Prosocial incentive versus financial incentive for biodiversity conservation: A field experiment on a smartphone app

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Abstract

What kind of, where, and how many species (including rare and invasive ones) are living? Although ascertaining this actual situation is essential for biodiversity conservation, it is difficult to completely monitor the situation through public fixed-point surveys. Information voluntarily provided by citizens assists in ascertaining the situation. We introduce a matching scheme whereby citizens post species information on a smartphone app for biodiversity conservation, and then monetary donations are made to activities for saving endangered species. We conduct a field experiment on the app with its users (N=830) and measure the scheme's effect on their posting behavior. We also measure the effect of another scheme that provides financial rewards for posting species information and investigate which charitable matching or reward matching has a greater behavioral change effect. We find no evidence that prosocial incentives increase the number of posting species information. On the contrary, financial incentives are found to have a continuous impact on increasing the number of such the postings during the treatment weeks. In particular, the promoting effect of financial incentives are strongly observed in the subgroup with a medium number of the postings at the pre-experimental period.

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We obtained ex-ante approval from the ethics committee of Center for Infectious Disease Education and Research, Osaka University, Japan (2022CRER0901). We also registered the experimental design with the AEA RCT Registry (Sasaki and Kubo, 2022).

1. Introduction

Citizens exhibit interests for a variety of social contribution activities, including biodiversity conservation ones. However, it is difficult for one citizen to participate in multiple activities with the same effort. There are both activities in which they want to directly participate and activities in which they would be satisfied to be indirectly involved.

In this study, we introduce a scheme whereby when people contribute to the activity in which they want to directly participate, another positive action also occurs in the social contribution activity in which they want to be indirectly involved. We experimentally test how much the scheme facilitates the former behavior.

Specifically, we introduce a matching scheme whereby citizens post species information on a smartphone app for biodiversity conservation, and then monetary donations are made to activities for saving endangered species. We conduct a field experiment on the app with its users (N=830) and measure the scheme's effect on their posting behavior. We also measure the effect of another scheme that provides financial rewards for posting species information and investigate which charitable matching or reward matching has a greater behavioral change effect.

It is reported that matching charitable donations to walking behaviors effectively promotes the walking behavior compared to offering financial incentives to the walking behavior (Schwartz et al., 2021). However, the effects of matching third-party donations to individuals' donations (e.g., matching gifts) are heterogeneous and can be positive or negative (Epperson and Reif, 2019).

2. Field Experiment

2.1. Experimental Design

In this study, we collaborated with a company providing a smartphone app for citizens to collect, post, and record species information, and conducted a field experiment with the app users from September to November 2022. The app was launched in May 2017, and the number of users exceeded 400,000 in April 2022.

When users take photos of plants and animals they see and post them to the app, the app identifies their names and types based on the AI. Then, the app records its species information as well as the time and place of taking and posting the photos. Citizens collecting species information and sharing it to the public will lead to a better understanding for what kind of, where, and how many species (including rare and invasive ones) are living. Ascertaining this actual situation is essential for biodiversity conservation.

We collected participants for this experiment in the following ways: We posted a recruitment ad on the front page of the app. On the transition page, we obtained opt-in participation consent from users. After obtaining their participation consent, we asked them to complete the first survey. The survey included a set of questions to ascertain their socioeconomic demographics, as well as

their use of the app, daily steps, mental health, reasons for participating in this event, etc. Consequently, we obtained an analysis sample of 830 participants.

We randomly assigned them to either of the control group (n=275), prosocial treatment group (n=273), or financial treatment group (n=282). We set a two-week treatment period, during which those assigned to the prosocial or financial treatment group receive the following interventions through E-mail, respectively:

> **Prosocial treatment group:** Based on the number of species information posted by each user, the experimenter donates to activities related to biodiversity conservation.
> *"For every species information you post, the experimenter will make a donation to an endangered species protection activity. He/she will donate 25 JPY for each species information you post, and up to 250 JPY for 10 species information."*

> **Financial treatment group:** Based on the number of species information posted by each user, the experimenter gives them financial rewards that can be used for their online shopping.
> *"For every species information you post, the experimenter will give you Amazon gift certificates. He/she will give you a 25 JPY gift certificate for each species information you post, and up to 250 JPY gift certificates for 10 species information."*

2.2. Balance Check

We conducted stratified randomization. The strata are based on 1) number of species information posted by users during the baseline period prior to participation, and 2) their prosocial or selfish motivations for participation. The first variable is automatically recorded by the app, while the second is collected in a self-report format in the first survey.

We checked for homogeneity between the three groups. Specifically, we confirmed no group-differences in numbers of species information posted on weekdays, of species information posted on weekends or holidays, of species photos posted on weekdays, and of species photos posted on weekends or holidays.

We also confirmed no group-differences in individual characteristic, including age, sex, family structure, years of education, ability to pay, and time use. We further confirmed no group-differences in prosocial or selfish motivations for participation, pro-environmental attitudes, physical activity, and mental health.

3. Analysis

3.1. Procedure

We receive from the app company the data on daily posted species information and daily posted

species photos for each user. Using the data, we construct two primary outcomes.

- Number of species information posted on weekdays (Number of unique postings)
- Number of species photos posted on weekdays (Number of postings)

The number of posted species information is not equal to that of posted species photos, which counts even if a user posts multiple photo of the same organism.

We use a difference-in-differences (DID) approach to estimate our treatment effects on participants' primary outcomes. First, we use the data from the baseline period prior to participation and the two-week treatment period and estimate the following equation.

$$\begin{aligned} Postings_{it} = \alpha_0 &+ \alpha_1 Prosocial_i \times Week1_t + \alpha_2 Prosocial_i \times Week2_t \\ &+ \alpha_3 Financial_i \times Week1_t + \alpha_4 Financial_i \times Week2_t \\ &+ \alpha_5 User_i \times Day\_of\_week_{it} + \alpha_6 Day_t + \varepsilon_{it}, \quad (1) \end{aligned}$$

where i and t denote users and day. $Prosocial_i$ takes 1 for the prosocial treatment group and 0 for the otherwise, while $Financial_i$ takes 1 for the financial treatment group and 0 for the otherwise. $Week1_t$ ($Week2_t$) takes 1 in the first (second) week of the treatment period and 0 in the otherwise. The coefficients of interest are α_1 and α_2, capturing the average difference in postings between the prosocial treatment and control groups. Similarly, the coefficients of interest are α_3 and α_4, capturing the average difference in postings between the financial treatment and control groups. $Individual_i \times Day\_of\_Week_{it}$ is an interaction term between individual i and the day of the week, which represents a fixed effect for user i and the day of the week. Day_t is a fixed effect for each day. We use cluster standard errors at the user level to account for serial correlation of each user. We test hypotheses of $\alpha_1 = 0$, $\alpha_3 = 0$, and $\alpha_1 = \alpha_3$, respectively. We also test hypotheses of $\alpha_2 = 0$, $\alpha_4 = 0$, and $\alpha_2 = \alpha_4$, respectively.

3.2. Results

Table 1 shows that neither the number of unique postings nor the number of total postings changes in the treatment group with prosocial incentives, compared to the control group. The effects in the first treatment week are positive and 2 or 3 but are not statistically significant. On the other hand, the financial incentives treatment is found to increase the numbers both of unique postings and total postings in the first treatment week. The effect on the number of unique postings is 2.284 and the effect on the total number of postings is 2.476, both with statistically significance at the 5% level. The increasing effect on the number of unique postings is maintained in the second treatment week.

These treatment effects could be heterogeneous. Using information on the number of unique postings at the baseline period, we created the following three subgroups: a subgroup with a high number of unique postings, a subgroup with a middle number of unique postings, and a subgroup with a low number of unique postings. Although we estimated the treatment effects for the three subgroups, the treatment effects of the prosocial incentives remain statistically non-significant in any of the subgroups. On the other hand, the treatment effect of financial incentives is stronger in the subgroup with the middle number of unique postings at the baseline period.

4. Conclusions

We find no evidence from this field experiment that prosocial incentives increase the number of posting species information. On the contrary, financial incentives are found to have a continuous impact on increasing the number of such the postings during the treatment weeks. In particular, the promoting effect of financial incentives are strongly observed in the subgroup with a medium number of the postings at the pre-experimental period. As a next step, we will focus on the content of the posted species and examine the effect of each treatment on posting rare and invasive species.

References

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Table 1.

	(1)	(2)	(3)	(4)	(5)
Depndent variable:	# of unique postings	# of postings	# of unique postings	# of unique postings	# of unique postings
Analysi sample:	Full sample	Full sample	High number	Middle number	Low number
Prosocial Incentive*Treatment Week 1	2.126	2.948	4.000	3.087	-0.143
	(1.596)	(2.125)	(4.659)	(2.695)	(0.69)
Prosocial Incentive*Treatment Week 2	0.877	0.24	5.949	0.322	-0.474
	(0.842)	(1.162)	(4.442)	(0.550)	(0.779)
Fiancial Incentive*Treatment Week 1	2.284**	2.476**	3.069	3.362***	0.721
	(0.983)	(1.125)	(4.469)	(1.158)	(0.757)
Fiancial Incentive*Treatment Week 2	1.817**	0.975	6.277	1.986***	-0.049
	(0.841)	(1.159)	(4.136)	(0.602)	(0.839)
Constant Term	4.285***	5.230***	16.996***	2.753***	1.139***
	(0.351)	(0.404)	(1.646)	(0.365)	(0.283)
Num.Obs.	2490	2490	363	1269	858

Robust standard errors are clusterd by user ID; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$