0.167 **	-0.170 **	-0.167 ***	-0.169 ***	-0.169 ***	-0.167 ***
	(0.066)	(0.064)	(0.066)	(0.064)	(0.064)	(0.063)	(0.064)
Female	-0.219	-0.239	-0.249 *	-0.229	-0.239	-0.226	-0.240
	(0.150)	(0.148)	(0.148)	(0.151)	(0.148)	(0.148)	(0.148)
Children	-0.064	-0.079	-0.084	-0.072	-0.082	-0.088	-0.074
	(0.177)	(0.174)	(0.174)	(0.175)	(0.174)	(0.175)	(0.174)
PV ownership	-0.079	-0.087	-0.080	-0.089	-0.089	-0.070	-0.087
	(0.319)	(0.317)	(0.313)	(0.311)	(0.313)	(0.310)	(0.317)
Gardening	0.014	0.002	-0.014	-0.009	0.009	0.011	-0.002
	(0.179)	(0.180)	(0.180)	(0.180)	(0.181)	(0.179)	(0.182)
Money-saving awareness	-0.151	-0.152	-0.155	-0.148	-0.204	-0.152	-0.151
	(0.106)	(0.106)	(0.104)	(0.106)	(0.174)	(0.107)	(0.106)
Environmental awareness	0.212 **	0.189 **	0.190 **	0.187 **	0.186 **	0.080	0.191 **
	(0.082)	(0.083)	(0.083)	(0.083)	(0.082)	(0.122)	(0.084)
Awareness of surroundings	0.016	0.015	0.018	0.013	0.014	0.007	0.039
	(0.071)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)	(0.117)
Cognition in public facilities		0.090	0.138	0.087	0.093	0.091	0.087
		(0.088)	(0.127)	(0.086)	(0.089)	(0.087)	(0.088)
Cognition in residences		-0.042	-0.038	0.049	-0.043	-0.034	-0.040
		(0.097)	(0.099)	(0.140)	(0.098)	(0.095)	(0.097)
Own×Cognition in public facilities			-0.044				
			(0.139)				
Others×Cognition in public facilities			-0.111				
			(0.159)				
Own×Cognition in residences				-0.099			
				(0.149)			
Others×Cognition in residences				-0.158			
				(0.169)			
Own×Money-saving awareness					0.027		
					(0.218)		
Others×Money-saving awareness					0.129		
					(0.260)		
Own×Environmental awareness						0.058	
						(0.166)	
Others×Environmental awareness						0.226	
						(0.174)	
Own×Awareness of surroundings							-0.058
							(0.154)
Others×Awareness of surroundings							-0.016
							(0.157)
Constant	3.128 ***	3.067 ***	2.888 ***	2.758 ***	3.358 ***	3.592 ***	2.978 ***
	(0.681)	(0.659)	(0.703)	(0.749)	(1.002)	(0.756)	(0.742)
Adj.R^2	0.020	0.017	0.011	0.012	0.010	0.016	0.009
N	237	237	237	237	237	237	237

Robust standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, 10% level, respectively.

Table C2 Analysis results in Experiment 1 (Dependent variable; Company change, Kameoka City).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own	-0.074	-0.060	-0.287	-0.184	-0.442	-0.324	-0.223
	(0.159)	(0.159)	(0.474)	(0.508)	(0.966)	(0.741)	(0.431)
Others	0.057	0.054	0.319	-0.424	-0.711	0.568	0.320
	(0.152)	(0.152)	(0.484)	(0.570)	(1.042)	(0.771)	(0.455)
Age	-0.031	-0.040	-0.040	-0.039	-0.038	-0.041	-0.045
	(0.054)	(0.053)	(0.053)	(0.053)	(0.054)	(0.053)	(0.054)
Female	0.019	-0.018	-0.034	-0.001	-0.023	-0.018	-0.027
	(0.136)	(0.138)	(0.139)	(0.139)	(0.138)	(0.138)	(0.140)
Children	0.579 ***	0.583 ***	0.579 ***	0.579 ***	0.592 ***	0.575 ***	0.579 ***
	(0.138)	(0.139)	(0.139)	(0.138)	(0.140)	(0.139)	(0.139)
PV ownership	-0.534 **	-0.565 **	-0.574 **	-0.569 **	-0.564 **	-0.566 **	-0.563 **
	(0.228)	(0.228)	(0.223)	(0.227)	(0.228)	(0.226)	(0.229)
Gardening	0.557 ***	0.533 ***	0.537 ***	0.532 ***	0.537 ***	0.556 ***	0.548 ***
	(0.152)	(0.154)	(0.154)	(0.153)	(0.155)	(0.155)	(0.156)
Money-saving awareness	-0.016	-0.018	-0.019	-0.019	-0.099	-0.016	-0.017
	(0.091)	(0.092)	(0.092)	(0.091)	(0.155)	(0.091)	(0.093)
Environmental awareness	0.094	0.090	0.085	0.090	0.091	0.108	0.096
	(0.081)	(0.082)	(0.082)	(0.081)	(0.081)	(0.132)	(0.084)
Awareness of surroundings	0.108 *	0.103 *	0.105 *	0.105 *	0.102 *	0.109 *	0.115
	(0.058)	(0.057)	(0.057)	(0.058)	(0.057)	(0.059)	(0.083)
Cognition in public facilities		0.040	0.050	0.035	0.041	0.037	0.043
		(0.067)	(0.092)	(0.066)	(0.067)	(0.066)	(0.067)
Cognition in residences		0.054	0.052	-0.005	0.053	0.049	0.047
		(0.082)	(0.083)	(0.117)	(0.083)	(0.083)	(0.083)
Own×Cognition in public facilities			0.065				
			(0.135)				
Others×Cognition in public facilities			-0.076				
			(0.132)				
Own×Cognition in residences				0.037			
				(0.150)			
Others×Cognition in residences				0.148			
				(0.164)			
Own×Money-saving awareness					0.074		
					(0.186)		
Others×Money-saving awareness					0.150		
					(0.200)		
Own×Environmental awareness						0.057	
						(0.152)	
Others×Environmental awareness						-0.110	
						(0.157)	
Own×Awareness of surroundings							0.051
							(0.122)
Others×Awareness of surroundings							-0.080
							(0.125)
Constant	1.453 ***	1.270 **	1.275 **	1.470 **	1.674 *	1.168	1.230 **
	(0.537)	(0.551)	(0.596)	(0.628)	(0.870)	(0.727)	(0.611)
Adi.R^2	0.108	0.108	0.106	0.105	0.105	0.107	0.106
N	333	333	333	333	333	333	333

Robust standard errors in parentheses. ***, ** and * indicate statistical significance at the 1%, 5%, 10% level, respectively.