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Abstract

We conduct a natural field experiment on the effect of having a celebrity endorse an information campaign aiming to induce pro-environmental behavior in the context of single-use plastics consumption. We find that an information campaign does not have a significant effect on behavior unless it is endorsed by a celebrity. Subjects in the treatment with a combination of information campaign and celebrity endorsement use around 25% fewer plastic items compared with subjects in the control group. Adding a pledge to the endorsement does not result in an incremental reduction in the use of plastic items. Exploratory analysis suggests that the information campaign itself affect attitudes, but not behavior, and that it is the celebrity endorsement itself that affect behavior.

Keywords: pro-environmental behavior, celebrity endorsement, information

JEL Codes: C93, D9, Q5

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1. Introduction

Many large-scale environmental problems are the aggregate result of small consumption and production decisions by a very large number of actors (Godfray et al., 2018; Poore & Nemecek, 2018). The standard economic policy recommendation would be to increase the relative price of the most polluting alternative. Frequently, though, this can be difficult to implement due to, among other things, the complexity of the environmental problem, implementation and administrative costs, and lack of observability (e.g. when there is a large informal sector or when individual behavior cannot be monitored). Attention has therefore been placed on alternative approaches to affect consumption and production of goods that involve negative externalities. Building on the assumption that people have pro-social or pro-environmental preferences (Andreoni, 1990; Kotchen & Moore, 2008), one prominent recommendation is to provide information on the environmental impacts of behavior, and how to reduce them (e.g. Jessoe and Rapson, 2014). Even more effective is the provision of social reference information (e.g. Alpízar et al., 2008). The most prominent example is the use of home energy reports (e.g. Allcott and Rogers 2014; Costa and Kahn 2013; Allcott 2011; Jaime Torres and Carlsson, 2018) where information about own and other's performance has been shown to reduce energy use by around 3% to 5% (Carlsson et al., 2020).[1] A third option is to couple information with messages containing injunctive norms, i.e., direct moral pleas to change behavior (e.g., Ito, Ida, and Tanaka 2018; Egebark and Ekström 2016), but the evidence of positive long-run effects of moral pleas is limited. Finally, information can be coupled with commitments or pledges in which a concrete goal is defined (Baca-Motes et al., 2013; Harding & Hsiaw, 2014).[2]

One interesting feature of information provision that has not been explored extensively is how important the source of information actually is. In this paper, we

[1] There are several elements of these information messages that can affect behavior, including what the comparison group is and the initial level of use. For example, effects on behavior tend to be stronger on individuals who initially have a high level of use (Rivers et al., 2017). They also tend to be stronger if the reference group is salient (Bergquist et al., 2019).

[2] For example, Harding and Hsiaw (2014) investigated how voluntary goal-setting concerning electricity savings affected electricity use. Those who set a realistic goal saved more than those who set a very low or very high goal.

explore whether celebrities can promote a behavioral change. Celebrities can deliver all kinds of information: information about the problem, information about peers, descriptive norms of pro-social behavior (injunctive norms), and requests for pledges. Celebrities are an integral part of marketing and branding of products, but not much is known about the effects of celebrities on pro-environmental behavior (Olmedo et al., 2020). 3 Even in the absence of formal evidence, celebrity endorsement is an increasingly popular strategy in the domain of environmental conservation and protection (Abidin et al., 2020), with lots of enthusiasm from both environmental initiatives and celebrities.4

In this paper, we present the results from a natural field experiment designed to study the effect of having a celebrity endorse an information campaign to reduce the use of single-use plastics in Vietnam. In the experiment, subjects were randomized into a control group or one of three different treatment groups. The treatments were (i) an environmental campaign, (ii) an otherwise identical celebrity-endorsed environmental campaign, and (iii) a celebrity-endorsed environmental campaign identical to (ii) with a written pledge to change behavior. We use careful pre-tests to select a local celebrity as the endorser for the campaign.

Individual behavior in the context of small, daily consumption decisions and waste generation is hard to measure in the field (Banerjee & Duflo, 2009; Burtless, 1995; Levine et al., 2018). To secure an easy-to-measure outcome variable based on actual behavior, we capture subjects' consumption decisions involving their use (or not) of single-use plastics in actual shops that were minimally adjusted to have a trained enumerator record behavior.

Having a celebrity endorse a campaign can trigger a change in behavior through several mechanisms. A celebrity could act as a role model or a leader with whom the subject would like to be associated. Leadership in this case comes not from formal

[3] Olmedo et al. (2020) searched the peer-reviewed and grey literature on environmental campaigns with celebrity endorsement in six languages. They found 79 campaigns implemented in nine countries from 1976 to 2018, with two-thirds of them conducted in China and reported in Chinese. Only four of them were evaluated and none provided evidence of the effectiveness of celebrity endorsement.

[4] Prominent examples include UNEP's Goodwill Ambassadors featuring supermodel Gisele Bündchen and football player Yaya Touré, and actor Leonardo DiCaprio's eponymous foundation dedicated to "support innovative projects that protect vulnerable wildlife from extinction, while restoring balance to threatened ecosystems and communities."

authority, but from charisma, and following them is voluntary (Hanna et al., 2018; Hermalin, 1998). Several studies argue that followers believe the leader has better information about the problem and potential solutions (Hermalin, 1998; Komai et al., 2007). Most of the empirical studies on leadership have focused on charitable fund raising or voluntary contribution to the public good using lab or lab-in-the-field experiments. For example, Jack and Recalde (2015) implemented a voluntary provision of public good experiment in 52 communities in rural Bolivia to examine the role of leadership. They found that contributions increase with information signaling from leading-by-example leaders and observable characteristics of leaders.

In the context of social dilemmas where individual benefits are at odds with the public benefits, leaders may shape subjects' belief about the behavior of others (Gächter & Renner, 2018), or may send an injunctive signal about the credibility and importance of the public benefits (Andreoni, 2006; Chang & Ko, 2018). In most cases, multiple mechanisms are at play, and disentangling them individually is not easy. In this paper, we provide exploratory evidence on the mechanisms behind behavioral changes resulting from celebrity endorsement.

We find that an information campaign does not have a significant effect on behavior unless it is endorsed by a celebrity. The effect of celebrity endorsement is sizeable. Subjects in the treatment with celebrity endorsement use around 25% fewer plastic items in the shop at the end of the experiment compared with subjects in the control group. The impact of our one-shot intervention also goes beyond the short-term effect, measured right after the intervention, and remains significant and similar in size around one month after the intervention. The total effects in the treatment where a pledge is added are even larger, but we do not find a statistically significant effect of pledges themselves.

Previous studies have shown that the inclusion of injunctive messages and social comparisons in a campaign can successfully induce behavioral changes (e.g. see a meta-analysis by Bergquist et al., 2019). In this study, we further the research by looking at the role of the messenger, i.e. the person who delivers the message promoting pro-environmental behavior. The role of celebrities in social marketing has been explored before. For example, Garthwaite & Moore (2013) examine how Oprah Winfrey's endorsement of president Obama affected people's votes and political

donations, and Alatas et al. (2019) evaluate the impact of a large-scale, celebrity-endorsed social media campaign on beliefs about vaccination and knowledge of immunization-seeking behavior by one's Twitter network. However, the impact of celebrity endorsement on pro-environmental behavior is understudied, despite the widespread use of celebrity endorsement and celebrity advocacy aiming to encourage pro-environmental activities. A few previous studies have looked at celebrity endorsement and stated intentions, as opposed to actual behavior, to buy more environmentally friendly products (Elgaaied-Gambier et al., 2018) or stated conservation behavior (Duthie et al., 2017). Both these studies found an effect of celebrity endorsement on stated behavior. In a non-experimental setting, Jacobsen (2011) examines the "Al Gore effect" on household pro-environmental behavior and finds that Al Gore's documentary "An Inconvenient Truth" temporarily increased the purchase of voluntary carbon offsets. As far as we are aware, ours is the first field experiment on celebrity endorsement of pro-environment behavior.

The rest of the paper is organized as follows. Section 2 describes the experimental design, randomization, and data collection procedure. Section 3 presents the main results and additional exploratory analysis. Section 4 discusses the results and Section 5 concludes.

2. Experimental Design

The experimental design and pre-analysis plan were formally registered with the American Economic Association's registry for randomized controlled trials, and formally approved on October 23rd 2019. The description below borrows heavily from this registered pre-analysis plan (Alpízar et al., 2019).

2.1 Treatments

In addition to a control group, the experiment has three treatments. We use an "add-on" design in the sense that elements are added to each new treatment. We also use a between-subject design such that each participant was assigned to only one of the treatments or to the control group.

The first treatment (Treatment 1) is an environmental campaign with a strong educational element. The environmental campaign was delivered in the form of marine

environment protection workshops organized by the researchers. At the workshop, participants (university students) first watched a video that described plastic pollution at both the global and local level, suggested solutions, and asked for a behavioral change at the individual level. The participants were then asked to reflect on their use and disposal of plastics, and how they could change their behavior. The workshop aimed at raising awareness, improving the knowledge of marine environment issues, and getting participants to change their behavior.

The second treatment (Treatment 2) had the same environmental campaign and request for a change, but it was endorsed by a celebrity. With a similar workshop setting as treatment 1, participants also watched a video that consisted of two related parts. Part one was the same video used in treatment 1, while part two featured the celebrity. The second part of the video provided no additional information on the problem of plastic pollution or its potential solutions. It simply related the problem to a concrete person and her efforts to change her behavior away from the consumption of single-use plastics.[5] The video was intended to have the celebrity support the information provided, and to show her leading by example.

In the third treatment (Treatment 3), we added a personal pledge option to explore how this could affect the effectiveness of celebrity endorsement. In addition to receiving the environmental information endorsed by the celebrity, the participants received a card with a to-do list and tips in the name of the celebrity, asking the participants to join her in the movement and make a pledge to reduce plastic pollution. The card listed a series of actions one can take to reduce plastic waste, ranging from specific behavior like "bring reusable bags when shopping" to more general suggestions such as "support environmental campaigns and policies". The card is shown in Figure A1 in the Appendix. The participants signed the card if they wanted to make the pledge. The pledge was private.[6] We asked the participants to keep the card and encouraged them to post it in their dormitory rooms. We did not check whether they actually signed the cards or posted them.

[5] The videos can be found at EfD Vietnam YouTube channel https://youtu.be/zzMq3HivP-E. It was uploaded six months after the experiment ended.

[6] The private pledge design also resembles the pledge tools in many existing environmental campaigns such as the pledge platform against plastic pollution operated by the National Geographic Society: https://www.nationalgeographic.com/environment/plasticpledge/.

Participants in the control group were invited to workshops that had no relation to plastic pollution, but with a similar length, in order to control for any effect from participating in a workshop. These workshops were a series of personality tests on general topics, such as being successful in school and how to plan a future career.

2.2 Choosing a Celebrity

Studies in marketing indicate that choosing an endorser who suits the promoted program is crucial (Choi & Rifon, 2012; Escalas & Bettman, 2017). First, the attributes and profile of an endorser attract attention from the audience and transfer image values to the audience through the message (Escalas & Bettman, 2017). Second, the congruence between the celebrity endorser and the audience is a key factor (Choi & Rifon, 2012). In addition, the image or actual practices of the celebrity endorser must have a connection with the characteristics of the promoted program (Duthie et al., 2017). For example, Elgaaied-Gambier et al. (2018) found that a celebrity endorser with an image connected with the environmental problem had an effect on stated purchase intentions in a survey, while a celebrity without a connection to the environmental problem did not have any effect on behavior. Thus, we aimed at having a celebrity endorser with characteristics congruent to the audience and pro-environmentally friendly practices relevant to the plastic issue.

The celebrity in this study is Hoang Thuy, who is best known for winning Season 2 of Vietnam's Next Top Model. She also represented Vietnam at the Miss Universe 2019 pageant. She is considered one of the most successful Vietnamese models. In addition, she was involved in environmental protection campaigns, including reducing plastic pollution, before this experiment. For example, in July 2019 she joined a well-known campaign named “green summer” organized by the Ho Chi Minh City’s Youth and Student Association with the participation of students from many universities in the region. The campaign successfully carried out a wide range of pro-environmental activities, i.e., river clean-up and fundraising. This is evidence of her popularity and the congruence between her empathy and environmental issues such as plastic pollution.

To assess the suitability of Hoang Thuy as our celebrity endorser, we carried out two rounds of pre-tests to explore whether she had the characteristics needed for an

effective celebrity endorser, summarized by Amos et al. (2008). Our first pre-test with around 245 Vietnamese university students in April 2019 showed that she is widely known among students and is a suitable candidate for a pro-environmental campaign. Over 65% of respondents knew about her, and she was among the top three choices among a list of 11 celebrity candidates when it came to promoting pro-environmental activities. The second pre-tests largely confirmed her pro-environmental image and credibility as public figure.

The ex post survey results in our study also confirm this: about 85% of the students in the sample had heard of her, and 80% were aware of her previous engagement in pro-environmental events. 75% of them agreed that she had a good social image and 85% thought she was an appropriate endorser for reducing plastic consumption.

Measuring Single-Use Plastic Consumption: A Shopping Experiment

Actual changes in daily consumption of single-use plastics are the best indication of an effective treatment. Unfortunately, such changes are not directly observable without being influenced by observer effects. In order to have our outcome variable as close as possible to actual behavior, we measure subjects' consumption of single-use plastics in shops that were minimally adjusted to have a trained enumerator record behavior.

All participants received vouchers for participating in the study (see Figure 1). The vouchers were framed as in-kind payment for their participation in each stage of the study and were not transferable. The vouchers could be redeemed at stands in designated shops in the student villages. These shops are often managed by students working part-time; our research assistants were also students. There was nothing unusual about the shops or the stands, and we tried to minimize the connection to the workshops and the research project. Clearly, we cannot rule out that some subjects might have realized that they were being observed by the people in the shop, but we did not receive any remarks from participants or our research assistants about this.

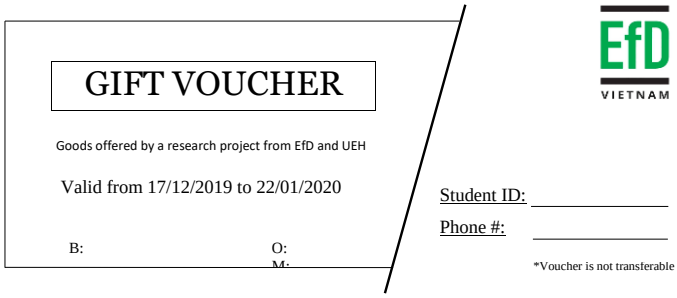

Figure 1. Voucher given to student for their participation in workshops (English translation, the original version was in Vietnamese)

The vouchers could be exchanged for a fixed package of goods, the same for all participants, that are typically associated with single-use plastics: five small packs of milk, four packs of instant noodles, four small boxes of yogurt, a soda drink, two pens and a mint candy bar. 7 These small goods are typically carried in light plastic bags, and consumed using plastic spoons and straws. The volume of the goods, mostly because of the milk and noodles, is meant to induce demand for bags. The liquid products, especially the soft drink, are to induce demand for straws. The yogurt is included to induce demand for spoons. The pens and the candy are included just as additional products. The total value of the goods was about five USD.

The three single-use plastic items available in the shop – plastic bags, straws, and spoons – are commonly available to customers free of charge in grocery stores in Vietnam. We provided these items in the same manner. Plastic bags, straws, and spoons were put on the counter for students to take when receiving the goods. They could take as many as they wanted and our research assistants did not intervene.

At each stand, a research assistant checked the student ID and delivered the goods.8 When students redeemed their vouchers, the research assistant silently recorded whether, how many, and what type of single-use plastic items were taken by each

[7] The items presented in the shopping experiment were determined based on student group discussions. The main indicators when choosing the items were that (1) these items are commonly consumed by students regardless of gender, weather conditions and daily time points, and (2) these items provide several options for students to use plastic items.

[8] Each student has a unique student ID number. We used this number for several purposes throughout the study. First, every participant had to write down his/her student number on the voucher when it was handed to him/her. This was to make sure that the voucher was not transferable. Second, the student number was recorded as an identifying number that was traceable to the subject. This was used to link with the surveys and outcome variables which were collected in different stages throughout the study.

subject to go with the package of goods. Matching the student IDs with recorded single-use plastic consumption, we can observe the behavior of each individual subject.

We capture the behavior of our subjects three times in the study, always using the same strategy that combines vouchers and surveys. Each subject completed three surveys: 1. A survey a few weeks prior to the intervention ("pre-treatment survey"); 2. A survey right after treatment, and 3. An endline survey at least three weeks after treatment. Each time they received a voucher valid for a period of time, but we strongly encouraged students to exchange them immediately, which almost all of them did. The timeline of this study, described in Figure 2, is important. Students received an invitation plus a voucher prior to the pre-treatment survey. This is to capture their baseline behavior without being influenced by the survey. At the intervention students participated in the workshop as described in Section 2.1. The shop exchange right after the intervention allows us to explore behavioral changes in the short term, when compared to the baseline. The endline shop exchange aims to examine whether the effect of our one-shot intervention can be sustained over the medium term.

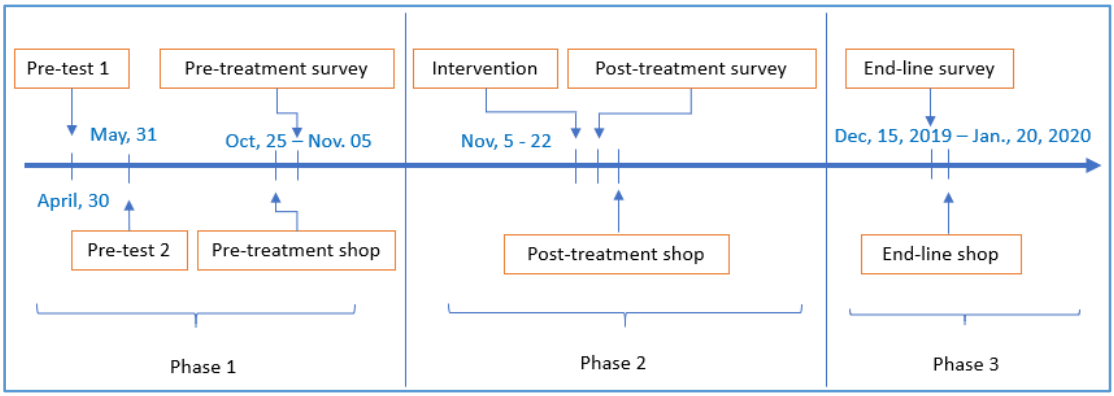

Figure 2. Timeline of the study

2.3 Randomization and Data Collection

In order to reduce contamination between treatments and control, our treatment assignment was randomized at the dormitory room level. Using all the undergraduate dormitory rooms in two student villages as our sampling frame, we randomly selected rooms for the study, and randomly assigned them to treatment or control. A typical

dormitory room in the student villages is shared by four, six, or eight students. We then randomly selected one student in each selected room to participate in the workshops. Because we only picked one student in each room, randomization still occurs at the individual level.

We conducted the experiment in two university dormitory systems in Vietnam. One student village is located in Ho Chi Minh City (HCMC), the largest city in Vietnam. The HCMC student village is the largest student community in Vietnam. This dormitory complex consists of 47 buildings with a maximum capacity of 6,700 rooms for about over 35,000 students. The other student village is in the city of Can Tho, the largest city in the Mekong Delta. It hosts about 7,000 students from Can Tho University in over 1,120 rooms.

We worked closely with the student village administration to invite students to participate in the study. We targeted only Vietnamese students and ruled out foreign students in our sampling frame. We invited 1,700 students to be part of our study, which accounts for about 4.4% of the student population. The majority of the invited students accepted the invitation. Over 1,600 students showed up in the pre-treatment shopping and then completed the pre-treatment survey, with about 1,200 students from HCMC and 400 from Can Tho. About 9% of the students dropped out after the pre-treatment survey despite our effort to track them down and to accommodate their schedules. A total of 1,460 students participated in the treatment workshops. The attrition between the workshop and the post-treatment survey was smaller. We observed 1,348 out of the 1,460 workshop participants at the post-treatment survey, giving an attrition rate of 7.7%. Eventually, after accounting for missing information in the survey and shopping experiment, we obtained 1,312 students with full participation and complete plastic use information from the three rounds of the study.

2.3.1 Balance Test

By randomly assigning students to the treatment and control groups, we expect that individual characteristics should be the similar across groups. Table A1 in the appendix reports descriptive statistics and p-values from balance tests. There are no sizeable or statistically significant differences between treatments at the 5% level of significance.

Joint tests of all variables suggest that individual characteristics are not systematically different across different treatments.

2.3.2 Attrition Test

Because we started the pre-treatment survey with 1,633 students and had 1,312 students in our final sample, we also check whether those 20% who dropped out are different from the remaining ones. Table A2 presents and compares individual characteristics of those in our main sample with those who dropped out. We test whether individual characteristics are associated with dropping out by estimating a probit model where the dependent variable is one if the subject dropped out. We find that students from rural areas and 3rd year students were less likely to drop out. There are no a priori reasons to believe these differences play a role in our results, and in any case randomization of participants into treatments meant any difference in the treatment cannot be ascribed to biased attrition.

3. Results

Summary statistics from the pre-treatment survey are included in Table A3 in the Appendix. In essence, our subjects are typical Vietnamese university students, half of whom are male. Since our study sample was drawn from university dormitories, our subjects are mostly from rural areas (68%) and are in their 1st or 2nd year at the university, with older students preferring to live off campus.

3.1 Descriptive Results

In Figure 3, we report the average number of plastic items for the four groups at each of the three purchase decisions (pre-treatment, short term and medium term).

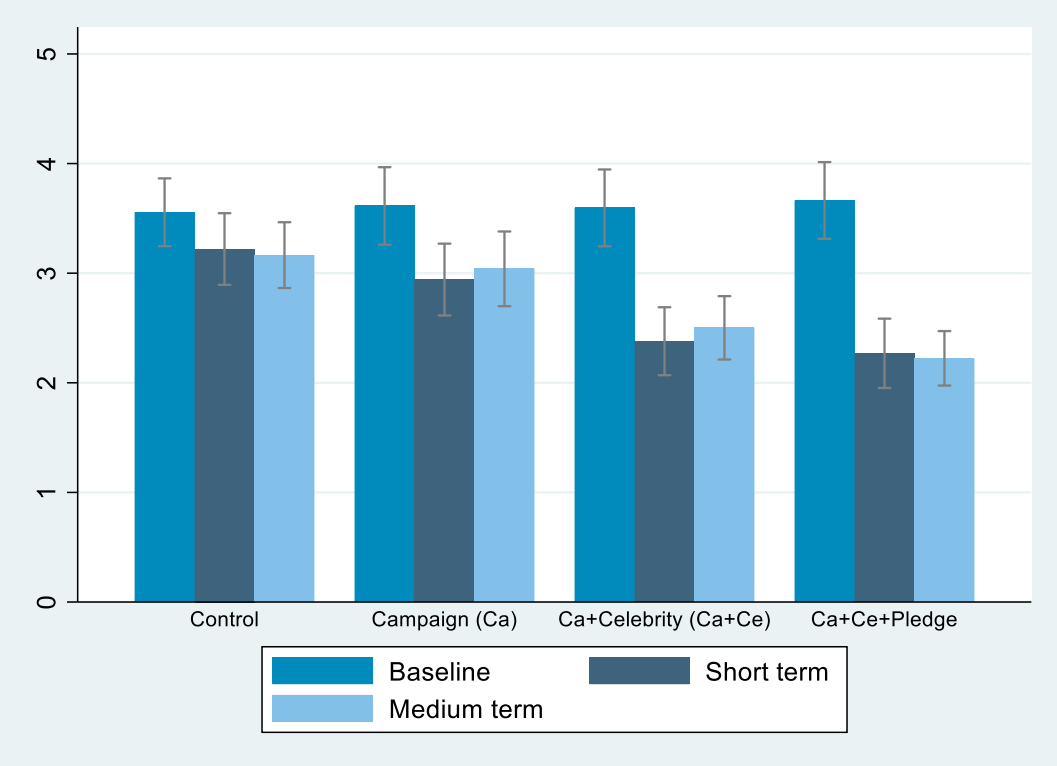

Figure 3. Total plastic use across treatment and control groups over time

To begin with, we can see that there are no differences between the control and the treatment groups at baseline. For example, the average number of plastic items picked up at the shops was 3.56 in the control group, and 3.60 in the celebrity treatment group.9 Focusing on behavior immediately after the treatment workshop, we see that the number of plastic items picked at the student shops decreases in all four groups, but the decrease is larger in the treatment groups, in particular with celebrity endorsement. A similar pattern can be seen in the medium term. In Figure 4 we also report the consumption information for each of the three different plastic items (bags, spoons and straws) separately.

[9] Using ranksum tests, we cannot reject the hypotheses of equal distribution between the control group and the three treatment groups at baseline (p-values are 0.749, 0.824 and 0.808, respectively)

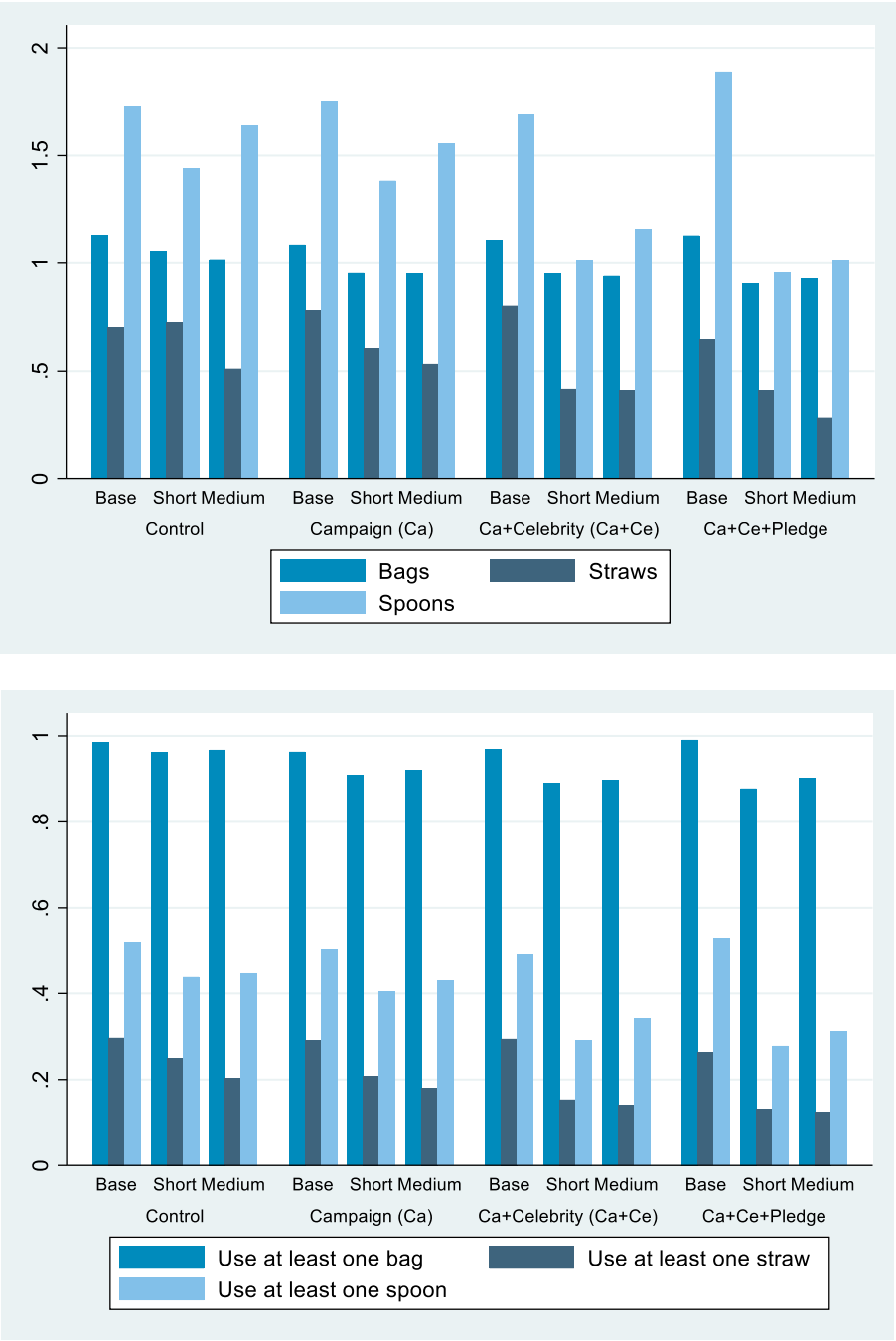

Figure 4. Total plastic use across treatment and control groups over time

Figure 4 shows that the average number of plastic bags does not vary over time or between treatment groups as much as the two other items. Moreover, looking at behavior prior to treatment, a vast majority (more than 97%) of participants used at least one bag, while the corresponding figures for straws and spoons are 29% and 51%.

We believe this pattern is the result of the fact that upon receiving the goods, the need for a bag is immediate and largely inelastic due to the lack of substitutes on the spot, whereas straws and spoons are mostly needed later (back in the dorm room) when substitutes are much easier to come by.

3.1 Main Results: Treatment Effects

The main outcome variable is the total amount of plastic items that an individual picked up in the shop. To analyze the effect of the treatments on behavior, we use a negative binomial model with random effects, because the outcome variable can only take non-negative integer values, and exhibits overdispersion (conditional variance greater than conditional mean).10

We estimate two models. First, we focus on comparing the total effect of each treatment to the control group, at each of the three time periods (column (1) in Table 1). We do this by estimating a model with interaction terms between time period and the treatment dummies. For example, the interaction term "(Environ. campaign + celebrity) × Short term" is used to explore whether the campaign endorsed by a celebrity has a short-term effect, when compared to the control group.

A second model attempts to isolate the additional effect of each treatment (see column (2) in Table 1). Recall that in treatment 2, the celebrity endorsement was added to the campaign, and in treatment 3, the pledge was added to the content of treatment 2. In this model, we create dummy variables representing the additional elements of the experimental design, and interact them with the time period dummies. Here, the interaction term "Celebrity × short term" isolates the effect of seeing a celebrity endorsement.

In both models, we include dummy variables to account for short- and medium-term observations, and dummy variables to capture potential differences in the treatment groups prior to treatment.

[10] In our pre-analysis plan, we stated that we would use an OLS model. We therefore present results using an OLS model in Table A3 in the appendix. The main findings are robust to this specification, and the main effects remain statistically significant.

Table 1. Treatment Effects, Negative Binomial Model with Random Effects

	(1)	(2)
(Environ. campaign) × Short term	-0.100	
	(0.075)	
(Environ. campaign + Celebrity) × Short term	-0.324***	
	(0.078)	
(Environ. campaign + Celebrity + Pledge) × Short term	-0.407***	
	(0.078)	
(Environ. campaign) × Medium term	-0.066	
	(0.075)	
(Environ. campaign + Celebrity) × Medium term	-0.248***	
	(0.078)	
(Environ. campaign + Celebrity + Pledge) × Medium term	-0.372***	
	(0.078)	
Environ. campaign × Short term		-0.100
		(0.075)
Celebrity × Short term		-0.224***
		(0.080)
Pledge × Short term		-0.084
		(0.083)
Environ. campaign × Medium term		-0.066
		(0.075)
Celebrity × Medium term		-0.183**
		(0.079)
Pledge × Medium term		-0.124
		(0.082)
Constant	2.002***	2.002***
	(0.093)	(0.093)
Controls for time period		
Short term	-0.116**	-0.116**
	(0.052)	(0.052)
Medium term	-0.125**	-0.125**
	(0.052)	(0.052)
Controls for pre-treatment use		
Environ. campaign	-0.005	-0.005
	(0.068)	(0.068)
Environ. campaign + Celebrity	-0.002	-0.002
	(0.068)	(0.068)
Environ. campaign + Celebrity + Pledge	0.023	0.023
	(0.067)	(0.067)
Observations	3,936	3,936
Number of individuals	1,312	1,312

Note: Dependent variable is number of plastic items taken at a shop (plastic bags + spoons + straws). Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

There are clear differences between the celebrity endorsement group and the control group with respect to how many plastic items the individuals took from the shop. From the first model, we observe that individuals took approximately 32% (25%) fewer items in the short term (medium term) when the campaign was endorsed by a celebrity, compared with the control group. These effects are sizeable and statistically significant.

There are no statistically significant differences between the campaign treatment and the control group. There is also a difference between the control group and the celebrity endorsement with a pledge. In the short term, individuals took around 41% fewer items (37% in the medium term) compared with the control group. Clearly, the endorsement of the celebrity had a substantial impact on behavior.

Next, we look at the incremental effect of the treatments. In column (2), we are able to detect some differences, despite a lower power. There is a sizeable and statistically significant difference between the campaign with a celebrity endorsement and the campaign without an endorsement, both in the short and medium term. There is no statistically significant effect of the pledge itself despite a negative sign and a relatively sizable coefficient. It could be that the additional effect of the pledge is too small to be reliably detected given our sample size.

It is also noteworthy that the effect of celebrity endorsement does not significantly decline over time in our experiment. The effect size in the medium term (18%) is a bit smaller than in the short term (22%), but the difference is not statistically significant. Given that the medium-term shopping took place over three weeks after the short-term shopping and that there was a weeklong school break during the period, the one-shot exposure to the celebrity endorsement treatment apparently had more than just a short-term effect on behavior.

Additional Exploratory Analysis

Excluding Plastic Bags

As we have discussed in the descriptive results, there is much less variation in the use of plastic bags, and most participants took at least one plastic bag, not the least because they had to carry all the items they received. In contrast, the demand for plastic spoons and straws is not as immediate, and one can easily find substitutes or use alternative ways of consumption.11 Thus, we believe that the usage of plastic spoons and straws is more susceptible to change. Therefore, we further look at the behavior with respect to plastic spoons and plastic straws only. This means that the fraction of zeros is sizeable (56% for the whole sample and all periods). Therefore, in Table 2, we report results from both a negative binomial model (columns 1 and 2 for the total and

[11] The correlation coefficient between spoon and straw use ($\rho = 0.389$) is much larger than that between bag use and spoon use ($\rho = 0.138$) or between bag and straw use ($\rho = 0.078$).

incremental analysis) and a zero-inflated negative binomial model (columns 3 and 4). The first model is a random effects model, while the second relies on clustered standard errors at the individual level.

Table 2. Treatment Effects, Negative Binomial and Zero-Inflated Negative Binomial Model.

	Negative binomial		Zero-inflated negative binomial			
	(1)	(2)	(3a)	(3b)	(4a)	(4b)
VARIABLES	No. items	No. items	No. items	Inflate	No. items	Inflate
(Environ. campaign) × Short term	-0.108		-0.069	0.101		
	(0.147)		(0.082)	(0.191)		
(Environ. campaign + Celebrity) × Short term	-0.528***		-0.090	0.574***		
	(0.158)		(0.090)	(0.194)		
(Environ. campaign + Celebrity + Pledge) × Short term	-0.683***		-0.020	0.806***		
	(0.158)		(0.090)	(0.195)		
(Environ. campaign) × Medium term	-0.072		-0.053	0.026		
	(0.146)		(0.084)	(0.193)		
(Environ. campaign + Celebrity) × Medium term	-0.363**		-0.121	0.381**		
	(0.153)		(0.084)	(0.185)		
(Environ. campaign + Celebrity + Pledge) × Medium term	-0.561***		-0.209**	0.600***		
	(0.154)		(0.085)	(0.198)		
(Environ. campaign) × Short term		-0.108			-0.069	0.101
		(0.147)			(0.082)	(0.191)
(Celebrity) × Short term		-0.421***			-0.021	0.473**
		(0.162)			(0.100)	(0.197)
(Pledge) × Short term		-0.155			0.070	0.232
		(0.172)			(0.107)	(0.201)
(Environ. campaign) × Medium term		-0.072			-0.053	0.026
		(0.146)			(0.084)	(0.193)
(Celebrity) × Medium term		-0.291*			-0.068	0.355*
		(0.156)			(0.089)	(0.186)
(Pledge) × Medium term		-0.198			-0.088	0.219
		(0.164)			(0.090)	(0.190)
Constant	-0.653***	-0.653***	1.496***	-0.178	1.496***	-0.178
	(0.100)	(0.100)	(0.041)	(0.113)	(0.041)	(0.113)
Controls for time period						
Short term	-0.173*	-0.173*	0.004	0.243*	0.004	0.243*
	(0.101)	(0.101)	(0.049)	(0.133)	(0.049)	(0.133)
Medium term	-0.159	-0.159	-0.018	0.215	-0.018	0.215
	(0.101)	(0.101)	(0.056)	(0.136)	(0.056)	(0.136)
Controls for pre-treatment use						
Environ. Campaign	-0.010	-0.010	0.067	0.057	0.067	0.057
	(0.101)	(0.101)	(0.063)	(0.160)	(0.063)	(0.160)
Environ. campaign + Celebrity	-0.037	-0.037	0.066	0.087	0.066	0.087
	(0.103)	(0.103)	(0.062)	(0.161)	(0.062)	(0.161)
Environ. campaign + Celebrity + Pledge	0.028	0.028	0.030	-0.031	0.030	-0.031
	(0.100)	(0.100)	(0.065)	(0.161)	(0.065)	(0.161)
Observations	3,936	3,936	3,936	3,936	3,936	3,936
Number of individuals	1,312	1,312				

Note: Dependent variable is number of plastic items taken at a shop (spoons and straws), excluding plastic bag. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Starting with the negative binomial model, the primary difference with the main results is that the estimated effects (in percentage points) are larger, as expected. For example, now the reduction in the medium term in the celebrity-endorsed campaign is 36% compared with the control, while the reduction in the short term is as high as 53%. In terms of statistical significance, the results are similar as before. Thus, there are no reasons to change our conclusion that the celebrity endorsement had a sizeable effect on behavior.

We then look at the zero-inflated models. We are able to separate the effects on the extensive margins (use or not) from the effects on the intensive margins (how many if any). Columns (3a) and (4a) show the effects on the consumption of plastic items conditioning on use and columns (3b) and (4b) show the effects on the share of zero-demanders. We see that the overall results in column (1) and (2) are primarily driven by an increase in the share of zero-demanders. The pattern of the treatment effects at the extensive margin is similar to that of the overall effects. Compared with the control group, the environmental campaign itself does not have a significant impact on using a straw or spoon, while the celebrity endorsement significantly increases the share of zero-demanders. The personal pledge treatment tends to produce a larger impact at the extensive margin, but the difference is not statistically significant. At the intensive margin – number of plastic items – there is only one effect that is statistically significant on the conditional number of items, and that is the medium-term effect of the celebrity endorsed campaign with a pledge in column (3a). This suggests that the pledge treatment can produce an even more persistent effect than we intended because of the physical existence of the pledge card as a reminder to the students. However, when we investigate the extent to which this effect can be attributed to the pledge element in column(4a), the statistical significance goes away despite the relatively sizable effect.

3.1.1 Role of Gender

Given that the celebrity endorser in this study is a female fashion model, the celebrity might be more well-known and more important to men than to women, or the other way around. Do note that we find that our celebrity endorser is more well-known

among female students in our sample.[12] It is therefore natural to ask whether there is any gender difference of the treatment effects. We therefore estimate separate models for men and women. Results are presented in Table 4.

Table 4. Treatment Effects, Negative Binomial Models for Men and Women

	Women		Men	
	(1)	(2)	(3)	(4)
(Environ. campaign) × Short term	-0.047		-0.136	
	(0.107)		(0.106)	
(Environ. campaign + Celebrity) × Short term	-0.335***		-0.265**	
	(0.111)		(0.111)	
(Environ. campaign + Celebrity + Pledge) × Short term	-0.437***		-0.340***	
	(0.114)		(0.108)	
(Environ. campaign) × Medium term	0.032		-0.139	
	(0.108)		(0.105)	
(Environ. campaign + Celebrity) × Medium term	-0.171		-0.279**	
	(0.110)		(0.110)	
(Environ. campaign + Celebrity + Pledge) × Medium term	-0.335***		-0.376***	
	(0.114)		(0.107)	
Environ. campaign × Short term		-0.047		-0.136
		(0.107)		(0.106)
Celebrity × Short term		-0.288***		-0.129
		(0.110)		(0.117)
Pledge × Short term		-0.103		-0.075
		(0.117)		(0.119)
Environ. campaign × Medium term		0.032		-0.139
		(0.108)		(0.105)
Celebrity × Medium term		-0.203*		-0.139
		(0.107)		(0.117)
Pledge × Medium term		-0.164		-0.097
		(0.113)		(0.119)
Constant	2.020***	2.020***	2.042***	2.042***
	(0.128)	(0.128)	(0.139)	(0.139)
Controls for time period				
Short term	-0.184**	-0.184**	-0.062	-0.062
	(0.077)	(0.077)	(0.070)	(0.070)
Medium term	-0.241***	-0.241***	-0.029	-0.029
	(0.078)	(0.078)	(0.069)	(0.069)
Controls for pre-treatment use				
Environ. Campaign	-0.007	-0.007	-0.028	-0.028
	(0.098)	(0.098)	(0.093)	(0.093)
Environ. campaign + Celebrity	0.030	0.030	-0.064	-0.064
	(0.098)	(0.098)	(0.095)	(0.095)
Environ. campaign + Celebrity + Pledge	0.039	0.039	-0.019	-0.019
	(0.099)	(0.099)	(0.092)	(0.092)
Observations	1,926	1,926	1,986	1,986
Number of individuals	642	642	662	662

Note: Dependent variable is number of plastic items taken at a shop (plastic bags + spoons + straws). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[12] For example, about 94% of the female students had heard of the celebrity endorser, while among male this fraction was 77%; about 75.5% of female students knew that she competed in Miss Universe 2019, while among male students 56% knew about this. Female students also had slightly more favorable opinions of her as an appropriate endorser for environmental campaigns in general and for plastic pollution in particular.

In the short term, the treatment effects are larger for women, although they are statistically significant for both men and women. In the medium term, the treatment effects are larger for men, and there is actually not a statistically significant effect of the celebrity campaign compared with the control group for women. However, when we look at the incremental effect of the treatments, it is only for women that we find a statistically significant effect of the celebrity endorsement. The results suggest that there may exist a gender difference when it comes to the effects of our interventions, with female students reacting more strongly to the celebrity element of the intervention. For male students, the overall significant effect of the campaign with celebrity endorsement, shown in column (3), seems to split evenly between the information element and the celebrity element. However, neither coefficient is statistically significant, probably due to the small sample size. The effects of pledge element, however, are consistently small and insignificant across genders.

4. Discussion

Our results are consistent with some previous non-experimental studies on celebrity endorsement and pro-social behavior (e.g. Jacobsen, 2011; Löfgren & Nordblom, 2010). The estimated effects are also substantial compared with other types of behavioral interventions such as social information, where effects on energy and water use are often around 2-5% (Allcott, 2011; Allcott & Rogers, 2014; Jaime Torres & Carlsson, 2018).

Despite our effort to minimize the connection between the shops and the intervention, one may worry that we capture an experimenter demand effect instead of the treatment effect. However, our results do not support this explanation. The survey and the shops were identical in all treatments and the control, so observed differences cannot be attributed to an experimenter demand effect.

As we have discussed, there could be several reasons why a celebrity endorsement has an effect. In this section, we explore some of these and the extent of each.

To begin, we look at the role of knowledge and awareness. While we designed the experiment so that the informational content of the videos was the same in all treatment

groups, having a celebrity endorse our environmental campaign could make our subjects more aware of the problem, more trusting of the information provided, and hence more knowledgeable. In order to investigate this, we rely on a set of knowledge questions that we asked in both the pre-treatment and post-treatment survey. From this, we construct a knowledge score indicating how many questions a student answered correctly. Average scores are presented in Table A4 in the appendix. The knowledge and awareness levels are already quite high pre-treatment, but there is a slightly higher score in treatments with a celebrity endorsement. However, the difference is not statistically significant and is small in magnitude (about 0.1 more correct answers). Therefore, we believe that an increase in knowledge and awareness is not a major channel behind the effect of celebrity endorsement.

Another potential mechanism is the provision of injunctive norms. Having a celebrity in the campaign may have strengthened the normative value of reducing plastic consumption. We measured perceived norms in two ways. First, in both surveys, we directly asked a question about the perceived injunctive norm: "Do you think people should reduce plastic consumption?" Second, following Homonoff (2018) and Allcott and Kessler (2019), in the post-treatment survey, we collected measures of attitudes/emotions with regard to plastic consumption.[13] These attitudes/emotions could reflect the utility loss or gain from using single-use plastics. Table A5 reports results from regression models. This is a difference-in-difference estimate for the perceived injunctive norm, while it is a cross-section from the endline survey for the four other measures. We find no evidence of any treatment effect on the perceived injunctive norm, and the differences between different treatment groups are also very small. This finding is not surprising given the very high level of the perceived norm at the baseline (with almost 92% of students agreeing or strongly agreeing that people should reduce plastic consumption), leaving little room for improvement. We do find that the environmental campaign induced stronger negative feelings towards using plastics. It suggests that our environmental campaign may have induced a stronger norm regarding single-use plastics. However, the celebrity endorsement treatment

[13] Specifically, the students were asked if they feel guilty when using single-use plastics (Guilt); if they feel upset when seeing others using single-use plastics (Upset); if they feel wasteful when using single-use plastics (Wasteful); and if they feel proud when they manage to avoid single-use plastics (Proud). The answers are on a 1-5 scale.

appears not to have any additional impact on any of these attitudinal measures. This implies that a change in the perceived norm is not the main factor that drives the observed impact of celebrity endorsement on behavioral changes in single-use plastic consumption.

While we do not find evidence that changes in attitudes/emotions account for the observed behavioral changes in single-use plastic consumption, the effects on attitudes and on behavior do reveal interestingly contrasting patterns. Attitudes respond positively to the informational campaign, but not to the celebrity endorsement, while behavior changes desirably with a celebrity endorsement, but not in response to the campaign message itself. Simply put, attitudes change because of the "message", while behavior changes because of the "messenger". This finding implies that the underlying factors that affect pro-environmental attitudes may be different from those that affect actual pro-environmental behavior. It relates to the "attitude-behavior gap" documented in the literature, where people's pro-environmental attitudes do not translate into actual pro-environmental behavior (Farjam et al., 2019). Our findings provide tentative evidence supporting the existence of such a gap: impacts on attitudes and intentions do not always translate into changes in actual behavior.

5. Conclusions

Overall, our findings show promising potential of social education and marketing using celebrity endorsement in promoting pro-environmental behavior. As a policy instrument based on voluntary action, it provides an inexpensive alternative for combatting plastic pollution, in addition to popular instruments such as bans and taxes/charges. Although a ban can be very effective in reducing plastic consumption, the changes can come with welfare losses. Sometimes such welfare losses can be significant enough to outweigh the benefits of a ban (for example, see Allcott and Taubinsky (2015) on energy-efficient lightbulbs). Similarly, taxes or charges have been proven to be effective in many settings, but they tend to impose the tax burden on consumers.

Our study suggests that a softer touch through a celebrity-endorsed environmental campaign can be effective in reducing single-use plastic consumption. The impacts we find are fairly large and are sustained for at least a few weeks with only a small decline

in the effect size. Although the information campaign itself did not have any effect on behavior, the celebrity endorsed campaign had a sizeable and statistically significant effect on behavior. Right after the endorsed campaign, the use of single-use plastic items was approximately 32% below that in a control group, and in the medium term it was 25% lower. When a personal pledge was added to the celebrity endorsement, the number of plastic items used was even further below that in the control: 41% immediately after the campaign and 37% in the medium term.

Further, our study provides several additional insights. When we study only plastic straws and spoons, which are more easily substituted than plastic bags, the treatment effects are still statistically significant and even larger in magnitude. Among the three treatment elements, namely the information campaign, celebrity endorsement and pledge, only the celebrity endorsement is statistically significant for reducing single-use plastic consumption. Also, the reduction in the use of plastic items due to treatment effects is mostly driven by zero-demanders. Similar but not identical patterns are found for men and women. Women show a stronger treatment effect in the short term, but the effect fades away more quickly in the medium term for women than for men.

While our findings carry important policy implications, we would like to be cautious when extrapolating to other settings. Our environmental campaign intervention, especially the celebrity endorsement treatment, was designed specifically for our targeted audience of university students, and we chose a celebrity who is well-known among this audience. University students tend to be younger, better educated, and more environmentally friendly than the rest of the population, and thus potentially more responsive to our campaign. In our sample, while we do see that more environment-oriented students tend to use less plastic, there is no strong evidence of heterogenous treatment effects with regard to environmental orientation. Future research should explore a different demography or a broader audience. Suitable celebrity endorsers should be carefully chosen to match the audience, as documented in the marketing literature.

Given the rising enthusiasm from celebrities, the limited political resistance, and the ability to reach a broad audience, mobilizing celebrities as champions for pro-environmental causes can be a powerful public policy instrument in the environmental domain.

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Appendix 1. Figures

Figure A1. Pledge card (the original version was in Vietnamese)

Appendix 2. Tables

Table A1. Summary Statistics and Balance Checks

	Summary statistics				Balance check		
	Control	Campaign	Celeb	Celeb+ pledge	Campaign	Celeb	Celeb+ pledge
Age	19.2	19.2	19.2	19.3	0.187	0.911	0.606
Male	0.55	0.48	0.48	0.50	0.128	0.114	0.313
Kinh	0.92	0.94	0.94	0.94	0.365	0.226	0.351
Rural	0.68	0.68	0.68	0.70	0.849	0.991	0.485
1st year	0.35	0.38	0.36	0.36	0.294	0.973	0.506
2nd year	0.36	0.28	0.34	0.33	0.095	0.787	0.837
3rd year	0.16	0.22	0.18	0.19	0.932	0.834	0.426
4th year +	0.13	0.13	0.13	0.12	-	-	-
No. of obs.	340	326	319	327			
Join test: p-values, chi-squared test					0.105	0.730	0.801

Note: The p-values of the balance test are obtained by regressing treatment assignment on individual characteristics using a multinomial logistic regression with the control group as the reference case.

Table A2. Attrition Check, Summary Statistics and p-Values of Attrition Check

	Baseline sample	Working sample (W)	Dropout (A)	P-value W=A
No. of obs.	1,633	1,312	321	
Age	19.2 (1.37)	19.2 (1.34)	19.2 (1.51)	0.198
Male	0.50 (0.50)	0.50 (0.50)	0.49 (0.50)	0.351
Kinh	0.93 (0.26)	0.93 (0.25)	0.92 (0.28)	0.755
Rural	0.66 (0.47)	0.68 (0.46)	0.56 (0.50)	0.000
1st year	0.37 (0.48)	0.36 (0.48)	0.42 (0.49)	0.506
2nd year	0.32 (0.47)	0.33 (0.47)	0.29 (0.45)	0.572
3rd year	0.17 (0.38)	0.18 (0.39)	0.13 (0.34)	0.064
4th year +	0.13 (0.34)	0.13 (0.33)	0.16 (0.36)	-
Join test: p-values form chi-squared test				0.001

Note: Standard deviations are shown in parentheses. The p-values of balance test are obtained by regressing attrition dummy on individual characteristics using a probit regression with the subjects remaining in the sample as the reference case.

Table A3. Treatment Effects, OLS

	(1)	(2)
(Environ. campaign) × Short term	-0.336	
	(0.259)	
(Environ. campaign + Celebrity) × Short term	-0.881***	
	(0.251)	
(Environ. campaign + Celebrity + Pledge) × Short term	-1.059***	
	(0.255)	
(Environ. campaign) × Medium term	-0.182	
	(0.264)	
(Environ. campaign + Celebrity) × Medium term	-0.703***	
	(0.254)	
(Environ. campaign + Celebrity + Pledge) × Medium term	-1.049***	
	(0.257)	
Environ. campaign × Short term		-0.336
		(0.259)
Celebrity × Short term		-0.545**
		(0.266)
Pledge × Short term		-0.178
		(0.262)
Environ. campaign × Medium term		-0.182
		(0.264)
Celebrity × Medium term		-0.520**
		(0.255)
Pledge × Medium term		-0.346
		(0.248)
Constant	3.556***	3.556***
	(0.158)	(0.158)
Controls for time period		
Short term	-0.335*	-0.335*
	(0.172)	(0.172)
Medium term	-0.391**	-0.391**
	(0.186)	(0.186)
Controls for pre-treatment use		
Environ. Campaign	0.0576	0.0576
	(0.240)	(0.240)
Environ. campaign + Celebrity	0.0397	0.0397
	(0.238)	(0.238)
Environ. campaign + Celebrity + Pledge	0.108	0.108
	(0.238)	(0.238)
Observations	3,936	3,936
Number of individuals	1,312	1,312

Note: Dependent variable is number of plastic items taken at a shop (plastic bags + spoons + straws). Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A4. Knowledge about Plastic Pollution

Panel A: Summary statistics of the knowledge score				
	Control	Env. Camp.	Celebrity	Celeb. + Pledge
Pre-treatment	9.71	9.66	9.59	9.64
	(1.45)	(1.57)	(1.46)	(1.38)
Post-treatment	9.85	9.93	10.01	10.13
	(1.34)	(1.67)	(1.86)	(1.39)

Panel B. DID regression results of treatment effect on knowledge			
DID regression coefficients: compared with control		DID regression coefficients: compared between treatments	
(Campaign) × Post-treatment	0.123	Campaign × Post-treatment	0.123
	(0.138)		(0.138)
(Campaign + Celebrity) × Post-treatment	0.276*	Celebrity × Post-treatment	0.153
	(0.145)		(0.155)
(Campaign + Celeb + Pledge) × Post-treatment	0.336***	Pledge × Post-treatment	0.0600
	(0.123)		(0.143)
Post-treatment	0.147*	Post-treatment	0.147*
	(0.089)		(0.089)
Campaign	-0.049	Environ. campaign	-0.049
	(0.117)		(0.117)
Campaign + Celebrity	-0.117	Celebrity	-0.117
	(0.113)		(0.113)
Campaign + Celebrity + Pledge	-0.064	Pledge	-0.064
	(0.110)		(0.110)
Constant	9.706***	Constant	9.706***
	(0.078)		(0.078)
Observations	2624	Observations	2624

Note: Dependent variable in Panel B is the knowledge score indicating how many questions a student answered correctly. It takes an integral value between 0 and 14. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5. Norms Regarding Plastic Pollution

	(1) Norm	(2) Guilt	(3) Upset	(4) Wasteful	(5) Proud
Campaign	-0.067	0.254**	0.145	0.202**	0.169*
	(0.081)	(0.103)	(0.098)	(0.102)	(0.087)
Celebrity	-0.008	-0.024	0.119	0.0521	-0.012
	(0.084)	(0.108)	(0.099)	(0.100)	(0.086)
Pledge	0.071	-0.068	-0.030	-0.181*	0.092
	(0.083)	(0.107)	(0.097)	(0.101)	(0.082)
Controls for time period					
Medium term	0.062				
	(0.057)				
Controls for treatment groups					
Environ. campaign	0.045				
	(0.069)				
Environ. campaign + Celebrity	0.058				
	(0.069)				
Environ. campaign + Celebrity + Pledge	0.036				
	(0.067)				
Constant	1.685***	3.353***	3.456***	3.838***	4.085***
	(0.048)	(0.0708)	(0.0663)	(0.0720)	(0.0608)
Observations	2615	1303	1303	1303	1303

Note: All the dependent variables are on a 1-5 scale. Norm is the answer to the following "Do you think people should reduce plastic consumption?" in both pre- and post-treatment surveys. We show the result of a DID regression in column (1). Guilt, Upset, Wasteful and Proud are students' responses when they were asked if they feel guilty when using single-use plastics; if they feel upset when seeing others using single-use plastics; if they feel wasteful when using single-use plastics; and if they feel proud when they manage to avoid single-use plastics. We show OLS regression of a cross-sectional comparison using responses from the post-treatment survey in columns (2)-(4). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.