Monetary and moral incentives of behavioral interventions: Field experimental evidence from hotel guest energy efficiency programs

Abstract

The purpose of this study is to measure the pure conservation effect of moral incentives and investigate their potential to reduce energy conservation in non-household sectors. Focusing on the overlap between moral and economic incentives, we employ a field experiment at a hotel to separate moral incentives from economic incentives. We find that although the pure conservation effect of moral incentives was insignificant, moral incentives did reduce hotel guests' electricity use by 10.3% when saved money in conservation was donated to an environmental protection organization. The result indicates that when we use moral incentives in non-household sectors, it is beneficial to spend saved money for environmental protection to gain people's support for conservation requests.

Key words: energy conservation, moral incentive, field experiment,

1. Introduction

Many studies have examined the effectiveness of moral incentives for energy conservation in the household sector. Moral incentives are intended to encourage conservation by triggering people's intrinsic desires to do the right thing or feel good about themselves by doing the right thing without monetary rewards (e.g., conservation messages). Many studies have concluded that moral incentives might be effective to reduce household electricity consumption (e.g., Reiss and White, 2008, and Ito, Ida, and Tanaka, 2016).

There is a trend to use moral incentives to encourage energy conservation in other sectors of society, but the effectiveness of such attempts has been unclear. For example, the Japanese government has encouraged firms' voluntary conservations by setting numerical targets in the Act on Rationalizing Energy Use. However, electricity demand has not reduced much, and the nation keeps facing potential power cuts due to the shortage of power supply. Also, Delmas et al. (2014) showed in a field experiment that moral incentives did not reduce electricity consumption at a university dorm.

We think that a key to understand why the impacts of moral incentives vary between the household and other sectors is the overlap of moral and economic incentives. Economic incentives use monetary rewards to encourage conservation (e.g., tradable permits and tax credits). The overlap of moral and economic incentives can occur because energy conservations in response to moral incentives inevitably generate monetary rewards in the form of reduced energy bills. Accordingly, we expect that the magnitude of conservation in response to moral incentives is highly dependent on who enjoys the monetary rewards.

In the household sector, the entity who takes conservation actions also enjoys resulting monetary rewards. For example, when households reduce their electricity use in response to conservation messages, they receive lower electricity bills as a result. Therefore, it is not clear whether they conserve electricity because they are triggered by the conservation messages or because they want to save on electricity bills. It is also likely that they are motivated by both. This may be one of the reasons why the magnitude of conservation in response to moral incentives tend to be large in the household sector.

On the other hand, in the other sectors, the entity who takes conservation actions is often different from the entity who enjoys resulting monetary rewards. For example, when a firm attempts to reduce its office electricity use to respond to conservation messages, it asks employees to take conservation actions, such as cutting back on air conditioner use. However, employees may not take conservation requests seriously because they do not receive any direct monetary rewards (i.e., no change in their salaries). Even worse, some employees may refuse to follow the conservation request because of their suspicion that the firm is acting for its own benefits. We expect that these partly explain why the magnitude of conservation in response to moral incentives tends to be small in non-household sectors.

Despite its importance, the overlap of moral and economic incentives has seldom been discussed in the relevant literature. Without recognizing the overlap and understanding who takes conservation actions

and who enjoys resulting monetary rewards, the effectiveness of moral incentives can be over- or under-estimated. This might then create wrong expectations on the effectiveness of moral incentives among policymakers.

Therefore, in this study we focus on the overlap between moral and economic incentives and attempt to answer the following questions:

(1) Do moral incentives have little effect on energy conservation when isolated from economic incentives?

(2) How do people respond to moral incentives if the saved money from conservation is used for environmental conservation?

The first question comes from our expectation that moral incentives work in the household sector because households can reduce energy bills by saving energy. In other words, few people may respond to moral incentives if they do not receive any economic incentives by saving energy. Because most previous studies report only the mixed effects of moral and such economic incentives, it remains unknown whether people respond to moral incentives alone. Therefore, in our experiment we attempt to separate moral incentives from economic incentives and measure the isolated conservation effect of moral incentives.

To separate moral incentives from economic incentives, we conducted a field experiment at a hotel. A hotel room price pre-includes energy costs during a stay. Therefore, hotel guests do not receive any monetary rewards for saving energy. This allows us to isolate the effect of moral incentives from the effect of economic incentives.

The second question originates from our assumption that some people refuse to follow conservation requests due to their suspect that the requests stem from entities' (e.g., firms') self-interests in cutting costs. If this assumption is true, more people are expected to follow conservation requests when the requests come from the entities' genuine concerns for the environment. Therefore, in our experiment, we tested an instrument in which we requested hotel guests to conserve energy and notified them that the money saved from their conservation efforts would be donated to an environmental protection organization.

To examine how effective the instrument would be, we compared the instrument with the case in which the saved money from conservation was returned to hotel guests. The case resembles conservation requests in the household sector in that the entity who takes conservation efforts and the entity who receives monetary rewards are identical. Conservation requests under such a circumstance have been shown to be effective in previous studies.

The main results of our experiment are summarized as follows. First, the isolated effect of moral incentives on hotel guests' conservation was insignificant. Second, moral incentives could induce hotel guests' electricity conservation when the saved money from their conservation was donated to an environmental protection organization. The conservation level was 50% of the case in which the saved

money was returned to hotel guests.

This study contributes to the relevant literature in two aspects. First, we measured the isolated effects of moral incentives on conservation by separating moral incentives from economic incentives, which has seldom been studied in the relevant literature. We found that moral incentives alone could not generate conservation efforts, indicating that few people conserve energy for purely altruistic reasons (i.e., desires to do the right thing). Second, we showed the instrument that could make moral incentives work. We found that moral incentives could generate conservation efforts if the saved money was used responsibly for conservation purposes. To our knowledge, no study has investigated into this.

2. Literature Review

Moral incentives are categorized into antecedent and consequence interventions. We review studies on the conservation effects of each intervention. Most studies focus on the household sector. One exception is Delmas et al. (2014), which is most relevant to our study.

2.1. Types of moral incentives

According to previous studies, **t**here are two types of moral incentives: antecedent and consequence interventions (see Geller et al.,1990; Dwyer et al., 1993; Schultz et al., 1995). We use a message (antecedent intervention) and an electronic in-home display (hereinafter called IHD) (consequence intervention) as moral incentives in our field experiment.

Antecedent interventions are assumed to influence one or more determinants prior to the performance of environmentally significant behavior. For example, providing households with information about energy-saving options may result in energy savings because people have acquired more knowledge.

Consequence interventions are assumed to influence determinants after pro-environmental behavior, utilizing providing a consequence contingent on the outcome of the behavior. For instance, giving households feedback about their energy savings may encourage them to reduce energy use because their levels of self-efficacy have increased.

2.2. Antecedent interventions in the household sector

Many studies have shown that sending messages on energy savings can reduce energy consumption in the household sector. For example, Reiss and White (2008) presented the findings about how conservation appeals affected energy consumption, using household-level data from California's energy crisis in 2000 and 2001. They concluded that conservation appeals resulted in a decrease in electricity consumption during the crisis. As another example, Ito et al. (2018) conducted a field experiment in Japan and found that conservation appeals reduced electricity consumption in the short run.

2.3. Consequent interventions in the household sector

Many studies have also shown the effectiveness of consequence interventions to reduce household

electricity consumption. Two types of consequent interventions mainly examined in these studies are IHD and energy reports.

Faruqui et al. (2010) reviewed the results of 12 separate trials from the US, Canada, Australia, and Japan and found that IHDs reduced demand by between 3 and 13%. Fischer (2008) summarized the results of 22 studies between 1987 and 2006 and concluded that although not all studies in the review showed reductions, typical savings were in the range of 5 to 12%. Many other studies have shown similar results, including Carroll et al. (2014) and Jessoe et al. (2014).

Regarding energy reports, Allcott and Rogers (2014) used the home energy report to inform households of their electricity demand. They found that the report was effective in reducing and shifting demand.

The findings from these studies on antecedent and consequent interventions in the household sector are not applicable to non-household sectors. The entity who takes conservation actions also receives resulting monetary rewards in the household sector, whereas in non-household sectors the entity who takes conservation actions is often different from the entity who receives resulting monetary rewards. Because households have additional incentives (monetary rewards), they probably respond to messages better than non-household sectors.

2.4. Application to non-household sectors

Only few studies have investigated the effects of moral incentives in non-household sectors. One example that is most relevant to our study is Delmas et al. (2014). They carried out a field experiment at a UCLA dormitory to examine the effects of energy reports. Participants in the experiment (dormitory residents) received information on their energy consumptions in the form of energy reports but did not receive any monetary rewards. Without monetary rewards, they found that participants were only minimally motivated to conserve and thus concluded that energy reports had no significant conservation effects. However, they did not investigate why participants did not respond to energy reports.

In our study, we go a step ahead to investigate why moral motivations might not be effective in non-household sectors. We assume that one of the reasons is the doubt that people have over the motive behind a conservation request when the money saved from their conservation efforts is claimed by someone else. We attempt to remove the doubt in our field experiment by donating the saved money to an environmental protection organization.

3. Experimental Design and Data

We conducted a field experiment at a hotel that consisted of two parts. Experiment 1 measured the isolated effect of moral incentives, specifically, a message and IHD, on hotel guests' conservation efforts. Experiment 2 examined how people would respond to a conservation request when the saved money from

conservation would be donated to an environmental protection organization.

3.1. Experiment setting

We conducted our experiment at Keihanna Plaza Hotel in Kyoto, Japan. The experiment period was from June to September of 2017 (Experiment 1) and from April 2018 to January 2019 (Experiment 2). We implemented the experiment in collaboration with Keihanna Plaza Hotel, Kyoto Prefecture, and Fuji Electric Company. Originally, Fuji Electric Company developed IHDs for hotel guest rooms and installed them at Keihanna Plaza Hotel in response to Kyoto Prefecture's attempt to reduce energy use at hotels. We teamed up with them to conduct our experiment.

We used ten single rooms of the same size and layout located on the same floor for our experiment. We changed an experiment treatment in each room every week to eliminate the effects of room characteristics, such as the amount of sunlight and wind coming in through windows. The electrical appliance in each room included an air conditioner, refrigerator, TV, room light, footlight, desktop light, bathroom light, and three electrical outlets.

There are two things to note about our experiment. First, the hotel was obligated to notify its hotel guests at the time of check-in that data on their energy use would be collected for experiment purpose. Each of the ten rooms was equipped with a device to measure electricity and hot water use every 30 minutes (i.e., pseudo real-time), which could be displayed on an IHD. No hotel guest requested for a room change after being notified about the data collection, which suggests no selection bias for the hotel guests' enrollments in our experiment. Second, our experiment was conducted in Japanese. Some of the hotel guests were foreigners. Because there might have been language bias, we controlled the effect of foreigners in the analysis.

3.2. Experiment 1

In Experiment 1, we measured the isolated effect of moral incentives on hotel guests' energy conservation. We used a conservation message (hereinafter called the message treatment) and IHD (hereinafter called the IHD treatment) as moral incentives and compared hotel guests' electricity and hot water use in these treatments with those in the control group with no such moral incentives. We randomly assigned 197 hotel guests to one of three groups: the message treatment (65 guests), the IHD treatment (71 guests), and the control group (61 guests).

3.2.1. Message treatment

In the message treatment, a hotel guest stayed in a room with a conservation message as shown in **Figure 1**. We printed the message in A4 size paper and displayed it on a desk so that it was easily noticeable. The data on electricity and water use in the room were collected every 30 minutes. However, the hotel guest could not see them because there was no IHD in the room.

Figure 1: The conservation message displayed in a guest room in the message treatment in Experiment 1

Note: The translation of the message is as follows: "Your cooperation in saving energy is needed. Each customer's action saves the global environment. We ask for your cooperation in reducing energy usage (electricity and hot water) in your room."

3.2.2. IHD treatment

In the IHD treatment, a hotel guest stayed in a room with an IHD and explanatory leaflet placed on a desk as shown in **Figure 2**. The IHD in our experiment was a touch screen tablet that could visualize electricity and hot water use in the room. The explanatory leaflet provided the explanation of the green and black line graphs in the main screen of the IHD. The cumulative electricity consumption in kilowatt hours (kWh) of the room since the guest entered the room was plotted as the green line graph on the primary vertical axis. Similarly, the cumulative hot water consumption in liters (L) was plotted as the black line graph on the secondary vertical axis. The graphs were updated every 30 minutes.

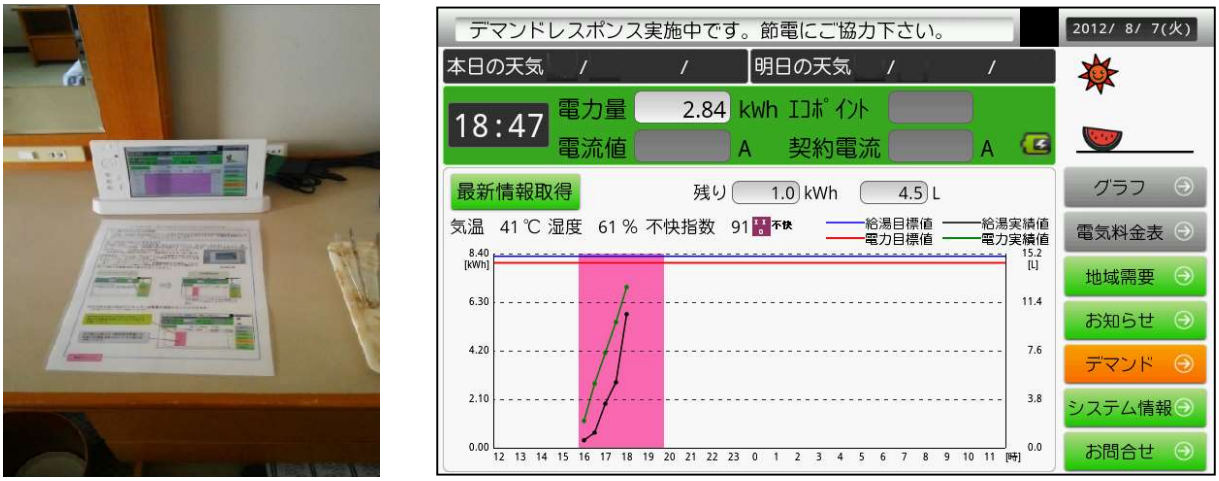

Figure 2: The IHD and explanatory leaflet (left) and the enlarged view of the IHD (right) in the IHD treatment in Experiment 1

Note: There were several other items in the IHD that were not relevant to Experiment 1 and thus not mentioned in the explanatory leaflet: the temperature (Celsius), humidity (percentages), temperature-humidity index (a.k.a. discomfort index), date, and time. In addition, the IHD showed target limits for electricity (red line) and hot water (blue line) consumptions and the remaining amounts of electricity (kWh) and hot water (L) until reaching the target limits. The target limits were set as default when the IHDs were initially installed, and we did not utilize them in Experiment 1. The translations of the explanatory leaflet is provided in the appendix.

3.2.3. Control group in Experiment 1

A hotel guest in the control group in Experiment 1 stayed in a room with no conservation message or IHD. The data on electricity and water use in the room were collected every 30 minutes, but the room had no IHD that could show the energy use to the hotel guest.

3.3. Experiment 2

In Experiment 2, we examined how hotel guests would respond to a moral incentive when the save money from conservation would be indeed used for conservation purposes (hereinafter called the donation treatment). To examine the effectiveness of the donation treatment, we also tested a treatment in which the saved money was returned to hotel guests (hereinafter called the monetary treatment). We compared hotel guests' energy use in these treatments with the control group, which received only a moral incentive. We randomly assigned 808 hotel guests to one of three groups: the monetary treatment (276 guests), the donation treatment (234 guests), and the control group (298 guests).

3.3.1. Donation treatment

In the donation treatment, we gave hotel guests a donation incentive in addition to a moral incentive (IHD). The donation treatment was to make it clear that the saved money through hotel guests' conservation efforts

would be donated to an environmental protection organization if conservation targets were achieved, and thus that the hotel would not directly benefit from hotel guests' conservation efforts.

A hotel guest in the donation treatment stayed in a room with an IHD as shown in **Figure 3** and the explanatory leaflet placed on a desk. The leaflet explained that if the guest achieved the conservation target(s), we were going to donate to World Wide Fund for Nature (WWF). We set conservation targets of not exceeding the average daily electricity and hot water consumptions in the room in the same month of the previous year. The leaflet explained that we would donate 300 Japanese yen (JPY) to WWF if the guest achieved one target (electricity or hot water) and 600 JPY if the guest achieved both targets (electricity and hot water).

Figure 3: The enlarged view of the IHD in the donation and monetary treatments in Experiment 2

Note: We simplified the main screen of the IHD in Experiment 2 by removing irrelevant information to make the conservation target limits conspicuous. The translation of the explanatory leaflet is provided in the appendix.

In Experiment 2, we modified the IHD from Experiment 1 to show the conservation target limits in two ways (**Figure 3**). First, the IHD showed the average daily electricity consumption as the red horizontal line and the average daily hot water consumption as the blue horizontal line. Second, the IHD showed how much more electricity (kWh) and hot water (L) the hotel guest could consume before passing the conservation target limits.

We used a hotel guest's self-reported information to process rewards at checkout. Front desk agents asked a hotel guest about the status of his or her conservation target achievement. If the guest achieved any targets, front desk agents expressed their appreciation and provided information on how we would donate to WWF and how we would publish the information on our website.

After Experiment 2, we calculated the total donation amount from the actual energy consumption data and donated the amount to WWF. Instead of making many small donations in the names of hotel guests, we

donated the aggregate amount in the name of our project team. We did not use hotel guests' names so as not to disclose any personally identifiable data. We posted the information on the donation, specifically the purpose of the project and donation amount, on our project website.

3.3.2. Monetary treatment

In the monetary treatment, we gave hotel guests a monetary reward (a gift card) in addition to a moral incentive (IHD). The treatment was to make it clear that the saved money through their conservation efforts would be given back to them if conservation targets were achieved, and thus that the hotel would not directly benefit from hotel guests' conservation efforts.

A hotel guest in the monetary treatment stayed in a room with the same IHD as in the donation treatment (**Figure 3**), but the explanatory leaflet placed on a desk was different. The leaflet explained that by achieving conservation targets, the hotel guest would receive gift cards. The conservation targets were the same as in the donation treatment, that is, not exceeding the average daily electricity and hot water consumptions in the room in the same month of the previous year. The reward amounts were set the same as in the donation treatment. The leaflet explained that the hotel guest would receive a 300 JPY gift card by achieving one target (electricity or hot water) and a 600 JPY gift card by achieving both targets (electricity and hot water).

Because we conducted the experiment at a hotel, it was essential to make handling monetary rewards at the time of checkout as easy and fast as possible for both hotel guests and front desk agents. We took two measures to make the process simple. First, we used gift cards instead of cash. We used gift cards called Quo Cards, which are accepted in most restaurants, convenience stores, gas stations, bookstores, and hotels in Japan. Quo Cards are sold in preset amount, starting at a face value of 300 JPY. We kept 300 JPY Quo Cards at the front desk and asked front desk agents to hand one card to a hotel guest who achieved one conservation target (electricity or hot water) and two cards to a hotel guest who achieved both conservation targets (electricity and hot water).

As the second measure to make the process simple, we used a hotel guest's self-reported information for judgement on rewards. Instead of checking the actual usage data, front desk agents asked hotel guests at checkout if they achieved any conservation targets to decide reward amounts. The self-reported information was used only for processing monetary rewards at checkout, and we used actual usage data in our analysis.

3.3.3. Control group in Experiment 2

A hotel guest in the control group in Experiment 2 stayed in a room with the same IHD as in the donation and monetary treatments as a moral incentive. The data on electricity and water use in the room were collected every 30 minutes and displayed on the IHD. However, the guest did not receive any other incentives, and thus there was no leaflet that explained such rewards in the room.

3.4. Summary statistics

Summary statistics of Experiment 1 and Experiment 2 are shown in Table 1 and Table 2, respectively. Overall, summary statistics of our sample seem reasonable. There are two things worth mentioning here.

First, the electricity use of the hotel guests in our experiments was lower than the average use in Japan. According to the Ministry of Environment, the electricity use of a household was about 12 kWh per day, and the average household size was about 2.5 in Japan in 2020. Therefore, the electricity use is calculated to be about 4.8 kWh per capita per day, which is twice as high as the electricity use of our sample. This is due to the different electricity needs between a hotel stay and daily life (e.g., no need of cooking nor laundry for a hotel stay).

Second, the humidity was higher in Experiment 1 than Experiment 2. This is because Experiments 1 and 2 were conducted in different months. Experiment 2 was held almost all year round, whereas Experiment 1 was held in between July and September, which is the most humid of the year in Japan.

Table 1: Summary Statistics: Experiment 1

	Message Treatment (N = 65)		IHD Treatment (N = 71)		Control Group (N = 61)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Electricity use (kWh per day per capita)	2.54	1.37	2.545	1.396	2.331	1.073
Water use (litters per day per capita)	82.153	83.563	72.394	64.197	91.967	78.82
Humidity (%)	59.507	3.849	60.335	3.701	60.778	4.388
Foreigners (proportion)	0.215	0.414	0.183	0.389	0.1967	0.4
Male (proportion)	0.738	0.442	0.732	0.445	0.7868	0.412

Table 2: Summary Statistics: Experiment 2

	Donation Treatment (N = 228)		Monetary Treatment (N = 270)		Control Group (N = 286)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Electricity use (kWh per day per capita)	2.51	1.746	2.315	1.789	2.788	1.876
Water use (litters per day per capita)	108.333	84.67	101.518	79.787	120.279	89.328
Humidity (%)	0.868	0.338	0.814	0.389	0.786	0.41
Foreigners (proportion)	0.14	0.348	0.107	0.31	0.111	0.315
Male (proportion)	0.486	0.114	0.503	0.110	0.492	0.110

4. Empirical Strategy and Results

In this section, we conduct an empirical analysis of Experiments 1 and 2. The analysis of Experiment 1 shows that moral incentives, when isolated from economic incentives, have little effect on conservation. The analysis of Experiment 2 shows that hotel guests saved energy when the money saved from their

conservation was donated to WWF. The conservation level was approximately 50% of the case in which the saved money was returned to hotel guests.

4.1. Experiment 1: Message and IHD treatment effects

We estimate the effects of the message and IHD treatments by ordinary least squares (OLS) for the following linear equation:

$$\ln x_{it} = \beta_0 + \beta_1 Message_{it} + \beta_2 IHD_{it} + \beta_3 Humidity_{it} + \beta_4 Foreigner_{it} + \beta_5 Male_{it} + \theta_i + \gamma_t + u_{it}. \quad (1)$$

The dependent variable, $\ln x_{it}$, is the natural log of electricity or hot water use per day of hotel guest i during the guest's hotel stay in month t ($t = 1, 2, \cdots, 12$). We use the natural log for the dependent variable so that we can interpret the treatment effects approximately in percentage terms. The treatment effects in exact percentage terms can be obtained by $\exp(\beta_1) - 1$ and $\exp(\beta_2) - 1$. In this section, we report both the log points and exact percentage terms.

The explanation of each dependent variable is as follows. $Message_{it}$ equals 1 if the hotel guest is in the message treatment. Similarly, IHD_{it} equals 1 if the hotel guest is in the IHD treatment. $Humidity_{it}$ is the average room humidity during the stay. $Foreigner_{it}$ and $Male_{it}$ are dummy variables to identify whether the hotel guest is a foreigner and male, respectively. Moreover, we include two fixed effects: the room fixed effect, θ_i, that controls for room-specific effects, such as the amount of sunlight, and the time fixed effect, γ_t, that controls for time-specific effects, such as weather. Finally, u_{it} is the error term.

Table 3 provides the result of a formal econometric analysis with standard errors. Columns 1 and 2 are for electricity use, and Columns 3 and 4 are for hot water use. Columns 2 and 4 include additional regressors which may influence electricity and hot water use, respectively.

Table 3: Experiment 1 Results

	Dependent Variable: Log of Electricity Use		Dependent Variable: Log of Hot Water Use	
	(1)	(2)	(3)	(4)
Message	0.009	-0.029	-0.099	-0.099
	(0.113)	(0.110)	(0.213)	(0.211)
IHD	0.089	0.0751	-0.091	-0.130
	(0.113)	(0.104)	(0.226)	(0.221)
Humidity		-0.031		0.009
		(0.010)		(0.016)
Foreigner		-0.296***		-0.407***
		(0.093)		(0.144))
Male		0.152*		-0.117
		(0.079)		(0.130)
Constant	1.214***	2.930***	4.056***	3.636***
	(0.118)	(0.598)	(0.235)	(0.973)
No. of Observations	197	197	197	197

R-squared	0.293	0.411	0.116	0.152
Room fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes

Note: Robust standard errors are in parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.1

It is found that neither the message nor IHD changed electricity and hot water use of hotel guests in Experiment 1. The coefficients of *Message* and *IHD* were insignificant in all the columns of **Table 3**. The result suggests that moral incentives alone cannot lower energy use.

The result contrasts with previous finding that moral incentives can lower energy consumption of households. The critical difference in energy conservation between households and hotel guests is that by saving energy households receive monetary rewards (i.e., lower energy bills) but hotel guests do not. This may imply that people do consider monetary rewards when deciding whether to save energy, and thus that few people conserve energy for purely altruistic reasons.

4.2. Experiment 2: Donation and monetary treatment effects

We estimate the effects of the donation and monetary treatments by ordinary least squares (OLS) for the following linear equation:

$$\ln x_{it} = \beta_0 + \beta_1 Donation_{it} + \beta_2 Monegary_{it} + \beta_3 Humidity_{it} + \beta_4 Foreigner_{it} + \beta_5 Male_{it} + \theta_i + \gamma_t + u_{it}. \quad (2)$$

$Donation_{it}$ equals 1 if a hotel guest i is in the donation treatment, and $Monetary_{it}$ equals 1 if a hotel guest is in the monetary treatment. The dependent variable and other regressors are the same as in model (1). **Table 4** provides the result of a formal econometric analysis with standard errors, in which the organization of columns is the same as in **Table 3**.

Table 4: Experimental 2 Results

	Dependent Variable: Log of Electricity Use		Dependent Variable: Log of Hot Water Use	
	(1)	(2)	(3)	(4)
Monetary	-0.189***	-0.194***	-0.145**	-0.171**
	(0.053)	(0.053)	(0.070)	(0.070)
Donation	-0.085	-0.103*	-0.062	-0.062
	(0.052)	(0.052)	(0.071)	(0.071)
Humidity		-0.0178***		0.0110**
		(0.003)		(0.004)
Foreigner		-0.097		-0.064
		(0.062)		(0.092)
Male		-0.002		-0.119
		(0.054)		(0.077)
Constant	1.418***	2.056***	4.620***	4.350***
	(0.081)	(0.145)	(0.107)	(0.196)
No. of Observations	808	784	808	784

R-squared	0.324	0.360	0.084	0.103
Room FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Note: Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. The number of observations in Columns 2 and 4 are smaller than 808 because we could not get information on Foreigner and Male from 24 hotel guests who did not answer questionnaires.

Hotel guests were more willing to conserve energy when the saved money was donated to WWF, compared with the result from Experiment 1. Column 2 of **Table 4** shows that the donation treatment (*Donation*) reduced hotel guests' electricity use by 0.103 log points (10.3 percent). The level of conservation was 53.1% (= 0.103/0.194) of the monetary treatment (*Monetary*), in which hotel guests' electricity use decreased by 0.194 log points (19.4 percent).

The comparison between the donation and monetary treatments allows us to estimate the relative effects of moral incentives between household and non-household sectors. The monetary treatment resembles the energy conservation in the household sector in that the entity who takes conservation efforts and the entity who receives resulting monetary rewards are identical. Therefore, the experiment results suggest that when applied to non-household sectors, moral incentives have the potential to achieve electricity saving that is equivalent to approximately 50% of electricity saving made in the household sector. Moreover, the 50% difference indicates that not a few people ignore conservation requests because they do not receive monetary rewards for their efforts.

It was more challenging to encourage hotel guests to save hot water than to encourage them to save electricity. As shown in Column 4 of **Table 4**, the donation treatment (*Donation*) could not reduce hotel guests' hot water use. A possible reason is that while hotel guests had several options to save electricity, such as air conditioners, TV, and lightings, they had only one option, shower, to reduce hot water use. Therefore, hotel guests may need strong incentives to reduce hot water use. In fact, hotel guests reduced hot water use by 0.171 log points (17.1%) in the monetary treatment (*Monetary*), though the significance level was lower for hot water than for electricity.

5. Conclusions

The purpose of this study was to measure the pure effect of moral incentives on energy conservation and explore an instrument that makes moral incentives work in non-household sectors. The overlap between moral and economic incentives has been widely ignored in previous studies. Most research has focused on the household sector and reported only the mixed effect of these incentives. This study separated moral incentives from economic incentives by conducting a field experiment at a hotel. The experiment results show that although the pure conservation effect of moral incentives was insignificant, moral incentives did reduce hotel guests' electricity use by 10.3% when saved money in conservation was donated to an

environmental protection organization.

There are two important practical contributions of this study. First, this study provided an estimate of the potential conservation effect of moral incentives in non-household sectors. The experiment results suggest that the electricity conservation effect of moral incentives in non-household sectors would be equivalent to approximately 50% of the electricity saving in the household sector. This estimate might be useful for policymakers to better gauge the impacts of their energy conservation campaigns. Without such estimates, policymakers might over- or underestimate conservation impacts.

Second, this study showed the potential that organizations could make bigger impacts on conservation if they are accountable for their conservation campaigns. If organizations in non-household sectors (e.g., firms, schools, and governmental offices) want to encourage their people (e.g., employees, students, and customers) to conserve energy, they should show how they are going to use the saved money for environmental protection. That way, organizations can successfully generate conservation efforts from their people and, at the same time, make additional impacts on conservation by spending the saved money on environmental protection, which also increases social images of the organizations.

One limitation of this study is that we used only one set of reward amounts, 300 and 600 JPY, in the experiment. To make reward handling simple, we used gift cards, which come in preset amounts, starting at 300 JPY. It remains future work to examine how people respond to different reward amounts.

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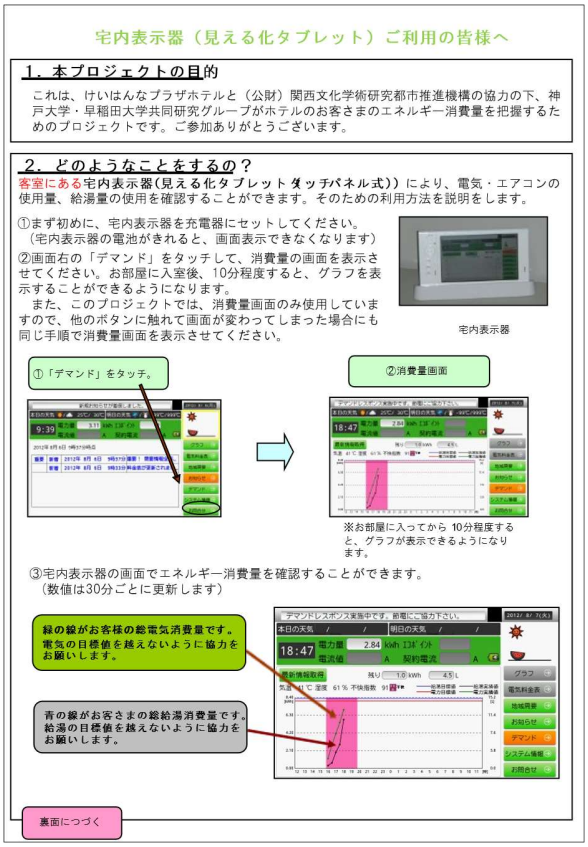
Appendix

Figure A1: Exterior of Keihanna Plaza Hotel

Note: (Address) 1-7 Hikaridai, Seikacho, Soraku-gun, Kyoto, 619-0237, Japan.

Figure A2: One of the guest rooms used for our experiment



宅内表示器（見える化タブレット）ご利用の皆様へ

1．本プロジェクトの目的

これは、けいはんなプラザホテルと（公財）関西文化学術研究都市推進機構の協力の下、神戸大学・早稲田大学共同研究グループがホテルのお客さまのエネルギー消費量を把握するためのプロジェクトです。ご参加ありがとうございます。

2．どのようなことをするの？

客室にある宅内表示器(見える化タブレット(タッチパネル式))により、電気・エアコンの使用量、給湯量の使用を確認することができます。そのための利用方法を説明をします。

①まず初めに、宅内表示器を充電器にセットしてください。
（宅内表示器の電池がきれると、画面表示できなくなります）

②画面右の「デマンド」をタッチして、消費量の画面を表示させてください。お部屋に入室後、10分程度すると、グラフを表示することができるようになります。
また、このプロジェクトでは、消費量画面のみ使用していますので、他のボタンに触れて画面が変わってしまった場合にも同じ手順で消費量画面を表示させてください。

宅内表示器

①「デマンド」をタッチ。

②消費量画面

※お部屋に入ってから 10分程度すると、グラフが表示できるようになります。

③宅内表示器の画面でエネルギー消費量を確認することができます。
（数値は30分ごとに更新します）

緑の線がお客様の総電気消費量です。電気の目標値を越えないように協力をお願いします。

青の線がお客さまの総給湯消費量です。給湯の目標値を越えないように協力をお願いします。

裏面につづく

To our hotel guests using the in-home display Touch screen tablet users

1. Purpose of our project

This is a project of Kobe University and Waseda University collaborative research group, with the cooperation of Keihanna Plaza Hotel and the Keihanna Science City, to understand the energy consumption of hotel guests. Thank you for your participation.

2. How to use the in-home display (touch screen tablet)

By using the in-house display (touch screen tablet) in the room, you can check your electricity and hot water usage as follows:

① First, place the touch screen tablet on the charging station.
(The tablet will be turned off if it runs out of battery.)

② Touch "デマンド" in the menu on the right side of the tablet to display the energy consumption screen. The graphs of your energy consumptions will appear in the energy consumption screen approximately 10 minutes after you enter the room.

Touch panel terminal

This project uses only the energy consumption screen. If you accidentally touch other icons and the tablet displays different screens, repeat this step to change it back to the energy consumption screen.

① Touch "デマンド"

② Energy consumption screen

* Graphs will be shown approximately 10 minutes after you enter the room.

③ Check your energy consumptions on the energy consumption screen.
(Graphs will be updated every 30 minutes.)

The green line graph is your cumulative electricity consumption. Please limit your consumption so as not to exceed the target limit.

The blue line graph is your cumulative hot water consumption. Please limit your consumption so as not to exceed the target limit.

Continues on the back.

3．アンケートにご協力ください

所定のアンケートにご協力ください。お答え頂いたアンケートは、フロントにお渡しください。

なお、本実証に関するご意見、ご質問は、下記窓口まで電話またはe-mailでお問合せください。
神戸大学　経済学研究科　岡島　成治（准教授）
TEL:080-7716-6003
e-mail:okajima@econ.kobe-u.ac.jp

4．ご使用量のデータについて

ご使用の部屋の電力量(エアコン、冷蔵庫、ポット、テレビ、照明など)・給湯量・お部屋の温湿度は、実証データとして有効に活用させていただきます。
但し、個人を特定してデータを公表することはいたしません。

3. Please fill out our survey

Please fill out the prescribed questionnaire and hand it in to the front desk.

If you have any questions or comments regarding this project, please contact us by phone or e-mail:

Kobe University, Graduate School of Economics
Shigeharu Okajima (Associate Professor)
TEL: 080-7716-6003
e-mail: okajima@econ.kobe-u.ac.jp

4. About the data

We collect data on the consumption amounts of electricity (by the air conditioner, refrigerator, electric pot, television, lighting, etc.) and hot water in this room, as well as the room temperature and humidity. We will use the data for research purpose only.

We will not disclose any personally identifiable data.

Figure A3: The explanatory leaflet of the IHD placed in a guest room in Experiment 1 (left) and its translation (right)

If you save electricity and hot water, we will donate to WWF.

If your consumption of electricity and/or hot water during your stay does not exceed the average consumption in the same month of the previous year, please notify the front desk at the time of checkout.
Our project team (see the backside for details) will donate 600 JPY if your consumption of both electricity and hot water is less than the previous average, and 300 JPY, if your consumption of either electricity or hot water is less than the previous average.
By saving energy, you can support the environmental protection initiatives by WWF.

How to use tablet	①	②	③	④
	Place the touch screen tablet on the charging station.	Hold down the power button① if the power is off.	Touch "ﾃﾞﾏﾝﾄﾞ"② to display electricity and hot water consumption.	Touch "ﾃﾞﾏﾝﾄﾞ"② if you accidentally change the screen.

Questions

This is a project of Kobe University and Waseda University collaborative research group, with the cooperation of Keihanna Plaza Hotel and the Keihanna Science City, to understand the energy consumption of hotel guests. If you have any questions or comments regarding this project, please contact us via e-mail:
Kobe University, Graduate School of Economics
Atsushi Morimoto email: morimoto@rabbit.kobe-u.ac.jp

About collected data

We collect data on the consumption amounts of electricity (by the air conditioner, refrigerator, electric pot, television, lighting, etc.) and hot water in this room, as well as the room temperature and humidity. We will use the data for research purpose only.
We will not disclose any personally identifiable data.

Figure A4: The explanatory leaflet in the donation treatment (left) and its translation (right)

If you save electricity and hot water, we will give you gift cards.

If your consumption of electricity and/or hot water during your stay does not exceed the average consumption in the same month of the previous year, please notify the front desk at the time of checkout.
Our project team (see the backside for details) will give you a 600 JPY gift card (Quo Card) if your consumption of both electricity and hot water is less than the previous average, and a 300 JPY gift card, if your consumption of either electricity or hot water is less than the previous average.

How to use tablet	①	②	③	⑤
	Place the touch screen tablet on the charging station.	Hold down the power button① if the power is off.	Touch "ﾃﾞﾏﾝﾄﾞ"② to display electricity and hot water consumption.	Touch "ﾃﾞﾏﾝﾄﾞ"② if you accidentally change the screen.

Previous average: Horizontal lines

Electricity: Green line graph

Hot water: Black line graph

Questions	This is a project of Kobe University and Waseda University collaborative research group, with the cooperation of Keihanna Plaza Hotel and the Keihanna Science City, to understand the energy consumption of hotel guests. If you have any questions or comments regarding this project, please contact us via e-mail: Kobe University, Graduate School of Economics Atsushi Morimoto email: morimoto@rabbit.kobe-u.ac.jp
About collected data	We collect data on the consumption amounts of electricity (by the air conditioner, refrigerator, electric pot, television, lighting, etc.) and hot water in this room, as well as the room temperature and humidity. We will use the data for research purpose only. We will not disclose any personally identifiable data.

Figure A5: The explanatory leaflet in the monetary treatment (left) and its translation (right)