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Take me with you! Economic Incentives, Nudging Interventions and Reusable Shopping Bags: Evidence from a Randomized Controlled Trial[*]

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Abstract. Little is known about the impact of policy interventions other than taxes and bans to reduce the demand for single use plastic bags. More specifically, the influence of environmental nudges and financial bonuses to curb the single use plastic bag purchase and consumption is largely understudied. To fill this gap, we run an RCT with loyalty card holders of one of the biggest supermarket chains in Yerevan (Armenia) to test and compare interventions based on environmental nudges and financial bonuses. We manipulate the type of the intervention – either a financial bonus or a nudge –, the presence of a reusable bag – either provided for free or not provided –, and the size of the bag – either small or big. Compared with the baseline setting with no intervention, both the financial bonus and the environmental nudge serve as effective policy instruments to reduce disposable plastic bag purchase. Moreover, reusable bags in combination with the environmental nudge or the financial bonus are more effective than the environmental nudge or the financial bonus alone. Finally, the financial bonus is substantially more effective than the environmental nudge, irrespective of the absence/presence of reusable bags.

Keywords: pro-environmental behavior, nudge, financial bonus, reusable plastic bag, randomized controlled trial.

JEL Classifications: C93; D12; D91; H23.

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1. Introduction

Plastic shopping bags are one of the most frequently purchased items by the consumers in the world and vividly represent the consumerist behavior of the *"throw-away"* society which favors disposable items over durable goods that can be repaired and reused (Napper and Thompson, 2019; United Nations Environment Program, 2018, 2020). According to estimates, approximately 0.5-1 trillion plastic bags are consumed annually or 1-2 million bags every minute worldwide (Nielsen et al. 2019; Plastics Oceans, 2019). Beyond any doubt, the (over)consumption of plastic bags exerts a serious negative impact on the environment and poses considerable threat to human and animal health.

In an effort to curb the plastic usage, policymakers actively design various policy interventions worldwide. Full or partial banning on plastic carriers is the most ubiquitous policy instrument nowadays, followed by taxes or levies that set a price for plastic bags previously provided for free to consumers (Nielsen et al., 2019). Despite the widespread adoption of these policies, there are only a few rigorous studies that evaluate and compare their impact. More specifically, Homonoff et al. (2020) juxtapose a ban on single use plastic bags (bags less than 2.5 mils thick) with a $0.07 "per bag" tax in Chicago (US). The authors conclude that a partial ban on disposable bags is ineffective, if there is no ban on close substitutes (bags more than 2.5 mils thick). On the contrary, the tax is effective enough to substantially curb the disposable bag consumption in the first few months, though there seems to be a rebound effect one year after the introduction of the tax with a gradually increasing consumption of disposable bags.[4] Cabrera et al. (2020) also illustrate that a tax on bags can substantially drop the purchase of disposable bags over a one-year time window with respect to a pre-treatment period of no regulation in Salto (Uruguay), though unlike Homonoff et al. (2020), the authors do not find a rebound effect over time. Homonoff (2018) compares the short-run effect of a $0.05 "per bag" tax with that of a $0.05 "per bag" bonus on the consumption of disposable bags in the Washington Metropolitan Area (US). The tax is found to cut the consumption, while the bonus has almost no impact.

Despite the prevalence of bans and taxes to curb disposable bag consumption, it is a well-established fact that the reaction to these policy instruments is not always affirmative and in the most extreme cases can result in strong opposition. For instance, the introduction of a tax or a levy on disposable plastic purchase (including disposable bags) can be politically sensitive and subject to overheated

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[4] Such a complex behavioral response is coherent with the idea that, in the short run, customers perceive the tax on the disposable bags as a loss and curb the consumption of disposable bags, though in the long run they get used to the tax as they change the reference price of the bags. Thus, the tax introduced on bags does not feel as a tax any longer.

debates (Solletty, 2018; Reuters, 2019; Maldonado et al., 2020), with the same argument extending to plastic bag bans. Furthermore, substantial administrative resources may be necessary to enforce the bans, which can be especially challenging in developing countries. For example, developing countries including Papua New Guinea, Bhutan and Uganda have made multiple, though rather unsuccessful attempts to enforce plastic bag ban ordinances (Nielsen et al., 2019). The launch of alternative policy interventions that either do not prohibit individuals to undertake a certain action (unlike bans) or do not negatively affect the economic incentives of individuals (unlike taxes) may serve as possible solutions to the aforementioned problems.

In recent years, governments have been increasingly improving individual behavior through behavioral science techniques to achieve policy objectives. In this context, the nudge interventions that respect the freedom of choice and do not change economic incentives have turned out to be exceptionally useful (e.g., Benartzi et al., 2017). Despite the widespread use of nudging, the impact of such interventions on the demand of disposable plastic bags is largely untested. A notable exception is the study by Romano and Sotis (2020), in which the authors discourage the purchase of disposable bags in a supermarket in Naples (Italy) by donating a small sum to an institution that is perceived negatively by supermarket visitors every time a disposable bag is purchased and by donating a small sum to a charity every time a disposable bag is not purchased. This behavioral intervention that does not impose any monetary costs on the supermarket customers, reduced the purchase of plastic bags by around 10% compared to previous periods during which no intervention was run. Not much is also known about the impact of bonuses on disposable bag consumption except the seminal study by Homonoff (2018), which finds no positive impact of bonuses on plastic bag consumption. Lastly, how nudges compare to financial incentives in an effort to reduce the demand for plastic bags is understudied as well.

In this paper, we run a randomized controlled trial (RCT) with loyalty card holders of Tsiran supermarket – one of the biggest supermarket chains in Yerevan (Armenia) – to test and compare the impact of introducing either an environmental nudge or a financial bonus on the purchase of single use plastic bags. We also strive to test whether interventions that combine free reusable bags (made of non-woven polypropylene) with the environmental nudge or the financial bonus can be more effective as compared with the environmental nudge or the financial bonus alone. On a side note, we also test whether the size of the bag plays a role in affecting costumers' behaviors. The RCT was conducted in all of the 9 branches of Tsiran supermarket situated in the capital city of Yerevan at the time of the trial.

Similar to many developed and developing countries Armenia suffers from the excessive use of disposable plastic bags. More specifically, according to the estimates of the Ministry of Environment, annually around 12,000 tons of plastic bags are produced. In Armenia, the problems related to single use plastic bags are exacerbated because of the poorly developed waste-management systems and poor infrastructure for collection and recycling. Given the latter, used plastic bags end up either in open landfills or in nature, posing considerable threat to the environment, humans and animals. Understanding this threat, the Government of Armenia is actively designing regulations to curb the consumption of disposable plastic in the country, including a possible ban on disposable plastic bags starting from 2022 (Armenpress, 2020). In the last few years, the major supermarket chains (including Tsiran supermarket) sell disposable bags for a fee of up to 20 AMD (around 0.04 USD), mimicking the tax on disposable bags implemented in other countries (Homonoff, 2018; Cabrera et al., 2020). Since there is no common regulation, the fee the supermarkets charge can differ. Meanwhile, smaller shops still provide plastic bags for free.

Regarding the treatment stimuli, the environmental nudge simply provides information about the harm disposable plastic bags cause to the environment, human, and animal health. Provision of information is considered as one of the most frequent and effective nudges adopted by policymakers (Sunstein, 2014; Patel, 2018). The bonus structure – unlike that in Homonoff (2018) – creates competition among the supermarket customers. More specifically, the customers are divided into groups of ten. During every visit to the supermarket the customers accumulate points if the shopping amount is positive and no disposable bag is purchased. The customers receive an SMS on a monthly basis informing their ranking in the group based on the points accumulated. The customer who collects the highest number of points in the group wins the competition and receives 20,000 AMD (around 40 USD) deposited to her loyalty card. As for the free reusable bag, it intends to change the customers' default option, since without a reusable bag the customer needs to opt in a pro-environmental behavior by exerting effort and spending money to purchase a bag, while with a reusable bag the customer needs to opt out from pro-environmental behavior by not using the bag (Johnson and Goldstein, 2003). Furthermore, the change of the default can reveal the supermarket's attitude toward pro-environmental behavior since the customers may perceive the provision of the free bag as a strong indication that pro-environmental behavior is the recommended course of action by the supermarket (McKenzie et al., 2006).

In August 2019, 5,809 loyalty card holders were randomized into a control arm that received no intervention and 6 treatment arms that manipulated the presence of a financial bonus or a nudge, the presence of a reusable bag and the size of the reusable bag. Given these manipulations we end up with

the following treatment arms: *Environmental Nudge* (829 participants), *Financial Incentives* (830 participants), *Environmental Nudge & Small Bag* (830 participants), *Environmental Nudge & Big Bag* (830 participants), *Financial Incentives & Small Bag* (830 participants), and *Financial Incentives & Big Bag* (830 participants). Later in the text, we detail the selection criteria for the sample under consideration. We have specifically chosen to work with loyalty card holders since almost all the transactions of these customers in the supermarket are registered and can be tracked at any point in time.

The contribution of our work to the scientific literature is twofold. First, we contribute to the limited literature that rigorously studies the impact of various policy interventions on the reduction of plastic bag purchase and consumption (e.g., Homonoff, 2018; Cabrera et al., 2020; Homonoff et al., 2020). To the best of our knowledge, little is known about the impact of nudges, financial bonuses and the provision of free reusable bags on the disposable bag purchase and consumption behavior of individuals. Second, we add to the limited literature that compares the power of nudges with that of financial incentives in the field (e.g., Ito et al, 2018). Given the excitement around nudges in recent years, we believe that it is important to understand how the policy interventions based on nudges that do not change the financial incentives of individuals and preserve the freedom of choice compare with classical policy interventions that usually affect human behavior through economic incentives.

The rest of the paper is structured as follows. Section 2 details the experimental design and the implementation details. The brief summary of the results is depicted in Section 3. Section 4 concludes the paper and puts forth policy recommendations.

2. The Experiment

2.1. Treatments

Our experiment aims at testing and comparing the impact of introducing either a financial bonus or an environmental nudge on the purchase of disposable plastic bags. The second aim of the experiment is to test whether interventions that combine differently sized free reusable bags with the environmental nudge or the financial bonus can be more effective as compared with the environmental nudge or the financial bonus alone. Stemming from our research questions, we designed an experiment consisting of 7 treatments detailed below.

Control group (830 people): Subjects in this group received neither a letter from the supermarket, nor a bag. By comparing the remaining treatments with this group, we are able to check whether the interventions are effective relative to the business as usual setting.

Environmental Nudge (829 people): Subjects in this group received an environmental letter, explaining the harm of the plastic to the environment, animal and human health. Please refer to Appendix A for the original letter in Armenian and the English translation.

Financial Incentives (830 people): Subjects in this group received a letter, which provided them with financial incentives to purchase fewer plastic bags. More specifically, the subjects were divided into groups of 10. Subjects in each group were competing throughout the experiment. The winner would receive 20,000 AMD (about 40 USD) deposited to her loyalty card. The rules of the competition were as follows:

- Customers received 2 points for spending less than 2,000 AMD (around 4 USD) and purchasing no plastic bags;
- Customers received 10 points for spending more than 2,000 AMD and purchasing no plastic bags;
- Customers received 0 points if they purchased a plastic bag irrespective of the shopping amount.

We opted for the abovementioned scoring rule for three main reasons. First, the rule is simple and can be easily internalized by costumers. Second, the rule implies that customers who spend more in the supermarket and buy more items have (relatively) higher incentives not to purchase plastic bags. Third, the rule is (relatively) fair in that costumers who spend more are assigned a higher number of points compared to those who spend less. Please refer to Appendix A for the original letter in Armenian and the English translation.

Environmental Nudge & Small Bag (830 people): Subjects in this group received the same environmental letter as in the *Environmental Nudge* treatment and a small tote bag made of non-woven polypropylene. There are important reasons to opt for non-woven polypropylene bags. First, these bags represent one of the most environmentally friendly alternatives to disposable bags worldwide and, more importantly, that can be found in Armenia. Second, these bags are made of a strong, washable material that guarantees their resilience over time. Third, non-woven polypropylene is environmentally sustainable as it comes from recycled material. Forth, non-

woven polypropylene bags are one of the most frequently used alternatives to single use plastic bags worldwide.

Environmental Nudge & Big Bag (830 people): Subjects in this group received the same environmental letter as in the Environmental Nudge treatment and a big tote bag.

Financial Incentives & Small Bag (830 people): Subjects in this group received the same letter with financial incentives as in the *Financial Incentives* treatment and a small tote bag.

Financial Incentives & Big Bag (830 people): Subjects in this group received the same letter with financial incentives as in the *Financial Incentives* treatment and a big tote bag.

During the experiment, we also sent reminders either once (January, April, July) or twice a month. The subjects in the environmental nudge treatments were reminded of how important it is to purchase fewer plastic bags for the sake of environmental protection. Those in the bonus treatments were reminded about the competition and the financial incentives to purchase fewer plastic bags. The participants in the bonus treatments received an additional monthly SMS informing them about their ranking within the group. The reminders were sent on a different day each month to exclude day-of-the-week effects. Both the text and the dates of the reminders are depicted in Appendix B.

2.2. Implementation

The preparations for the study took place in the second half of 2019, while the RCT kicked off on January 21, 2020 and lasted until July 11, 2020.[5] The RCT was conducted in all 9 branches of Tsiran supermarket chain in the capital city of Yerevan.[6] Overall, 5,809 loyalty card holders of the supermarket chain were randomized into 7 treatment arms in August, 2019. The inclusion criteria of the participants into the randomization sample was as follows:

- The participant should have been an active customer in the sense that she should have used the loyalty card at least twice on average in each month from April to July 2019 (the data shared by the supermarket for the randomization). This inclusion criteria would guarantee the likelihood of future visits to the supermarket, thus minimize the trial attrition. We also

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[5] The start of the experiment was planned on January 13 (this date is mentioned in the financial letters), nonetheless, the experiment (hence the delivery of the packages) started on January 21, because of minor issues related to the software for distributing letters and bags after a thorough pretest (see the description of the software later in this section). Since the starting date of the trial is common for all participants this short delay does not threaten the internal validity of the trial.
[6] At the time of the implementation of the trial the vast majority of the supermarket branches were situated in Yerevan.

excluded those customers who used their card more than 60 times from April to July 2019 (i.e., 15 times each month on average, which is almost every second day). The excessive usage of the card could potentially imply that the participant most likely shared the card with a friend or a family member. That said, these customers were excluded from the study to assure a tightly controlled setting and high internal validity of the randomized controlled trial.

- The participant should have purchased at least 3 plastic bags from the supermarket from April to July, 2019. We thus excluded costumers who were already exhibiting environmentally friendly behavior prior to our intervention. Since we faced a reusable bag constraint and our main focus is on the purchase of plastic bags, we tried to make sure that reusable bags are provided to those individuals who purchase at least few plastic bags. We kept the threshold of this inclusion criterion as low as possible (i.e., 3 plastic bags purchased in 4 months) not to harm the external validity of the trial (i.e., not to focus only on those individuals who purchase a considerable number of plastic bags).

- The participants should have purchased fewer than 80 bags from the supermarket from April to July, 2019 (i.e., on average 20 bags per month). Those with excessive bag consumption can be business consumers, rather than individuals. The response of these two groups to the treatment stimuli can be rather heterogenous and the data do not allow us to distinguish business consumers from individual ones.

The abovementioned inclusion criteria leave us with 5,809 participants out of around 17,000 customers who hold a loyalty card and visited the supermarket at least once from April to July 2019. To enhance balancing, we stratified randomization by gender and by the supermarket branch the individual "belongs to". To construct the latter measure, we calculated the distance from the individual's living address to all 9 supermarket branches and assumed that the individual belongs to the supermarket branch which is the nearest to her living address. There was a separate stratum for the individuals with no address labeled as *"no branch."*

The stratified individual randomization exposes us to the threat of downward biases in the treatment effects due to potential spillovers across subjects in different treatment groups. Nonetheless, this randomization strategy was pretty much the best feasible alternative at the time of our experiment. An alternative option could have been block-randomization by supermarket branches (i.e., an entire supermarket branch would be allocated to a unique treatment arm). However, since the supermarket counted only 9 branches in the capital city at the time of the randomization, we would have ended

with very few groups over which to randomize the treatment assignment. Once the randomization was carried out, we verified that the treatment arms were well-balanced in terms of the observable characteristics under our disposal: the overall number of items bought from April to July 2019, the overall number of plastic bags bought from April to July 2019, the number of times the loyalty card was used from April to July 2019 (which proxies the number of visits to the supermarket), and the gender of the loyalty card holder. Tables C1-C4 in Appendix C confirm that our stratified randomization yielded balanced sampling. Since we implemented the randomization in August 2019, while the experiment started in January 2020, we also checked whether the customers who actually shopped in the supermarket from August to December 2019 exhibited similar shopping behavior in terms of the observable characteristics. Tables C5-C9 illustrate that the shopping behavior of the subjects in different treatment arms is rather similar in the post-randomization period.

The environmental and financial incentive letters were distributed in envelopes. In the *Environmental Nudge* and *Financial Incentives* treatments, only the letters were distributed. In the bag treatments, the envelopes with letters were stapled on the bags and distributed along with the bags. For the sake of brevity, henceforth we will refer to the letters or the combination of letters and bags as *packages*. These packages were stored at the cash desk and distributed by the cashiers. Figure 1 provides an example of a package distributed during the experiment.

Figure 1: Example of a Letter and a Bag
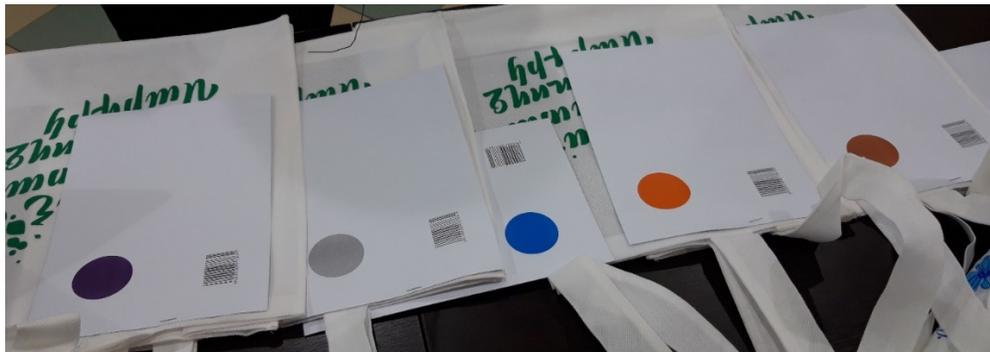
Note: An example of a letter and a bag.

There is a barcode and a colored circle on envelopes. Each color corresponds to a unique treatment group. When a subject showed up in the supermarket for the first time during the experiment and her loyalty card was scanned at the cash desk, a text with the color (e.g., "blue") appeared on the cashier's screen, instructing her to hand in the package of a given color to the loyalty card holder. All envelopes shared the same barcode. Before handing in the package to the participant, the cashier scanned the

barcode on the envelope. First, this allowed us to understand whether the participant had been already given a package during her first visit. If a participant was given a package on day t, then her name was manually removed from the database at the end of day t by the supermarket staff. Thus, if the customer had already received a package on day t, starting from day $t+1$ no instructions appeared on cashier's screen when this customer's loyalty card was scanned again. This design choice was meant to assure that each experimental subject would receive only one package during the experiment.[7] Second, it served as a proof that the packages had been actually delivered to the participants, allowing us to calculate the number of subjects that were given packages in each treatment. During the trial, the team regularly visited all 9 supermarket branches to follow the implementation process as well as was actively in touch with the managers of the supermarket branches.

There were barcodes not only on the envelopes but also on the bags. The small bags shared a unique barcode. The same referred to the big bags. The cashiers were instructed to scan the barcodes of the bags every time they saw a customer doing shopping with the reusable bag. This allowed us to control the usage of the tote bags.

Before running the trial on January 21 several training sessions were held with all the cashiers and the managers of the supermarket branches. We introduced the main aim of the experiment as well as provided detailed instructions to the cashiers and the branch managers. Mock shopping scenarios were run with the cashiers to test their understanding of the instructions. If a cashier was hired after the training, she was separately instructed by the branch manager.

The cashiers were specifically instructed to flag those loyalty card holders who would buy plastic bags after the shopping (i.e., after the loyalty card would be scanned and the shopping would be registered). This would decrease the number of plastic bags a customer bought and would be especially relevant in the treatments with financial incentives. Though we instructed the cashiers, we were confident that

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[7] Since the name of the subject who was given a package during her first visit on day t was removed on day $t+1$, those subjects who visited the supermarket stores more than once on day t and presented their loyalty cards during the shopping could receive more than one package. Furthermore, since these names were removed manually from the database, due to some delay in the process, a small number of subjects received more than one package. Despite these limitations, there are aspects that guarantee the internal validity of our trial. First, the software allows us to track whether a subject was delivered more than one package. There were 275 such subjects (8% of the subjects who received a package: please refer to Section 3 for a detailed analysis of the subjects who received bags). Our main results are intact if we drop these 275 subjects from the data. Second, receiving multiple packages would pose a substantial problem for the internal validity of the trial, if the subjects who received multiple packages would give the extra bags to the subjects in the treatments without bags. Since we are also able to track the reusable bag usage (described later in this section), the analysis of the bag usage reveals that this is not the case. Please also note that if a customer was offered the package and she refused to take it, her name was removed from the database. Thus, if her loyalty card was scanned during the next visits no instructions appeared on the screen requesting the cashier to give her a package.

the number of such cases would be very few, as the subjects were unaware of how the supermarket would monitor their purchase decisions since the financial letter did not specify this point (the letter simply asked loyalty cardholders to bring their personal loyalty card when going to the supermarket for shopping and exhibit it to the cashier). Indeed, during the experiment no such cases were registered.

The regular SMS sent to the customers also contained a hotline number for potential questions and inquiries (this refers to the treatments with financial incentives). The hotline was active throughout the entire experiment.

3. Results

3.1. How many subjects received a package?

Before proceeding to the results of the trial, we check how many subjects were given a package during the experiment and whether the number of subjects given a package is balanced across treatments. The distribution of the packages started on January 21. Overall, 3,432 subjects out of 4,979 (the overall number of subjects in the treatment groups) were actually given a package. Around 37% of the subjects (570 subjects out of 1547) who did not receive a package did not show up in the supermarket. The remaining 63% (977 subjects out of 1547) either showed up albeit refused to take the package or showed up in the supermarket after April 24 for the first time when we stopped distributing the packages. In any case, even the subjects in the treatment groups who did not receive a package were in fact treated since, on top of distributing packages, we also sent SMS containing the treatment stimuli. To state it differently, around 69% of the sample who was intended to receive the packages actually did so (3,432 subjects out of 4,979). Meanwhile, all the subjects included in the treatment groups were sent regular SMS either containing an environmental nudge or notifying about the competition in the treatments with financial incentives.

Figure 2 depicts the number of subjects who were given a package over time.[8] The figure suggests that the packages were mainly distributed in January. The remaining packages were distributed in February and March. Table 1 illustrates the number of subjects receiving a package, by treatment.

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[8] In May (38 subjects) and June (1 subject) were delivered a package by mistake.

Table 1: Number of Subjects with a Package

Treatment	Subjects Given a Package	Percentage of the Sample
Environmental Nudge	537	64.777%
Financial Incentives	538	64.819%
Environmental Nudge & Big Bag	580	69.880%
Financial Incentives & Big Bag	605	72.892%
Environmental Nudge & Small Bag	586	70.602%
Financial Incentives & Small Bag	586	70.602%
Overall	3432	68.930%

Note: The table illustrates the number of subjects the packages were delivered to in each treatment. The overall number of subjects is 829 in the *Environmental Nudge* treatment and 830 in the *Financial Incentives*, *Environmental Nudge & Big Bag*, *Financial Incentives & Big Bag*, *Environmental Nudge & Small Bag*, and *Financial Incentives & Small Bag* treatments.

Interestingly, Table 1 suggests that slightly fewer subjects received packages in the *Environmental Nudge* and *Financial Incentives* treatments than in the treatments with bags. More specifically, 68 fewer subjects got the packages in the *Environmental Nudge* treatment compared to the *Financial Incentives & Big Bag* treatment in which the highest number of subjects got the packages. Similarly, there is a difference of 67 subjects between the *Financial Incentives* treatment and *Financial Incentives & Big Bag* treatment. Most likely, the customers refused to take the envelope, albeit did not refuse to take the envelope and the bag. A more formal regression analysis suggests that the probability of a package being delivered in the *Environmental Nudge* and *Financial Incentives* treatments is significantly lower compared to the remaining treatments, while the difference across the treatments with bags is statistically non-significant. Note that the difference in the probability of packages being delivered between the *Environmental Nudge* and *Financial Incentives* is also statistically insignificant (please refer to Table D1 in the Appendix D). As discussed later in the text, we believe that this difference in the probability of a package being delivered can have only a minimal (if any) impact on our main results.

Figure 2: Number of Subjects Receiving a Package
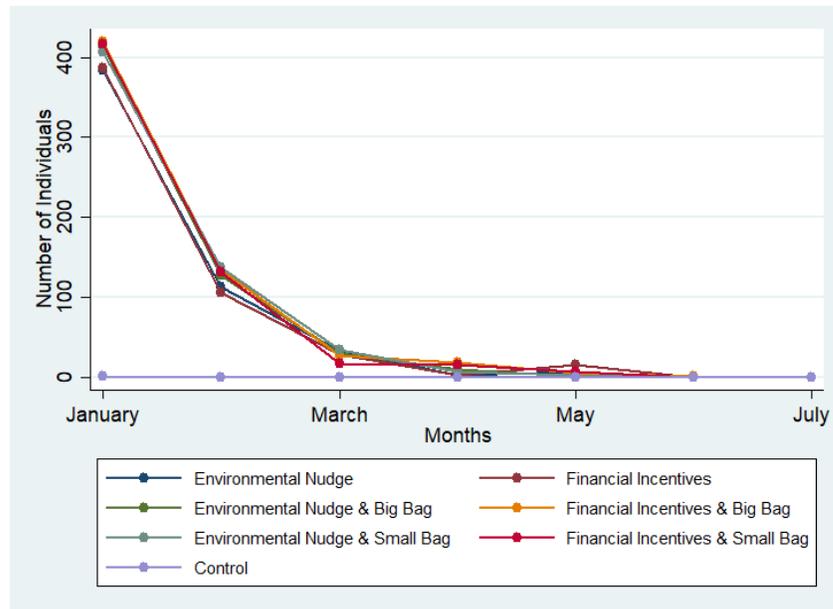
Note: The figure illustrates the overall number of subjects who received a package on a monthly basis during the experiment.

3.2. Descriptive Discussion of the Treatment Effects

We now investigate differences across treatments in subjects' purchase of plastic bags. The outcome variable of our analysis is the (aggregate) number of plastic bags purchased by the subject during the experimental time window. The variables that serve as controls in the regression analysis are constructed in the same vein. For example, for each participant we aggregate the number of items purchased during the experimental time window. Comparing the outcomes at the end of the intervention for the treatment and comparison groups is one of the potential strategies to analyze the results of a randomized evaluation (Glennerster and Takavarasha, 2013).

Figure 3 depicts the average plastic bag purchase by treatment and the corresponding 95% confidence intervals by the end of the experiment (i.e., July 11, 2020). Several considerations regarding the figure are worth noting:

a) Both the financial and the environmental treatments dominate the control group in curbing customers' purchase of plastic bags.

b) The financial treatments outperform the respective environmental treatments. In other words,

    i. plastic bag purchase in *Financial Incentive* treatment is lower than in the *Environmental Nudge* treatment;

ii. plastic bag purchase in *Financial Incentives & Small Bag* (*Financial Incentives & Big Bag*) treatment is lower than in the *Environmental Nudge & Small Bag* (*Environmental Nudge & Big Bag*) treatment;

c) In most of the cases, the reusable bags in combination with an environmental nudge or a financial bonus are more potent catalysts in reducing the purchase of plastic bags compared to environmental nudges or financial bonuses alone.

Figure 3: Average Plastic Bag Purchase During the Experiment
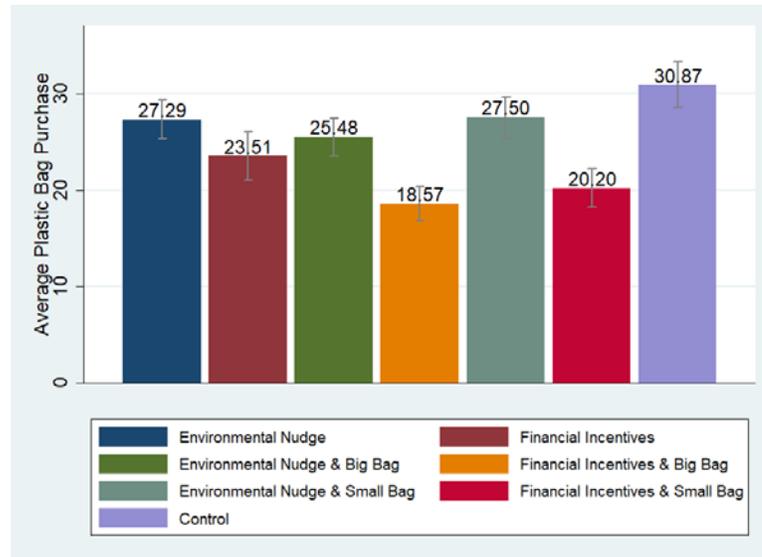
Note: The figure illustrates the average plastic bag purchase by treatment and the corresponding 95% confidence intervals during the experiment. To compute the average, for each customer we aggregate the plastic bag purchase for the months from January to July.

Figure 4 plots the average purchase of plastic bags over time from January 2020 to July 2020 in each treatment. The evidence in Figure 4 is aligned with that in Figure 3 in the sense that conclusions in points a)-c) mainly hold throughout the experiment. Note that the small differences across treatments in January and July can be explained by the fact that the customers are tracked for only 10 days in January and 11 days in July. Importantly, Figure 4 illustrates that the COVID-19 pandemic and the subsequent economic hardship did not seem to interact with the interventions since, within a treatment group, subjects exhibit similar behavior both in February (when no COVID-19 cases were detected in Armenia) and in the remaining months (when COVID-19 cases were detected). Had we observed a significant drop in plastic bag purchase in April, May or June relative to February within treatments with financial incentives unlike the treatments without financial incentives, we would suspect that the economic hardship during COVID-19 interacted with our financial interventions in the sense that the

consumers intensified the competition for getting extra amount of money for subsistence. In sum, we believe that COVID-19 does not undermine the validity of our experiment.

Figure 4: Average Plastic Bag Consumption Over Time
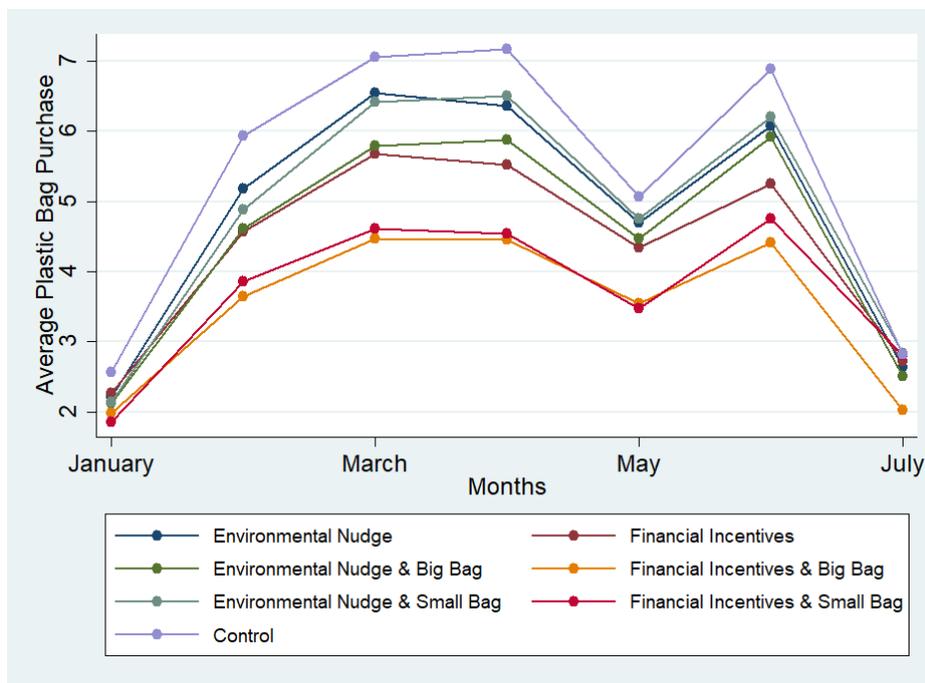
Note: The figure illustrates the average plastic bag purchase over time in each treatment.

3.3. Parametric Analysis of the Treatment Effects

A formal econometric investigation allows us to better identify the treatment effects and control for a number of confounding elements which might alter the graphical evidence reported in Figure 3. For instance, in addition to the treatment manipulation, the number of plastic bags purchased by costumers can be also affected by the number of times a loyalty card is used (e.g., frequent visitors may buy more bags) as well as by the number of items purchased during the experiment. To get the uncontaminated causal effect of the treatment manipulation on the dependent variable, it is sufficient to introduce one of these highly correlated variables (Spearman's $\rho=0.849$, $p=0.000$) as additional control (Huenermund and Louw, 2020). Stemming from these considerations, we estimate an OLS model detailed below:

$$Y_i = \beta_0 + \sum_{l=1}^{6} \beta_l T_{il} + \beta_2 X_i + \varepsilon_i,$$

where Y_i is the aggregate plastic bag purchase of individual i for January to July 2020. T_{il} is an indicator variable denoting whether individual i belongs to treatment l. X_i is a vector of control

variables, which includes the gender of individual i, and either the total number of items individual i purchased during the experiment or the number of times individual i used the loyalty card.

Please also note that 658 participants (around 11% of the sample) did not show up in the supermarket during the entire experiment. Thus, the values for these subjects are set to missing in the data. According to a formal regression model, the attrition rate does not depend on the treatment allocation (please refer to Table D2 in the Appendix D). In sum, while this attrition pattern can reduce the statistical power of the experiment, it does not invalidate the results of the experiment (Glennerster and Takavarasha, 2013).

Table 2: Treatment Effects Analysis

	(1)	(2)	(3)
Environmental Nudge	-3.585**	-2.612***	-3.466***
	(1.581)	(0.818)	(1.202)
Financial Incentive	-7.367***	-5.772***	-7.340***
	(1.759)	(1.148)	(1.430)
Environmental Nudge & Big Bag	-5.388***	-4.774***	-5.048***
	(1.556)	(0.880)	(1.183)
Financial Incentive & Big Bag	-12.305***	-10.178***	-10.208***
	(1.511)	(0.889)	(1.136)
Environmental Nudge & Small Bag	-3.372**	-4.675***	-3.302***
	(1.639)	(0.884)	(1.274)
Financial Incentive & Small Bag	-10.676***	-9.355***	-9.097***
	(1.573)	(0.942)	(1.214)
Number of Items Purchased		0.094***	
		(0.002)	
Gender		4.590***	6.078***
		(0.584)	(0.764)
Number of Times Card Used			0.576***
			(0.023)
Constant	30.872***	4.046***	8.341***
	(1.211)	(0.711)	(0.979)
Mean of the Control Group	30.872	30.872	30.872
F statistics	17.553	445.299	100.943
Adjusted R-squared	0.017	0.630	0.348
Number of Observations	5,151	5,151	5,151

Note: OLS regression. Dependent variables. The aggregated plastic bag purchase of each individual for January to July (columns 1 and 2) or the aggregated plastic bag purchase of each individual for January to July standardized by the number of visits to the supermarket from January to July (columns 3 and 4). Independent variables. *Environmental Nudge* – Dummy variable which equals 1 in the *Environmental Nudge* treatment and 0 otherwise; *Financial Incentive* – Dummy variable which equals 1 in the *Financial Incentive* treatment and 0 otherwise; *Big Bag & Environmental Nudge* – Dummy variable which equals 1 in the *Big Bag & Environmental Nudge* treatment and 0 otherwise; *Big Bag & Financial Incentive* – Dummy variable which equals 1 in the *Big Bag & Financial Incentive* treatment and 0 otherwise; *Small Bag & Environmental Nudge* – Dummy variable which equals 1 in the *Small Bag & Environmental Nudge* treatment and 0 otherwise; *Small Bag & Financial Nudge* – Dummy variable which equals 1 in the *Small Bag & Financial Nudge* treatment and 0 otherwise; *Number of Items Purchased* – aggregated number of items each individual bought from January 21 to July 11, 2020; *Number of Times Card Used* – aggregated number of times each individual used her loyalty card from January 21 to July 11, 2020; *Gender* – Dummy variable which equals 1 if the individual is male and 0 otherwise.

Table 2 suggests that the introduction of the *Number of Items Purchased* as a control variable dramatically increases the model fit. Furthermore, the latter model fits the data much better than the one with the *Number of Times Card Used* as a control variable.[9] That said, from here onward, we base our inference on the coefficients in model 2, since it provides unbiased estimates of the treatment manipulations on the plastic bag purchase controlling for confounding variables.

How do the treatment stimuli compare to the baseline setting? In all treatments, the plastic bag purchase is significantly lower than in the baseline. Given the results depicted in Table 2, we can formulate the following result:

Result 1. Both the environmental nudge and the financial bonus reduce the purchase of plastic bags and, therefore, stimulate pro-environmental behavior.

How do the interventions with the environmental nudge compare with the introduction of a financial bonus? According to the results, the financial bonus treatments outperform the respective environmental nudge treatments. More specifically, the purchase of plastic bags in the *Financial Incentives & Big Bag* treatment is around 21% lower than the purchase of plastic bags in the *Environmental Nudge & Big Bag* treatment (F=41.25, p=0.000). In the same vein, the purchase of plastic bags in the *Financial Incentives & Small Bag* treatment is around 18% lower than the purchase of plastic bags in the *Environmental Nudge & Small Bag* treatment (F=27.01, p=0.000). In a similar fashion, the purchase of plastic bags in the *Financial Incentives* treatment is 11% lower than the purchase of plastic bags in the *Environmental Nudge* treatment (F=8.85, p=0.003). On the basis of these findings we state the following result:

Result 2. Small financial incentives are more effective to reduce the purchase of plastic bags than environmental nudges.

Does the reusable bag affect the plastic bag purchase on top of the environmental nudge or the financial bonus? The provision of reusable bags significantly drops the purchase of the plastic bags in the treatments with the environmental nudge as well as in the treatments with the financial bonus. More specifically, the plastic bag purchase in the *Environmental Nudge & Big Bag* treatment is around 8% lower than in the *Environmental Nudge* treatment (F= 7.96, p= 0.010). Similarly, the plastic bag purchase in the *Environmental Nudge & Small Bag* treatment is around 7% lower than in the *Environmental Nudge* treatment (F=7.23, p=0.014). We apply the Bonferroni correction to adjust the

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[9] The adjusted R-squared is twice as high in model 2 as in model 3. Furthermore, the AIC and BIC in model 2 (44377.15 and 44436.08, respectively) are smaller than the AIC and BIC in model 3 (47293.63 and 47352.55, respectively).

p-values for multiple comparisons. On a side note, there is no difference across the two bag treatments with environmental nudges (F=0.01, p=0.905).

Similar findings albeit with much larger effect sizes apply to the treatments with the financial bonus. In the *Financial Incentives & Big Bag* treatment the purchase of plastic bags is around 17% lower than in the *Financial Incentives* treatment (F=15.64, p=0.000). Likewise, in the *Financial Incentives & Small Bag* treatment the purchase of plastic bags is around 14% lower than in the *Financial Incentives* treatment (F= 9.61, p=0.004). Again, there is no difference across the two bag treatments (F=0.84, p=0.361).

One may attribute the difference between the *Financial Incentive*, *Financial Incentives & Small Bag*, and *Financial Incentives & Big Bag* treatments to the fact that around 70 more packages were delivered in the latter two treatments compared to the *Financial Incentive* treatment (please refer to Table 1). Thus, the awareness about the competition in the *Financial Incentives & Big Bag* and *Financial Incentives & Small Bag* treatments could be higher than in the *Financial Incentive* treatment, which could result in fewer plastic bag purchase in these treatments. In our view, even if the subjects in the *Financial Incentive* treatment did not receive a package (in this case a letter), they were regularly notified about the competition through an SMS. In this regard, the impact of electronic communication channels such as SMS can be at least as high as that of traditional communication channels such as physical letters (e.g., Mascagni et al., 2017; Ortega and Scartascini, 2020).

Result 3. *The reusable bag in combination with an environmental nudge or a financial bonus shrinks the purchase of plastic bags compared to the environmental nudge or the financial bonus alone.*

4. Conclusion and Policy Recommendations

Taxes and bans are the most prevalent policy interventions to curb the disposable bag purchase and consumption, nonetheless the behavioral response to these policy instruments is not always affirmative and, under certain conditions, can even result in strong opposition. Furthermore, rigorous scientific studies illustrate that these policy interventions do not always lead to desired consequences. For instance, a partial ban on thin single use plastic bags can result in substituting the thin bags with thick ones, which can trigger more environmental harm (Homonoff et al., 2020). In the same vein, the introduction of a tax on disposable bags can first curb their consumption and then rebound (Homonoff et al., 2020).

The impact of policy intervention other than taxes and bans to curb the demand for plastic bags is rather understudied in the literature. For instance, while the governments of various countries actively

utilize nudge interventions to achieve different policy objectives, the impact of such interventions is largely unknown in the struggle against disposable bags. Another overlooked intervention that can appear to be rather successful is the provision of bonuses if single use plastic bags are not purchased. In this paper, we run an RCT with loyalty card holders of one of the biggest supermarket chains in Yerevan (Armenia). We generate unique data to compare the impact of an environmental nudge with that of a financial bonus on the purchase of single use plastic bags. We also study whether interventions that combine free reusable bags (made of non-woven polypropylene) with the environmental nudge or the financial bonus can be more effective compared to the environmental nudge or the financial bonus alone. The bonus structure implemented during the experiment is such that it stimulates competition among supermarket customers.

Our findings suggest the policymakers that environmental nudges, at least from the short run to the medium run, can curb the purchase of plastic bags. Indeed, a regular SMS in combination with an environmental leaflet can reduce the purchase of single use plastic bags by around 12% relative to the business as usual setting, whereby these plastic bags are sold for a small amount of money.

According to our results, financial bonuses can result in a more substantial reduction of plastic bag purchase, especially when coupled with the free distribution of reusable bags. More specifically, a sheer financial bonus drops the purchase of disposable bags by around 24% relative to the baseline, while the provision of reusable bags coupled with financial bonuses drops the purchase of disposable bags by around 35-40% relative to the baseline.

Policymakers can think of (fiscal) interventions (in the form of tax deductions) aimed at inducing big supermarket chains and other economic entities responsible for excessive plastic bag sales to implement competitive schemes that award small financial bonuses to costumers exhibiting the best pro-environmental performance in the purchase of plastic bags. The use of such financial bonuses based on competitive schemes can also be accompanied by a free distribution of reusable bags. To exclude that a household receives multiple disposable bags from several economic entities (e.g., each supermarket chain provides a separate reusable bag), there can be a designated governmental agency which distributes one reusable bag per household on a bi-annual or annual basis. Indeed, there are precedents of free reusable bag distribution by designated governmental agencies. For instance, New York city distributes reusable bags given the state's plastic bag ban (New York Times, 2020).

An important question to consider is whether the financial bonuses coupled with the free distribution of reusable bags can lead to more environmentally favorable outcomes relative to the baseline business as usual setting. In general, more material and energy are required to produce a reusable bag compared

to a disposable bag, which in turn increase the environmental footprint of one reusable bag relative to one disposable bag. Ultimately, both bag types have pros and cons and whether they should be widely used or not can trigger serious environmental tradeoffs without a straightforward answer. More specifically, the single use plastic bags are a poor option in terms of litter on land, marine litter and microplastics, albeit they score rather high in such environmental impact categories as climate change, acidification, water use, land use and the like (United Nations Environment Program, 2020). That said, whether a single use plastic bag or a reusable non-woven polypropylene bag is deemed as more appropriate should largely depend on which of the abovementioned environmental aspects are given the highest priority in a given context. For instance, if a country has under-developed waste-management systems and poor infrastructure for collecting and recycling (Armenia belongs to such countries), there are sound arguments against single use plastic bags because of high volumes of littering and the related negative environmental impact (e.g., United Nations Environment Program, 2020). In these countries, reusable bags should be considered as viable substitutes to disposable plastic bags. If this is the case, then one of the main objectives the policymakers face is to promote their usage, because the more frequently these bags are used the more environmentally-friendly they become compared to single use plastic bags.

It is estimated that a reusable non-woven polypropylene bag can have the same climate impact as a reusable bag if used for 10-20 times (United Nations Environment Program, 2020). Figure 5 illustrates the average usage of reusable bags by the end of the experiment (with the respective 95% confidence intervals) in the four treatments in which subjects were given a bag. We only focus on those participants who were supposed to receive a bag and *actually* did so. A reusable bag in the treatments with financial incentives was used around 10 times, while a tot bag in the treatments with an environmental nudge was used almost twice less. Thus, small financial bonuses are twice as effective as environmental nudges in promoting the use of reusable bags.

Figure 5: The Usage of a Tote Bag
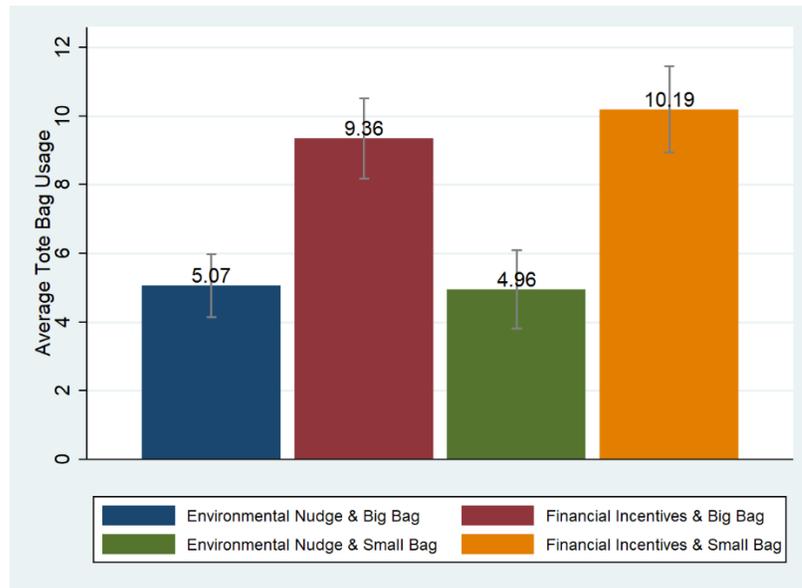
Note: The figure reports the mean frequencies of the usage of the tote bags during the experiment in the four treatments in which subjects were given a bag.

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Appendices

Appendix A: The original letters used in the Experiment (in Armenian) and their English translations

A1.1: The Original Letter Used in the Environmental Nudge Treatment (first page and second page)

Հարգելի՛ հաճախորդ,

«Ծիրան» սուպերմարկետների ցանցը խնդրում է Ձեզ սուպերմարկետում գնումներ կատարելիս ընդհանրապես չգնել մեկանգամյա օգտագործման պլաստիկ տոպրակներ գանձապահից՝ աջակցելով շրջակա միջավայրի պահպանությանը: Փոխարենն առաջարկում ենք գնել և օգտագործել «Ծիրան» սուպերմարկետներում վաճառվող բազմակի օգտագործման տոպրակները. 1 տոպրակը բավական է երկար ժամանակ գնումներ կատարելու համար :

Ինչո՞ւ

Պլաստիկը աղտոտում է Ձեր շրջակա միջավայրը:

Եթե պլաստիկը չի վերամշակվում, այն 100-ավոր տարիներ մնում է բնության մեջ:

Պլաստիկ տոպրակների հաճախակի օգտագործումը հանգեցնում է պլաստիկի կուտակմանը աղբավայրերում, դրանից առաջացած թունավոր նյութերն արտահոսում են գետեր և լճեր, իսկ պլաստիկի այրման հետևանքով աղտոտվում է օդը:

Պլաստիկը հայտնվում է Ձեր անդային շղթայում

Գիտե՞ք, որ այսօր պլաստիկ տոպրակներից առաջացած պլաստիկի փոքրիկ կտորներն ամենուր են: Կենդանիները հաճախ կուլ են տալիս այդ կտորները, և այդ կերպ պլաստիկը հայտնվում է մեր ափսեներում:

Հաշվի առնելով մեկանգամյա օգտագործման պլաստիկ տոպրակների բացասական ազդեցությունը շրջակա միջավայրի վրա՝ խնդրում ենք սուպերմարկետում գնումներ կատարելիս չգնել պլաստիկ տոպրակներ զանձապահից:

Հարգանքով,
«Ծիրան» սուպերմարկետ

A1.2: The English Translation of the Letter Used in the Environmental Nudge Treatment (first page and second page)

Green Armenia, Healthy People

If plastic is not recycled it can stay in the environment for hundreds of years.

The frequent use of plastic results in the accumulation of plastic in the landfills, toxic chemicals from plastics drain out and seep into lakes and rivers, while burning the plastic pollutes the air.

Dear Customer,

"Tsiran" Supermarket Chain asks you not to purchase single use plastic bags at the cashier when shopping at the supermarket in order to protect the environment.

Instead, we suggest you to buy and use the reusable bags sold at the supermarket. 1 bag is enough for shopping in the supermarket for a long time.

Why?
Plastic pollutes the environment.

Plastic appears in

Your Food Chain

Do you know that the particles of plastic bags are everywhere? The animals usually swallow these particles and in this way the plastic appears in our plates.

Taking into account the negative impact of single use plastic bags on the environment we ask you not to buy single use plastic bags from the cashiers when shopping in the supermarket.

Sincerely,

Tsiran Supermarket

A2.1: The Original Letter Used in the Environmental Nudge & Bag Treatments (first page and second page)

Հարգելի́ հաճախորդ,

«Ծիրան» սուպերմարկետների ցանցը խնդրում է Ձեզ սուպերմարկետում գնումներ կատարելիս ընդհանրապես չգնել մեկանգամյա օգտագործման պլաստիկ տոպրակներ զանձապահից՝ աջակցելով շրջակա միջավայրի պահպանությանը: **Փոխարենն առաջարկում ենք գնումներ կատարելիս օգտագործել Ձեզ նվեր տրված բազմակի օգտագործման տոպրակը:** Այս տոպրակը բավական է երկար ժամանակ գնումներ կատարելու համար:

Ինչո՞ւ

Պլաստիկը աղտոտում է Ձեր շրջակա միջավայրը:

Եթե պլաստիկը չի վերամշակվում, այն 100-ավոր տարիներ մնում է բնության մեջ:

Պլաստիկ տոպրակների հաճախակի օգտագործումը հանգեցնում է պլաստիկի կուտակմանը աղբավայրերում, դրանից առաջացած թունավոր նյութերն արտահոսում են գետեր և լճեր, իսկ պլաստիկի այրման հետևանքով աղտոտվում է օդը:

Պլաստիկը հայտնվում է Ձեր սննդային շղթայում

Գիտե՞ք, որ այսօր պլաստիկ տոպրակներից առաջացած պլաստիկի փոքրիկ կտորներն ամենուր են: Կենդանիները շատ հաճախ կուլ են տալիս այդ կտորները, և այդ կերպ պլաստիկը հայտնվում է մեր ափսեներում:

Հաշվի առնելով մեկանգամյա օգտագործման պլաստիկ տոպրակների բացասական ազդեցությունը շրջակա միջավայրի վրա` խնդրում ենք սուպերմարկետում գնումներ կատարելիս չգնել պլաստիկ տոպրակներ գանձապահից:

Հարգանքով,
«Ծիրան» սուպերմարկետ

A2.2: The English Translation of the Letter Used in the Environmental Nudge & Bag Treatments (first page and second page)

Green Armenia, Healthy People

If plastic is not recycled it can stay in the environment for hundreds of years.

The frequent use of plastic results in the accumulation of plastic in the landfills, toxic chemicals from plastics drain out and seep into lakes and rivers, while burning the plastic pollutes the air.

Dear Customer,

"Tsiran" Supermarket Chain asks you not to purchase single use plastic bags at the cashier when shopping at the supermarket in order to protect the environment.
Instead, we suggest you to use the reusable bag that you received as a present. This bag is enough for shopping in the supermarket for a long time.

Why?
Plastic pollutes the environment.

Plastic appears in Your Food Chain

Do you know that the particles of plastic bags are everywhere? The animals usually swallow these particles and in this way the plastic appears in our plates.

Taking into account the negative impact of single use plastic bags on the environment we ask you not to buy single use plastic bags from the cashiers when shopping in the supermarket.

Sincerely,
Tsiran Supermarket

A3.1: The Original Letter Used in the Financial Incentives Treatment

Հարգելի՛ համախոսորդ,

Դուք մասնակցում եք «Շիրան» սուպերմարկետի կազմակերպած մրցույթին և կարող եք վաստակել **20.000 դրամ**:

Ի՞նչ է պետք անել հաղթելու համար:

1. Գանձապահից պլաստիկ տոպրակ մի՛ գնեք: Փոխարենն առաջարկում ենք գնել և օգտագործել «Շիրան» սուպերմարկետներում վաճառվող բազմակի օգտագործման տոպրակները: 1 տոպրակը բավական է երկար ժամանակ գնումներ կատարելու համար:
2. «Շիրան» սուպերմարկետում գնումներ կատարելիս միշտ ներկայացրեք Ձեր կուտակային քարտը:
3. Հնարավորինս շատ մրցութային միավորներ հավաքեք 2020թ. հունվարի 13-ից 2020թ. հուլիսի 11-ն ընկած ժամանակահատվածում:

Ինչպե՞ս են հաշվարկվում մրցութային միավորները:

- Եթե այցի ընթացքում պլաստիկ տոպրակ չեք գնում, և Ձեր ծախսած գումարը չի գերազանցում 2000 դրամը, Դուք ստանում եք 2 մրցութային միավոր:
- Եթե այցի ընթացքում պլաստիկ տոպրակ չեք գնում, և Ձեր ծախսած գումարը 2000 դրամ ու ավելի է, դուք ստանում եք 10 մրցութային միավոր:
- Եթե այցի ընթացքում մեկ կամ ավելի պլաստիկ տոպրակ եք գնում, Դուք ոչ մի մրցութային միավոր չեք ստանում: Օրինակ եթե այցի ընթացքում ծախսել եք 15.000 դրամ և գնել եք մեկ կամ ավելի պլաստիկ տոպրակ, ստանում եք 0 միավոր:

Կարևոր է հիշել.

- Ձեր այցերի ընթացքում վաստակած մրցութային միավորները կուտակվում են:
- Դուք մրցում եք «Շիրան» սուպերմարկետի կուտակային քարտ ունեցող 9-ը այլ համախոսորդի հետ: Ձեր խմբի նման խմբերը շատ են:
- Խմբերում ամենաշատ միավոր վաստակած անձն ընտրվելու է որպես հաղթող:
- Շահած գումարը փոխանցվելու է Ձեր կուտակային քարտի վրա:

Մրցույթը սկսվել է **հունվարի 13-ին** և կշարունակվի մինչև **հուլիսի 11-ը**:

Մրցույթի ավարտից հետո արդյունքները կշանուցվեն Ձեզ SMS հաղորդագրության միջոցով: Հարցերի դեպքում կարող եք վանգահարել «Շիրան» սուպերմարկետի թեժ գիծ [ ] համարով:

A3.2: The English Translation of the Letter Used in the Financial Incentives Treatment

Dear Customer,

You take part in a competition organized by "Tsiran" supermarket where you can win **20.000 AMD**.

What do you need for winning?

1. **Do not buy a plastic bag from the cashier. Instead, we suggest you to buy and use the reusable bags sold at the supermarket. 1 bag is enough for shopping in the supermarket for a long time.**
2. When shopping in the supermarket always present your loyalty card.
3. Accumulate as many competition points as possible from January 13, 2020 to July 11, 2020.

How are the competition points calculated?

- If you do not buy plastic bags during your visit and your shopping amount does not exceed 2000 AMD, you receive 2 competition points.
- If you do not buy plastic bags during your visit and your shopping amount is greater or equal to 2000 AMD, you receive 10 competition points.
- If you buy one or more plastic bags during your visit you do not receive any competition point. For instance, if you have spent 15.000 AMD during your visit and you have bought one or more plastic bags you receive 0 points.

Important points to remember.

- The competition points you earn during your visits accumulate.
- You compete with 9 other customers who also hold loyalty cards issued by "Tsiran" supermarket. There are many groups like yours.
- The individuals who accumulate the highest number of competition points in each group win the competition.
- The amount you win will be transferred to your loyalty card.

The competition started on **January 13** and will last until **July 11**.

You will be notified about the results of the competition through an SMS. In case of questions you can call "Tsiran" supermarket hotline at XXXXXXXX.

A4.1: The Original Letter Used in the Financial Incentives & Bag Treatments

Հարգելի համախոսրդ,

Դուք մասնակցում եք «Ծիրան» սուպերմարկետի կազմակերպած մրցույթին և կարող եք վաստակել **20.000 դրամ**:

Ի՞նչ է պետք անել հաղթելու համար:

1. Գանձապահից պլաստիկ տոպրակ մի գնեք: Փոխարենը կարող եք օգտագործել Ձեզ նվեր տրված բամմակի օգտագործման տոպրակը: Այս տոպրակը բավական է երկար ժամանակ գնումներ կատարելու համար:
2. «Ծիրան» սուպերմարկետում գնումներ կատարելիս միշտ ներկայացրեք Ձեր կուտակային քարտը:
3. Հնարավորինս շատ մրցութային միավորներ հավաքեք **2020թ. հունվարի 13-ից 2020թ. հուլիսի 11-ն** ընկած ժամանակահատվածում:

Ինչպե՞ս են հաշվարկվում մրցութային միավորները:

• Եթե այցի ընթացքում պլաստիկ տոպրակ չեք գնում, և Ձեր ծախսած գումարը չի գերազանցում 2000 դրամը, Դուք ստանում եք 2 մրցութային միավոր:
• Եթե այցի ընթացքում պլաստիկ տոպրակ չեք գնում, և Ձեր ծախսած գումարը 2000 դրամ ու ավելի է, դուք ստանում եք 10 մրցութային միավոր:
• Եթե այցի ընթացքում մեկ կամ ավելի պլաստիկ տոպրակ եք գնում, Դուք ոչ մի մրցութային միավոր չեք ստանում: Օրինակ եթե այցի ընթացքում ծախսել եք 15.000 դրամ և գնել եք մեկ կամ ավելի պլաստիկ տոպրակ, ստանում եք 0 միավոր:

Կարևոր է հիշել

-Ձեր այցերի ընթացքում վաստակած մրցութային միավորները կուտակվում են:
-Դուք մրցում եք, «Ծիրան» սուպերմարկետի կուտակային քարտ ունեցող 9-ը այլ համախոսրդի հետ: Ձեր խմբի նման խմբերը շատ են:
-Խմբերում ամենաշատ միավոր վաստակած անձն ընտրվելու է որպես հաղթող:
-Շահած գումարը փոխանցվելու է Ձեր կուտակային քարտի վրա:

Մրցույթը սկսվել է **հունվարի 13-ին** և կշարունակվի մինչև **հուլիսի 11-ը**:

Մրցույթի ավարտից հետո արդյունքները կծանուցվեն Ձեզ SMS հաղորդագրության միջոցով: Հարցերի դեպքում կարող եք վանգահարել «Ծիրան» սուպերմարկետի թեժ գիծ [_____] համարով:

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A4.2: The English Translation of the Letter Used in the Financial Incentives & Bag Treatments

Dear Customer,

You take part in a competition organized by "Tsiran" supermarket where you can win **20.000 AMD**.

What do you need for winning?

1. **Do not buy a plastic bag from the cashier. Instead you can use the reusable bag you received as a present. This bag is enough for shopping in the supermarket for a long time.**
2. When shopping in the supermarket always present your loyalty card.
3. Accumulate as many competition points as possible from January 13, 2020 to July 11, 2020.

How are the competition points calculated?

- If you do not buy plastic bags during your visit and your shopping amount does not exceed 2000 AMD, you receive 2 competition points.
- If you do not buy plastic bags during your visit and your shopping amount is greater or equal to 2000 AMD, you receive 10 competition points.
- If you buy one or more plastic bags during your visit you do not receive any competition point. For instance, if you have spent 15.000 AMD during your visit and you have bought one or more plastic bags you receive 0 points.

Important points to remember.

- The competition points you earn during your visits accumulate.
- You compete with 9 other customers who also hold loyalty cards issued by "Tsiran" supermarket. There are many groups like yours.
- The individuals who accumulate the highest number of competition points in each group win the competition.
- The amount you win will be transferred to your loyalty card.

The competition started on **January 13** and will last until **July 11**.

You will be notified about the results of the competition through an SMS. In case of questions you can call "Tsiran" supermarket hotline at XXXXXXXX.

Appendix B: The texts and the dates of the SMS sent to the participants

Dates Sent	Text
31/01/2020 14/02/2020 28/02/2020 13/03/2020	***Environmental Nudge* treatment** When shopping at Tsiran supermarket do not buy plastic bags, since they pollute the environment. Instead buy one reusable bag and use for a long time. ***Environmental Nudge & Small Bag* and *Environmental Nudge & Big Bag* treatments** When shopping at Tsiran supermarket do not buy plastic bags, since they pollute the environment. ***Financial Incentives*, *Financial Incentives & Small Bag*, *Financial Incentives & Big Bag* treatments** As a loyalty card holder you participate in a competition held by Tsiran supermarket where you can win around 20.000 AMD. To do so, you should not buy plastic bags when shopping in the supermarket. The competition will continue until July 11. Please call xxxxxxxxx for more details. You will be provided with more information during your next visit to the supermarket.
27/03/2020 23/04/2020 08/05/2020 22/05/2020 05/06/2020 22/06/2020 03/07/2020	***Environmental Nudge* treatment** When shopping at Tsiran supermarket do not buy plastic bags, since they pollute the environment. ***Environmental Nudge & Small Bag* and *Environmental Nudge & Big Bag* treatments** When shopping at Tsiran supermarket do not buy plastic bags, since they pollute the environment. Instead, use the reusable bag the supermarket provided to you. ***Financial Incentives*, *Financial Incentives & Small Bag*, *Financial Incentives & Big Bag* treatments** As a loyalty card holder you participate in a competition held by Tsiran supermarket where you can win around 20.000 AMD. To do so, you should not buy plastic bags when shopping in the supermarket. The competition will continue until July 11. Please call xxxxxxxxx for more details. You will be provided with more information during your next visit to the supermarket.

14/07/2020	The results of the competition held by Tsiran supermarket are being finalized and the winners will be soon notified through an SMS.

Appendix C: Checking Differences Across Treatments

Table C1: April

	Gender	Card Used	Items Bought	Plastic Bags
Environmental Nudge	0.001	0.431**	1.848	0.155
	(0.023)	(0.195)	(1.453)	(0.180)
Financial Incentive	0.003	0.025	-0.418	-0.027
	(0.023)	(0.193)	(1.414)	(0.178)
Big Bag & Environmental Nudge	-0.002	-0.133	0.051	0.058
	(0.023)	(0.192)	(1.535)	(0.187)
Big Bag & Financial Incentive	-0.000	0.173	2.430*	0.236
	(0.023)	(0.192)	(1.462)	(0.179)
Small Bag & Environmental Nudge	-0.000	-0.019	1.442	0.115
	(0.023)	(0.190)	(1.477)	(0.181)
Small Bag & Financial Incentive	0.001	0.209	2.447	0.318*
	(0.023)	(0.191)	(1.489)	(0.185)
Constant	0.338***	4.592***	30.277***	3.456***
	(0.016)	(0.138)	(1.029)	(0.127)
F statistics	0.008	1.906	1.380	0.925
Adjusted R-squared	-0.001	0.001	0.000	-0.000
Number of Observations	5,809	5,809	5,809	5,809

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C2: May

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	0.362	0.494	0.089
	(0.237)	(1.989)	(0.249)
Financial Incentive	-0.233	-3.960**	-0.372
	(0.230)	(1.889)	(0.241)
Big Bag & Environmental Nudge	-0.190	-1.927	-0.228
	(0.235)	(1.970)	(0.245)
Big Bag & Financial Incentive	-0.133	-1.712	-0.196
	(0.234)	(2.030)	(0.249)
Small Bag & Environmental Nudge	-0.224	-1.136	-0.148
	(0.231)	(2.007)	(0.250)
Small Bag & Financial Incentive	0.002	-0.280	0.019
	(0.231)	(2.022)	(0.250)
Constant	7.684***	53.086***	6.028***
	(0.163)	(1.405)	(0.176)
F statistics	1.549	1.285	0.908
Adjusted R-squared	0.001	0.000	-0.000
Number of Observations	5,809	5,809	5,809

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C3: June

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	0.356	0.209	0.145
	(0.240)	(1.851)	(0.233)
Financial Incentive	0.288	0.467	0.155
	(0.235)	(1.930)	(0.238)
Big Bag & Environmental Nudge	-0.040	-0.633	0.247
	(0.235)	(1.898)	(0.237)
Big Bag & Financial Incentive	-0.034	0.798	0.315
	(0.232)	(1.986)	(0.246)
Small Bag & Environmental Nudge	-0.026	2.087	0.326
	(0.231)	(1.940)	(0.237)
Small Bag & Financial Incentive	0.396*	1.739	0.323
	(0.236)	(1.928)	(0.239)
Constant	7.370***	50.507***	5.677***
	(0.164)	(1.344)	(0.163)
F statistics	1.424	0.496	0.527
Adjusted R-squared	0.000	-0.001	-0.001
Number of Observations	5,809	5,809	5,809

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C4: July

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	0.355*	0.694	0.141
	(0.193)	(1.560)	(0.199)
Financial Incentive	-0.060	-2.429	-0.234
	(0.187)	(1.510)	(0.191)
Big Bag & Environmental Nudge	0.103	-0.487	0.086
	(0.185)	(1.526)	(0.191)
Big Bag & Financial Incentive	-0.004	-0.053	0.057
	(0.186)	(1.589)	(0.197)
Small Bag & Environmental Nudge	0.118	1.335	0.189
	(0.185)	(1.556)	(0.196)
Small Bag & Financial Incentive	0.089	-0.334	0.061
	(0.185)	(1.558)	(0.197)
Constant	5.468***	37.972***	4.363***
	(0.130)	(1.104)	(0.137)
F statistics	0.954	1.238	1.005
Adjusted R-squared	0.000	0.000	-0.000
Number of Observations	5,809	5,809	5,809

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C5: August

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	-0.239	-3.003	-0.262
	(0.863)	(5.354)	(0.682)
Financial Incentive	-2.226***	-10.185**	-0.814
	(0.771)	(5.004)	(0.632)
Big Bag & Environmental Nudge	-0.295	3.183	0.850
	(0.867)	(6.014)	(0.717)
Big Bag & Financial Incentive	-1.574*	-2.971	0.033
	(0.804)	(5.470)	(0.677)
Small Bag & Environmental Nudge	-1.021	1.662	0.500
	(0.935)	(6.447)	(0.848)
Small Bag & Financial Incentive	-1.106	-3.471	0.075
	(0.878)	(5.871)	(0.762)
Constant	8.232***	49.352***	5.296***
	(0.661)	(4.075)	(0.511)
F statistics	2.712	1.571	1.395
Adjusted R-squared	0.007	0.002	0.001
Number of Observations	1,024	1,024	1,024

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C6: September

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	-0.335	-2.415	-0.633
	(0.711)	(4.323)	(0.528)
Financial Incentive	-1.264**	-6.139	-0.487
	(0.635)	(3.900)	(0.534)
Big Bag & Environmental Nudge	-0.131	3.825	0.582
	(0.702)	(4.552)	(0.596)
Big Bag & Financial Incentive	-0.786	-0.596	-0.127
	(0.662)	(4.397)	(0.569)
Small Bag & Environmental Nudge	-0.998	-1.960	-0.063
	(0.703)	(4.299)	(0.608)
Small Bag & Financial Incentive	-0.872	-3.559	-0.215
	(0.644)	(4.262)	(0.559)
Constant	6.850***	39.405***	4.728***
	(0.509)	(3.076)	(0.413)
F statistics	1.104	1.152	1.021
Adjusted R-squared	0.000	0.000	0.000
Number of Observations	1,301	1,301	1,301

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C7: October

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	-0.000	-2.843	-0.734
	(0.594)	(3.840)	(0.477)
Financial Incentive	-0.401	-0.594	0.060
	(0.626)	(4.097)	(0.560)
Big Bag & Environmental Nudge	0.843	10.535**	1.508**
	(0.676)	(4.802)	(0.632)
Big Bag & Financial Incentive	-0.162	1.409	0.596
	(0.599)	(3.975)	(0.550)
Small Bag & Environmental Nudge	-0.988	-0.674	0.220
	(0.680)	(4.796)	(0.718)
Small Bag & Financial Incentive	-0.721	-5.308	-0.618
	(0.581)	(3.728)	(0.483)
Constant	6.520***	36.828***	4.293***
	(0.419)	(2.780)	(0.381)
F statistics	1.388	2.157	3.604
Adjusted R-squared	0.003	0.006	0.009
Number of Observations	1,370	1,370	1,370

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C8: November

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	-0.618	-3.314	-0.823
	(0.637)	(4.187)	(0.559)
Financial Incentive	-0.411	-1.491	-0.294
	(0.640)	(4.272)	(0.587)
Big Bag & Environmental Nudge	-0.342	2.466	0.142
	(0.647)	(4.450)	(0.588)
Big Bag & Financial Incentive	0.339	3.854	0.365
	(0.665)	(4.531)	(0.610)
Small Bag & Environmental Nudge	-1.012	-3.614	-0.337
	(0.679)	(4.544)	(0.664)
Small Bag & Financial Incentive	-0.828	-5.215	-0.663
	(0.621)	(4.042)	(0.568)
Constant	6.719***	38.454***	4.587***
	(0.468)	(3.146)	(0.469)
F statistics	1.012	1.250	1.521
Adjusted R-squared	0.000	0.001	0.001
Number of Observations	1,339	1,339	1,339

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Table C9: December

	Card Used	Items Bought	Plastic Bags
Environmental Nudge	0.174	1.056	-0.136
	(0.677)	(4.965)	(0.544)
Financial Incentive	-0.755	-3.629	-0.067
	(0.643)	(4.592)	(0.534)
Big Bag & Environmental Nudge	-0.467	0.963	0.174
	(0.662)	(5.004)	(0.579)
Big Bag & Financial Incentive	-1.149*	-5.977	-0.414
	(0.625)	(4.513)	(0.542)
Small Bag & Environmental Nudge	-0.970	-0.588	0.507
	(0.670)	(4.929)	(0.655)
Small Bag & Financial Incentive	-0.415	-1.761	0.184
	(0.651)	(4.528)	(0.554)
Constant	7.107***	43.220***	4.740***
	(0.485)	(3.455)	(0.412)
F statistics	1.190	0.675	0.496
Adjusted R-squared	0.001	-0.002	-0.002
Number of Observations	1,287	1,287	1,287

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

Appendix D: Supporting Tables

Table D1: The Difference in the Envelopes Distributed

	(1)
Environmental Nudge	-0.081***
	(0.023)
Financial Incentives	-0.081***
	(0.023)
Environmental Nudge & Big Bag	-0.030
	(0.022)
Environmental Nudge & Small Bag	-0.023
	(0.022)
Financial Incentives & Small Bag	-0.023
	(0.022)
Constant	0.729***
	(0.015)
F statistics	4.303
Adjusted R-squared	0.003
Number of Observations	4,979

Note: OLS regression. Dependent variable. *Package Delivered* – Dummy variable which equals 1 if a package was delivered to the customer and 0 otherwise. All other remarks of Table 2 apply. *Financial Incentives & Big Bag* treatment is the omitted category. The Wald test of the equality of coefficients suggests that the difference between *Environmental Nudge & Big Bag, Environmental Nudge & Small Bag* and *Financial Incentives & Small Bag* is statistically non-significant ($F_{(2, 4973)}=0.933$). Bonferroni correction is applied to adjust the p-values for multiple comparisons. Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table D2: The Pattern of Missingness

	(1)
Environmental Nudge	-0.001
	(0.015)
Financial Incentives	0.002
	(0.015)
Environmental Nudge & Big Bag	0.012
	(0.015)
Financial Incentives & Big Bag	0.007
	(0.015)
Environmental Nudge & Small Bag	0.014
	(0.016)
Financial Incentives & Small Bag	0.016
	(0.016)
Constant	0.106***
	(0.011)
F statistics	0.401
Adjusted R-squared	-0.001
Number of Observations	5,809

* $p<0.1$; ** $p<0.05$; *** $p<0.01$