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“Limited Attention, Salience and Changing Prices:  
Evidence from a Field Experiment  
in Online Supermarket Shopping”

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## **Abstract**

How do consumers allocate their attention over price fluctuations in multiple products, and how do they respond to information on these price changes? We address these questions using data from a field experiment on a website that offers purchase and delivery from one large local supermarket chain in the U.S. Our main findings indicate that (i) a large proportion of consumers forego significant saving opportunities that they were aware of, (ii) consumers are more likely to compare prices between substitutes that appear close to each other, and (iii) personalized "nudges" have a differential effect on consumers. Furthermore, we propose a typology of shoppers and shopping trips, based on a level of attentiveness, and show that nudges and information provision helps only the "attentive" shoppers.

**Keywords:** Limited attention, Salience, Information processing, Supermarket shopping.

# 1 Introduction

A consumer in the modern market place is faced with an overwhelming amount of information about a multitude of consumption alternatives. There is an ocean of substitutes for almost every product type, each product type is offered by a myriad of suppliers, and there are many frequent promotions that cause prices across suppliers to fluctuate almost continuously. While the internet offers easy and cheap access to information about prices, there is a great number of prices that consumers need to inspect. Consumers are then faced with the difficult problem of deciding each period what information to focus on and how much to invest in processing that information.

Understanding how consumers solve this problem is an important prerequisite for understanding how consumption responds to price fluctuations. In particular, empirical evidence has shown that aggregate consumption adjusts slowly to shocks and may be excessively sensitive to *past* known information (see Carroll, Slacalek and Sommer (2011)). The rational inattention literature has argued that this "stickiness" is consistent with a model in which individuals trade-off net consumption gains (from finding a better affordable bundle) with the cost of acquiring information (see, e.g., Sims (2003) and Reis (2006)). In this literature information is modeled as a black box through the relation between prior and posterior beliefs. We take a step towards opening this black box by examining what type of information (on changing prices) consumers are willing to obtain and process, and how this information affects their decisions.

Several important questions arise with respect to consumer behavior. To what extent do shoppers invest in obtaining more precise information on prices of substitute goods? Conditional on obtaining this information, do shoppers correctly process it? Does bringing people's attention to potentially useful information and summarizing that information help them make better choices? (intuitively, this highlights which information one should focus on, and may reduce the cost of processing that information). Can more information have an undesirable effect of overwhelming some shoppers who consequently make suboptimal choices?

Thus far, the literature has provided only a few empirical answers to the above

questions, primarily because it is difficult to obtain data that tracks consumers over a period of time in an environment where prices are changing, consumers are exposed to signals about the changing prices and one can observe whether consumers paid attention to these signals. We overcome this challenge by partnering with a website that offers purchase and delivery from one large local supermarket chain in the U.S. The website displays products offered in the supermarket store and allows customers to create a basket, which is then delivered to their home. We implemented randomized controlled trials in which the website gave temporary discounts on select items and alerted only a subset of customers about these price changes. The objective was to understand how shoppers responded to this information and how various product displays (e.g., putting close substitutes next to each other or farther apart on the screen) and different ways of framing the information on price changes (e.g., ranking product categories according to size of discount) affected behavior. The website has provided us with this data, which would shed light on how consumers dynamically manage their limited attention.

Several key insights emerge from our data. First, a significant proportion of customers behave irrationally in the following sense: They open promotional emails with information on rebates that are automatically awarded for buying certain items - whose prices are significantly lower than the rebate - but they do *not* realize these rebates (hence, in a sense, they leave money on the table). Second, obtaining information on discounts *does* require some effort: Even when a produce item appears on the screen *next to* a cheaper organic alternative, a significant proportion of consumers buy the *more expensive* conventional item. This proportion is much higher when the consumer needs to scroll down the screen to view the cheaper organic alternative. Third, summarizing information (i.e., aggregating many pieces of information and highlighting a few key points) for “attentive shoppers” (shoppers who read promotional emails and respond optimally by purchasing the rebate item) allows them to make better choices: Conditional on opening emails and purchasing items that grant a rebate, consumers who received emails with a summary of the discounts were more likely to choose an item on sale over a more expensive (almost perfect) substitute (e.g., an organic product item that was cheaper than its conventional counterpart).

These findings suggest that consumers may need help in sorting many pieces of information, and that summaries and "nudges" (alerting consumers about updates) can guide them to better decisions. However, our data also hints at a potential cost of providing individuals with information, even if it is partially processed in the form of a summary. For some consumers this information may still be overwhelming and time consuming to understand. Consequently, they may end up allocating less time for comparing prices and more time to trying to understand the information offered to them. Hence, those who failed to correctly process the information given to them (by not choosing items that lead to savings), may have made better choices if they had spent more time comparing prices. Indeed, subjects in the control group (who did not receive summary information), who opened the promotional email but did not buy a rebate-awarding item, bought *more* items on sale than participants in the treatment group who opened the email with summary information but yet did not buy a rebate-awarding item. We interpret this latter group of participants as individuals who spent time trying to process the additional information but failed, and consequently allocated less time to simply compare prices.

Most of the literature on information acquisition makes no distinction between *acquiring* better information and correctly *processing* that information. Our findings suggest that this distinction is important for understanding purchasing behavior in the face of frequently changing information on prices. While providing consumers with summaries that highlight some of the main changes in prices reduces their uncertainty and raises the precision of their information, some consumers may find it difficult to process that information. Thus, for some consumers, information provision may crowd out - in terms of time allocation - simple price comparisons that may be easier to understand.

The remainder of the paper is organized as follows. Section 2 discusses related literature. The design of the randomized control trials are explained in Section 3 and the results are discussed in Section 4. Section 5 concludes.

## 2 Related literature

The proposed research is inspired by theoretical studies of limited attention. De Clippel, Eliaz and Rozen (2015) analyze a market in which consumers wish to consume a bundle of  $M$  different product types. Consumers are aware of the prices offered by one of the suppliers (the "leader") but need to inspect each product type to learn the identity of a competing supplier and the price it offers. Each consumer is characterized by the capacity of product types that he can inspect, and this capacity is distributed in the population. A notable feature of this model is that in equilibrium a consumer who can inspect at most  $k$  product types inspects the  $k$  most expensive markets. This suggests that when a consumer with limited attention faces information on price changes in a number of categories he may choose to inspect only the ones with the highest savings.

This study is also motivated by a recent theoretical analysis of the effect of *salience* on consumer behavior. Most notably, Bordalo, Gennaioli and Shleifer (2016) propose a model of how one product attribute may be more salient than another. In our data, salience plays a role in terms of which discounts are more easily noticeable (e.g., appear at the top of a list that is emailed to shoppers), and which substitutes are more prominent (e.g., appear on the same line on the computer screen).

A number of studies provide experimental evidence on how individuals manage limited attention. Gabaix, Laibson, Moloche and Weinberg (2006) provide evidence that laboratory behavior of subjects in experiments where instrumental information was costly to acquire (either financially or because time was scarce) matches the predictions of a boundedly rational model where individuals use only approximate option-value calculations. Caplin and Dean (2013) use a laboratory design to test a behavioral property of the rational inattention model. In contrast to our work, these studies have been performed on students in laboratory settings. A recent exception is Bartos, Bauer, Chytilová and Majtěka (2016), who provide evidence from field experiments in rental housing and job applications showing that suppliers in these markets do not acquire all the available information (they do not view the resumes of all the applicants), but rather focus their attention only on a select group

of applicants, based on stereotypical attributes of that group (employers are more likely to view resumes of majority candidates while landlords are more likely to view resumes of minority candidates).

One implication of limited attention is that decision makers find it difficult to cope with information overload, which may lead to suboptimal behavior. Iyengar (2010) surveys a series of experimental studies conducted by her that provide evidence in a variety of contexts (in particular, in retirement savings and consumption) how information overload can induce irrational behavior. This is consistent with our finding that some subjects in the treatment group, who received detailed information on discounts, were less likely to realize savings (through discounts and refunds) than subjects in the control group who received less detailed information.

The prevalence of limited attention also suggests that “nudges” or reminders that make some information salient may help individuals make better decisions. In our study consumers in the treatment group were sent emails alerting them to the item categories with the biggest sales. We find that this nudge impacted different types of shoppers differently, while for some consumers it caused them to switch to the cheaper substitute, it seemed to have the opposite effect on others. Such a differential effect of nudges was also found in Costa and Kahn (2013), who show that providing feedback to households on own and peers’ home electricity usage reduced the consumption of liberals and increased that of conservatives.

There are only a few studies that present empirical evidence on the implications of limited attention on consumer behavior. The main obstacle in providing such evidence is the difficulty in obtaining data on the information that consumers paid attention to. Hossain and Morgan (2006) conduct a field experiment on eBay and find that when two auctions offer the same effective total price, more bidders are attracted to the auction with a lower opening price and higher shipping price. Chetty, Looney and Kroft (2009) provide evidence from a field experiment in a grocery store showing that posting prices that include taxes reduces demand. De los Santos, Hortacsu, and Wildenbeest (2012) use a large data set on web browsing and purchasing behavior to test whether consumers are searching in accordance to various classical search models. Helmers, Krishnan and Patnam (2015) use a unique data set from an online

retailer to show that consumers are more likely to buy products that receive a saliency shock when they are recommended by new products.<sup>1</sup> Clerides and Courty (2015) use scanner data from a supermarket chain to show that during periods in which the price of a discounted pack of detergent was lower than the corresponding price of a larger (“economy-size”) pack (of the same product), consumers still bought the larger, and more expensive pack. This finding suggests that some consumers are either not comparing all prices, or are not computing (or computing erroneously) the price per-unit when making their purchasing decisions.

### 3 Experimental Design

We partnered with a website that offers a purchase and next day delivery service from a large U.S. supermarket in a University city. The website includes roughly 3,000 items that are sold in the supermarket store. These items are divided into several categories to help customers perform an intuitive search (e.g. produce, dairy, etc.). Customers can also search the website for any item they would like to purchase using a search command. Customers need to add the item or items that they would like to purchase to their basket, and at checkout they pay for the products including a flat delivery fee of \$2.99 for each order. During the period of the experiment there was no option to re-order previous baskets or to add items from previous orders. In addition, all prices were fixed and there were no promotional sales.<sup>2</sup> Customers are required to choose a delivery date and a 2-hour delivery window. The cutoff time for next day delivery is midnight every day. These customers are mainly students (80 percent) with some professors (10 percent). Only 10 percent of customers are unaffiliated with the University.<sup>3</sup>

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<sup>1</sup>The salience shock was created by a group of items that appeared below each product with the title "You May Also Like."

<sup>2</sup>Since then the website has undergone significant changes and is now offering a much wider selection of items. In addition, customers now have the option to re-order past baskets (or to add items from previous orders) and the website offers weekly sales.

<sup>3</sup>This information resulted from responses to an optional survey conducted at checkout during the first month of the experiment period. Eighty percent of the shoppers included in our sample responded to the survey.



The website tracks data on customers' purchases over time. Several randomized trials were conducted in 2016 between January 29th and May 5. In order to do so, its population of 355 customers who had made purchases in the second half of 2015 were randomly divided into two groups – 178 in treatment and 177 in control. In general, these trials included making temporary price changes and increasing the salience of these price changes for the treatment group using different types of email notifications. The website has provided us with data on purchasing behavior of customers in the sample both before and during the trial period as well as a survey that was conducted during the experiment period.

The experiment occurred over a period of 13 consecutive weeks and consisted of four trials that are summarized in Table (1): (1) weeks 1-3; (2) weeks 4-5, 7; (3) weeks 6, 8-10; (4) weeks 11-13. Price changes were made in weeks 1, 6 and 10. This means that during weeks 1-5, 6-9 and 10-13 different sets of discounts were in effect.

Discounts were offered on items that were popular with its customers during the six-month period before the experiment started (see Table (2)). Only items that had obvious substitutes such as organic items that had conventional versions (e.g., produce, milk, eggs) or a product that had two competing brands (e.g. Chobani and Fage greek yogurts of the same flavor and the same fat content) were selected for the experiment. The items whose price was manipulated during the experiment were defined as Target Items, and their alternatives were defined as Substitute Items. These items fall into the following general categories:

1. organic and conventional items,
2. same items that are offered in different sizes (e.g. jumbo avocado and regular avocado) or bulk quantities (e.g. apples, that are offered as single units or 3lb bags, or milk that is offered in 0.5gal and 1gal)
3. brand names vs. generic store brand (e.g. Aunt Millie's breads vs. generic supermarket wholewheat bread), and
4. two competing brands of the same exact product (e.g., Dasani vs. Ice Mountain mineral water in bottles of the same size).

There are two motivating factors behind the choice of target items. First, there is recent evidence that consumers display relatively low brand loyalty to supermarket items as compared to clothing and appliances (Nielsen (2013)), and their choice of food brands is most affected by price considerations (Byron (2008)). Within the food and beverage category, consumers tend to exhibit more brand loyalty to breakfast cereals, carbonated drinks and snacks (Chidmi and Lopez (2007), Nielsen (2013)). *None* of these were included as target items in the experiment, hence, we assume that price sensitivity is stronger than brand loyalty in deciding between a target item and its substitute.

The second motivating factor is the public perception of organic items. Studies have indicated that consumers generally express positive attitudes toward organic foods, perceiving them as tastier and kinder to the environment (Roddy et al. (1996), Magnusson et al. (2001)). While there may be disagreement among researchers whether this perception is backed by scientific evidence (see Baransky et al. (2014) for a meta-analysis that claims there are healthier aspects of organic food), what is important for the current study is the public perception.

As mentioned above, three price changes were made during the experiment period. The lowest relative discounts (in percentages) on target items were maxed at 25% in the second set of discounts, and the highest relative discounts were maxed at 75% in the third set of discounts. In the first and second sets of discounts, target items' prices were often equal to or slightly below substitute items' prices and in the third set of discounts, target items' prices were often significantly below substitute items' prices. See Tables (3-4) for a full list of the relevant target and substitute items as well as the discounts given during the experiment period.

Discounted items were marked on the website with two asteriks (\*\*), and a footnote at the bottom of the screen explained that the marked item was on sale and the original higher price was specified. This method of marking discounts was used because of the following reasoning. First, we did not want discounts to be too salient so there would be an advantage for receiving an email that provided information on which items were discounted. Second, we wanted to allow any shopper who accessed the website to find out about the temporary sale if he exerted some effort in noticing

fine details.<sup>4</sup>

During each week of the experiment individuals in both the treatment and control group received an email with a rebate item. Emails were sent via a website which provides the option of tracking whether or not users opened their email and whether or not they clicked on the links that were provided in the email. Table (5) lists the rebate item offer for each week as well as both the price of the item and benefit of purchase for individuals in both the treatment and control groups.

In the first trial (weeks 1-3), both control and treatment groups received an email offering free shipping (valued at \$2.99) if they would add a specific rebate item to their basket and spend at least \$20. The email to the treatment group included additional information: (1) it explained that discounted items were marked on the website with two asterisks, and (2) it listed four broad categories of items (e.g., fruits, milk, vegetables, eggs) with the biggest discounts ordered from highest to lowest discounts in percentages. The sentence that introduced these discounted categories was the only sentence that appeared in bold-face characters. Figure (1) provides examples of the email format for both the treatment and control group.

In the second trial (weeks 4,5,7), the control email was identical to the one from the first trial while the treatment email changed and included more information. First, while the control group received the same offer of free shipping as before, the treatment group received a larger potential benefit: A (one-time) \$10 rebate on a purchase that exceeded \$20 if the customer buys a rebate item. All rebate items cost less than \$10. Second, starting with this week the order of the four categories with the biggest discounts was reversed in comparison to the first trial as the categories were now listed from lowest to highest discounts in percentages. The sentence that introduced these discounted categories was still the only sentence that appeared in bold-face characters. Figure (2) provides examples of the email format for both the treatment and control group in this period.

Starting with the third trial (weeks 6,8-10) the email to treatment shoppers included a personalized message that appeared as a separate paragraph in bold-face letters and which pointed out specific categories in which they had purchased items in

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<sup>4</sup>We operated under the constraint that all shoppers must face the same exact set of prices.

their last trip and for which there now existed cheaper on-sale alternatives (see Figure (3)).<sup>5</sup> In addition, there were two changes to the format of the email. First, the explanation about the weekly rebate item appeared as a separate paragraph and was the only paragraph that appeared in italics. Second, the sentence that introduced the list of biggest discounts no longer appeared in bold (so that the new personalized message was the only paragraph appearing in bold).

In the fourth trial (weeks 11-13), the control group was also offered a \$10 rebate on purchases of at least \$20 which included a rebate item. There were also two changes made to the treatment email. First, the email listed four specific items (not categories) with the largest discounts that month in ascending order. Second, the email included the following phrase: “Our April sale prices are so low that organic sale items are often even cheaper than the conventional alternative!”.

## 4 Findings

Our base sample consists of 134 shoppers who made at least one purchase on the site that included either a target or substitute item during the experiment period. Sixty five of these shoppers belonged to the original treatment group and sixty nine to the original control group. Thus, roughly 40 percent of the original sample of 177 Control shoppers and 178 treatment shoppers participated in the experiment.<sup>6</sup> Table (6) provides summary statistics for both the original sample and the relevant base sample in the pre-experiment period (December 2014 - January 2016). Not surprisingly, since individuals were randomly allocated to treatment and control, there are no significant differences in shopping trends between the treatment and control groups in either the original full sample or the relevant base sample for our

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<sup>5</sup>These personalized messages were sent only to treatment shoppers who bought items whose price changed. Due to technical reasons, the email in week 7 did not include the personalized messages to any treatment shoppers.

<sup>6</sup>There were 18 individuals in both the treatment and control group that unsubscribed from the company’s mailing list during the period of the experiment. Two of the unsubscribers from the treatment group did make purchases during the experiment period. We excluded them from all analysis.

analysis. Generally, more frequent shoppers were more likely to purchase in the experiment period. Thus, shoppers in the relevant base sample averaged seven trips prior to experiment start for both treatment and control, versus the lower average of four trips in the full original sample during this same period.

Our complete sample includes an additional 96 new shoppers who started using the website during the experiment period but were not part of the original full sample (since they did not make purchases on the site during the second half of 2015). These new shoppers were added to the control group since like the original control group, they did not receive any emails with information about the discounts. Because of this common feature, the behavior of newly added shoppers should be similar to that of the original control group. This brings us to a total of 230 shoppers. Indeed, we find that our main findings remain robust to removing these shoppers from our data (in fact, some of the main effects are stronger when we exclude these shoppers). All the tables that appear in this paper for the complete sample are reproduced for the smaller original sample in our online appendix.

Table (7) provides summary statistics of consumer behavior during the period of our experiment (532 shopping trips conducted by 230 shoppers). On average, shopping trips consist of roughly 9 items (s.d. 8). Carts that were created by shoppers who opened the promotional email averaged 11 items per shopping cart, while those who did not averaged 8 items over the same shopping period. One plausible explanation for this difference is the minimal expenditure (\$20) required to receive a discount when purchasing the rebate item. Indeed, Figure (5) shows that those who open emails have a significant spike surrounding the \$20 cutoff point.<sup>7</sup>

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<sup>7</sup>This behavioral response is referred in the economic policy literature as 'Bunching at the Notch'. Notches are discontinuous jumps in choice sets that incentivize the respondents to change their behavior in a way that will maximize their gains by choosing the more beneficial choice set (Sallee and Slemrod (2012)). Here, we introduced a notch at \$20, since only purchases of \$20 and above are benefited with a \$10 discount. Therefore, we would expect customers to respond by bunching at the \$20 notch. This means that there will be only few purchases just under \$20, followed by a spike around \$20 from the right, a drop in purchases after the spike and then a rise in purchases. See Figure (5).

## 4.1 Aggregate response to rebate offers

During the experiment period, all customers were awarded either free shipping (with a value of \$2.99) or an immediate rebate of \$10 if they purchased the weekly rebate item and spent \$20 or more. The price of the rebate item, during most weeks, was lower than \$2.99, and more than 95% of purchases in this period were above \$20. Therefore, adding the rebate item to the basket (in most weeks) is the rational response to these offers (see Table(5) for a summary of rebate items and their value per week). However, we find that shoppers behaved irrationally in a significant proportion of their shopping trips by "leaving money on the table".

**Observation 1.** *A significant proportion of shopping trips conducted by shoppers who opened the promotional email (38% of 245 shopping trips) did not include the rebate item even though its cost was below its benefit, thus foregoing an average savings of \$5.26.*

Shoppers who did not open the promotional email were unaware of the weekly rebate item, and hence, were less likely to realize the potential savings. Indeed, we show in Table (7) that the probability of purchasing the rebate item during a shopping trip for those individuals who opened their emails was roughly double that of those who did not (60% versus 31%). However, in 40% of those trips where shoppers opened emails and thus, were presumably aware of the relatively large rebate activated upon buying the rebate item (sometimes up to 50 percent of their total spending) they still chose *not* to buy that item.<sup>8</sup> The choice of whether to purchase the rebate item may provide information on the different types of customers buying on the site. Figure (6) shows the distribution of shoppers by their tendency to purchase the rebate item across shopping trips. Indeed, the majority of shoppers follow a certain "type" of purchasing behavior where they either always purchase the rebate item when opening their email (over 40 percent of shoppers), or never purchase the rebate item (roughly

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<sup>8</sup>Table (7) summarizes all shopping trips that took place during the experiment period. Thus, roughly 40 percent of 269 shopping trips conducted by shoppers who read the promotional email did not include the rebate item. When removing the 2 weeks where the rebate item was priced above the rebate benefit we are left with 245 shopping trips, where 38% of these trips did not include the rebate item.

27 percent of shoppers).

## 4.2 Limited attention, salience and shoppers' response to discounts

As explained in the previous section, most of the price cuts targeted items that had "obvious" substitutes: conventional vs. organic, two competing (non-generic) brands of the same yogurt type and flavor (with identical fat content), two competing brands of mineral water, two competing brands of milk with the same fat content, two competing brands of the same type of bread, etc. Assuming brand loyalty is less likely to hold for these types of items, we hypothesize that most shoppers will not purchase an item that is a close substitute to a target item whose price is lower. Furthermore, assuming shoppers perceive organic items as being higher quality than their conventional counterparts, fully attentive shoppers should never buy a conventional item whenever its organic version is weakly cheaper. Table (8) illustrates that these hypotheses are not supported by our data.

**Observation 2.** *More than 60% of 1,071 items purchased included an item not on sale that was a close substitute to a weakly cheaper on-sale target item (average difference of \$0.34, which constitutes an average mark-up of 14%). This includes conventional produce items and generic store brands that were as expensive as their organic and leading brand counterparts.*

Why did a significant proportion of shoppers choose apparently dominated alternatives on their shopping trips (more expensive and of lower quality)? One plausible explanation may be that shoppers were not fully attentive to all available discounts. This suggests that a consumer who considers a particular option is more likely to notice "neighboring" options - options that are right next to it - than options that require scrolling down. In light of this, we say that a target item and its substitute are "neighbors" if they appear on the same line on the website. Figure (7) illustrates this by displaying a screenshot from the website. The target item that is shown, organic bananas, was on sale for \$0.24 per unit (regular price \$0.49), while the two corresponding - and adjacent - substitutes are "banana ripe" and "banana mild

green” whose prices remained constant at \$0.39 per unit. Thus, we expect shoppers to be more likely (*not*) to purchase a discounted target item when its neighboring substitute is more expensive (*cheaper*).

Indeed, Table (8) shows that the impact of price changes (a decrease in price when the discount is in place followed by an increase when the discount expires) is greatest when these changes are more salient, i.e., when they affect neighboring items.

**Observation 3.** *There is a significant increase (11 percentage points) in the proportion of purchases of target items whenever they go on sale and a significant decrease (14 percentage points) whenever the sale expires. These changes are higher for items with substitutes that appear on the same line on the store’s website (a 15 percentage point rise and a 22 percentage point drop vs. a 10 percentage point rise and a 10 percentage point drop).*

Lines 2-3 in Table (8) clearly show that neighboring items were most impacted by sales. While prior to sale, 18% of items purchased were of the more expensive target item, this number almost doubles to 34% during the sale period, and drops by more than half to 11% when the sale ends. Target items that were not neighbors tended to be more popular than neighbors prior to sale, averaging 26% of items purchased. The demand for these items increased to 36% during the sale period and dropped to 26% post sale. Thus, purchases of the target item increased by 5 percentage points (s.e. 3.3) for neighbors versus non-neighbors during the sale period and decreased by 12 percentage points (s.e. 6.5) for neighbors versus non-neighbors after the sale terminated. These observations suggest that inattention played an important role leading some shoppers to choose dominated items.

With regards to the differential effect of discounts across product categories, shoppers were most likely to purchase a discounted target item when it was produce (a 15 percentage point increase in purchases). This behavior seems rational as the largest percent discounts on the site were always in the produce department. We observe the smallest effect (6.5 percentage point increase in the purchasing rate) for



items that required shoppers to compute a price per unit.<sup>9</sup> For example, the website regularly sold bags of four apples (target item) for \$5.39 which is more expensive than buying four single apples for \$1.25 each. This means that buying single apples dominated buying in bulk (it was cheaper and one could purchase any amount instead of in multiples of four). However, during the sale period, the bag of four apples was offered for \$4.49, which is 51 cents cheaper than buying 4 individual apples. Similarly, the price of half a gallon of milk (target item) was regularly \$2.99, while the price of a gallon was \$3.99 (while during its sale period the price of the half gallon was \$1.75, 49 cents cheaper than purchasing a gallon of milk). One explanation for the relatively small effect of these relatively large price changes during the sale period is that in order to benefit from the potential savings, a shopper needed to compute the price per unit for these alternatives. This may not have been apparent to many shoppers, or may have required extra effort which they chose to avoid.

It is interesting to note that while we do not find a statistically significant effect of a sale on products that require refrigeration, we do find a significant drop in purchases of the target item post sale (a 17 percentage point decrease).<sup>10</sup> This suggests that price increases may be more salient than price decreases for the following reason. Some treatment shoppers may have purchased organic (refrigeration) items prior to the discounts without paying much attention to their price relative to their conventional versions. During the period of the experiment, they took advantage of the discounts and at the same time, the email that alerted them to discounts drew their attention to the price of the conventional substitutes. When the discount expired, some shoppers who intended to continue their habit of purchasing the organic items may suddenly realize how high the price is compared to the conventional substitute and consequently abandon purchasing the organic items.

The summary statistics in the organic items section of Table (8) provide some support for this hypothesis. Shoppers with a history of buying organic items, increase their probability of purchase of the target organic item from 41 percent to 65 percent

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<sup>9</sup>This increase is not statistically significant from zero

<sup>10</sup>Refrigeration items include eggs, dairy, and milk. The data on items that require refrigeration is a much smaller sample of only 292 purchases.

during the sale period. However, once the sale ends their probability of purchase shrinks to 14 percent, almost a third of their original purchasing rate. This is a much harsher response than that found among general shoppers, who increase their purchase of organic items from 22 to 35 percent during the sale period, and revert back to 15 percent after the sale ends. This finding may be explained by the fact that the website forces consumers to create a new shopping cart each trip. Generally, price changes may be more salient when a customer does *not* have the option to select items from his previous cart.

Since we have detailed data on individual shoppers we can investigate whether some shopper types - across *both* the treatment *and* control groups - have a higher (lower) propensity to respond to sales. At the end of section 4.1, we discussed that one key property of shoppers is their frequency of purchasing the weekly rebate item, *conditional on opening the promotional email* (see Figure (6)). We say that a shopper is an “attentive type” (“inattentive type”) if he bought the rebate item in at least 70% (at most 30%) of those shopping trips that occurred during weeks in which he opened the promotional email.<sup>11</sup> The following observation follows from Table (9), which summarizes purchasing behavior for different items across shopping trips among shoppers who opened their email during the relevant sale period.

**Observation 4.** *Attentive shoppers are more likely to purchase an on-sale target item (8.8 percentage points (s.e. 4.7)) than inattentive shoppers. The difference between these shopper types is mainly driven by non-neighboring items, for which the attentive shoppers are 11.7 percentage points more likely to purchase the on-sale target item than the inattentive shoppers.*

This observation suggests that attentive shoppers may be more attuned to sales than inattentive shoppers since choosing the on-sale target item requires a higher degree of attention when the target and substitute items do not appear on the same

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<sup>11</sup>Our results are robust to refining the definition of attentive shoppers to those who purchase the rebate item more than 90 percent of the time as well as refining the definition of inattentive shoppers to those who purchase the rebate less than 10 percent of the time. The behavior of shoppers who purchase the rebate between 30 and 70 percent of the time falls somewhere between the inattentive and attentive shoppers.

line. We examine this issue further in subsection 4.4, where we compare between the treatment and control groups.

### 4.3 Nudges and framing

A central feature of the experiment was the (random) differential provision of information to shoppers. Recall that all shoppers received promotional emails but only the treatment group was notified of the discounts (and how to identify them on the website). The treatment group was also given a summary of the highest discounted categories (see Figures (1)-(4) for examples of the different emails sent out during the experiment period). We therefore hypothesize that shoppers in the treatment group should be more likely to purchase on-sale target items than shoppers in the control group.

The treatment design allows us to study both how the framing of information on price cuts and the efficacy of “nudges” impacted the propensity of shoppers to respond to changing prices. Recall that the treatment email listed the discounted categories in sequential order, which may give prominence to the top-listed category. In addition, starting from week six, there were several changes to the format and content of the treatment email. First, depending on their previous purchases, shoppers began to receive new personalized messages alerting them to the existence of on-sale alternatives to items they had previously bought (e.g., "Don't forget to consider some alternatives to your last purchase of \_\_\_ that we have on sale this month.").<sup>12</sup> These personalized messages appeared in a separate paragraph in bold-face characters, which added to their salience. We refer to such personalized messages as "nudges". In light of the behavioral literature on nudges, we hypothesized that these would influence the behavior of all shoppers in the treatment group who received these messages. Second, information on the weekly rebate item appeared in a separate paragraph and was italicized. Third, the sentence that introduced the list of four biggest discount categories ("Our biggest discounts are ...") appeared in normal

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<sup>12</sup>These personalized messages were sent only to treatment shoppers who bought items whose price changed.

font whereas previously it appeared in bold. This might have made the personalized message (the "nudge") more salient than the list of biggest discounts.

Focusing on consumer behavior over different shopping trips, our findings indicate the following.

**Observation 5.** (i) *Conditional on buying an item in the top listed category, the likelihood of buying an on-sale target item was higher (though not statistically significant from zero) in the treatment group (44% vs. 34% with  $N=73$ ), and there is almost no difference when considering target items not in the top category (35% vs. 34% with  $N=447$ ).*

(ii) *The personalized nudges did not have an aggregate effect on shoppers in the treatment group.*

Part (i) of Observation 5 suggests that shoppers were more likely to pay attention to information on discounts that had more prominence. Note that the top listed category (or item) did not always display the highest discount (in percentages or in monetary value). In the first three weeks the categories were listed in *descending* order of discounts but in later weeks they were presented in *ascending* order. Thus, allocating most attention to the top category/item was not always the optimal thing to do. Unfortunately, there are not enough data points to allow us to check whether this difference in ordering had an effect on purchasing behavior.

Part (ii) of Observation 5 follows from Table (10) that compares the shopping behavior of the control and treatment groups between the second stage of the experiment that included nudges and the first stage that did not. Surprisingly, this table suggests that when nudges did have an effect it seemed to have been negative. In particular, the likelihood of purchasing a rebate item decreased for the treatment group but rose for the control group. Assuming the change in purchasing trends of the control group is due to learning that occurs over time (as the content of the email they received did not change between periods), differencing out this effect implies that if anything, receiving individualized information decreased the probability of purchase of the target item in a specific shopping trip by 11 (s.e. 9.8) percentage points for individuals in the treatment group compared to the control group (see

column DID).

One possible explanation for the apparent ineffectiveness of nudges is that the focus of treatment shoppers had shifted away from the list of biggest discounts (which was previously in bold) to the personalized message (which was the only sentence in bold) that highlighted only one particular category. This may have caused shoppers to invest more time in figuring out what item they should switch to, which may have led them to ignore the weekly rebate item and the list of biggest discounts. However, the aggregate effect of nudges may be somewhat misleading in that it hides a differential effect on distinct types of shoppers, whereby some shopper types benefitted while other did not. We explore this possibility in the next subsection, where we introduce a classification of shoppers and of shopping trips.

#### 4.4 The treatment effect of providing summary information

Subsection 4.2 reported the *aggregate* response of shoppers to price changes. In this subsection we compare between the response of treatment shoppers to that of the control group in order to better understand the effect of providing shoppers with summary information on price changes. Using the typology of attentive and inattentive shoppers introduced in Subsection 4.2 (see Observation 4), we compare the behavior of these two shopper types between the treatment and control groups. (see Table 11).

**Observation 6.** *Both attentive and inattentive shopper types increased their purchase rate of target items during the sale period. Among attentive shoppers, the largest increase was exhibited by individuals in the treatment group (an increase of almost 100 percent versus only 50 percent in the control group), while among inattentive shoppers, the largest increase was exhibited by individuals in the control group (an increase of over 200 percent versus only 60 percent in the treatment group).*

Table (11) compares the behavior of shoppers in both the treatment and control groups. before and after sales across various dimensions. Part A focuses on attentive shoppers while part B focuses on inattentive shoppers. As evident from the table, attentive shoppers in the treatment group increase their purchase rate of target

items during the sale period by 23.4 percentage points (s.e. 6.4) and shoppers in the control group increase their purchase rate by 15 percentage points (s.e. 4.9). This difference is driven by target items whose substitute appeared on a different line: the purchase rate of the target item increased by 28.6 percentage points for treatment shoppers (s.e. 7.4) and only by 17.3 percentage points for control shoppers (s.e. 5.8). This highlights the fact that the extra information provided to treatment shoppers was particularly helpful in identifying sales that were not salient. Part B of Table (11) makes the same comparisons but for inattentive shoppers. Here we observe the opposite pattern: control shoppers reacted more strongly to sales than treatment shoppers. These findings suggest that the provision of information may have impacted attentive shoppers differently than inattentive shopper types.

A natural question that arises is whether a shopper’s attention remains constant across shopping trips, or alternatively, is something that varies across time due perhaps to external distractions? In other words, should we allow for the fact that shoppers may exhibit different levels of alertness during different shopping trips? While previously we defined attentiveness at the shopper level based on the fraction of shopping trips in which they made the "attentive" decision to purchase the rebate item, we now consider attentiveness at the shopping trip level.

In all weeks where the cost of the rebate item was lower than the rebate, we define a shopping trip as “attentive” (“inattentive”) if the shopper opened the promotional email and purchased (did not purchase) the weekly rebate item.<sup>13</sup> Note that the label “attentive/inattentive” refers to the behavior of a shopper on an individual shopping *trip*. The same individual could be attentive on one trip and inattentive on another. Using this classification of shoppers we are able to refine the results presented in Table (11).

**Observation 7.** *Attentive shopping trips conducted by individuals in the treatment group were significantly **more likely** to include a discounted target item than*

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<sup>13</sup>Out of 13 experiment weeks there were only 2 weeks where the rebate item was priced higher than the rebate. In week 2, the rebate item was blueberries that were priced at \$4.49 (regular price \$5.49) with a rebate of \$2.99. In week 4, the rebate item was broccoli that was priced at \$3.25 (regular price \$4.49) with a rebate of \$2.99 for Control group and \$10.00 for treatment group.

the corresponding trips in the control group. In contrast, *inattentive* shopping trips conducted by individuals in the treatment group were **less likely** to include a discounted target item than the corresponding shoppers in the control group.

Table (12) summarizes our findings for the two types of shopping trips. Similar to Table (11), we find that treatment shoppers on attentive shopping trips (see top panel) *more than tripled* the likelihood of purchasing a target item during the sale period (a shift from 12% to 43%), while individuals conducting shopping trips of this type in the control group exhibited a *much smaller* increase (from 26% to 41%). In addition, treatment shoppers on attentive trips with a history of purchasing the substitute item prior to the experiment, increased their probability of purchasing the target item from 13% to 48% during the sale period, while control shoppers on attentive shopping trips exhibited a smaller change in behavior (14% to 35%) which is not statistically significant at the 5% level.

The bottom panel of Table (12) summarizes behavior on inattentive shopping trips. Interestingly, the likelihood that these trips include a discounted target item during the sale period was *lower* in the treatment group even though this group received more information than the control group. Specifically, the likelihood of a target item being included in the basket during the sale period increased from 20% to 34% for the control group (and this difference is statistically significant at the 1% level), while for the treatment group it increased from 20% to only 24%, an increase which is not statistically significant from zero. While the control group more than doubled the probability of purchasing the target item during the sale period on inattentive shopping trips when the substitute appeared on the same line (from 17% to 41%) , treatment shoppers do not seem to show any response to the sale.

Information overload may be one potential reason for why the response to price cuts is stronger for inattentive shoppers (shopping trips) in the control group. Shoppers (shopping trips) that we label as inattentive may exhibit a lower threshold for the amount of information that can be processed (rebate item, rebate amount, personalized sale recommendation, general sale categories). Hence, these shoppers in the treatment group may have been overwhelmed by the information that was provided and consequently, may have spent more time trying to process it (e.g., trying

to decide which category to inspect). It might have been easier for these shoppers to simply browse items and pick their preferred option in each line (instead of searching for the highest discounted category according to the instructions in the email). Thus, the combination of not processing the additional information, and having less time to spend browsing items, may have led the inattentive shoppers in the treatment group to be less responsive to the discounts.

## 4.5 Controlling for shopper fixed effects

The panel feature of our dataset enables us to track the shopping behavior of individuals over time (before, during and after the sale). We can therefore control for unobserved characteristics of shoppers and examine how price changes impacted their purchasing behavior. Equation (1) models individual  $i$ 's choice to purchase a target product  $k$ ,

$$P_{ik} = \beta_0 + \beta_1 Sale_k + \beta_2 A_i + \beta_3 A_i \times Treat_i + \beta_4 A_i \times Treat_i \times Sale_k + \beta_5 A_i \times Sale_k + X_i \alpha + \gamma_k + \eta_i + \varepsilon_{ik} \quad (1)$$

We expect a higher likelihood of buying an item when it is on sale, and hence expect  $\widehat{\beta}_1 > 0$ .

$A_i$  refers to the attentiveness of the shopper. As discussed previously, this can be defined at the individual level (attentive shoppers) or at the trip level (attentive shopping trips). We therefore run our analysis using both definitions and find the results to be similar. Generally, it seems that defining attentiveness at the individual level introduces more noise to the analysis than focusing on attentiveness at the shopping trip level.

The coefficient  $\beta_2$  measures the impact of attentiveness on the probability of purchasing the target item regardless of whether or not it is on sale, while  $\beta_3$  picks up the added propensity to buy the target item for attentive shoppers that are in the treatment group. A priori, the expected sign of  $\widehat{\beta}_2$  is unclear since many of the target items are usually perceived to be of higher quality (i.e., organic or a leading



brand) and are generally more expensive than their (conventional or a generic store brand) substitutes. Since the treatment and control group were randomly allocated it seems reasonable to assume that their preferences for the target item should be similar. However it may be that once treatment shoppers become aware of target items they continue to buy them even when they are not on sale (implying  $\hat{\beta}_3 > 0$ ), or alternatively, that increased awareness of sale prices may decrease their probability of buying that same item when it is not on sale (implying  $\hat{\beta}_3 < 0$ ).

We expect that providing attentive shoppers with additional product information should increase the probability that they will purchase a target item when it is on sale. Therefore, we expect a positive coefficient on  $A\_Treat_i \times Sale_k$  ( $\hat{\beta}_4 > 0$ ). It is important to measure this effect separate from an attentiveness effect, where more attentive shoppers will be more attuned to sales regardless of whether or not they are in the treatment group ( $\hat{\beta}_5 > 0$ ).  $X_i$  is a vector of observed characteristics related to whether or not the shopper opened the promotional email that week, whether or not the email was personalized, and the differential effect on the treatment group. The item fixed effects  $\gamma_k$  account for the different underlying probabilities of purchasing each target item. Individual fixed effects  $\eta_i$  account for unobserved differences in preferences across individuals.<sup>14</sup>  $\varepsilon_{ik}$  represents other characteristics that impact shopping decisions but remain unobserved (e.g. travel, health, etc.).

**Observation 8. The Treatment Sale Effect:** *Attentive shoppers in the treatment group are significantly more likely to purchase a target item during the sale period. This finding is robust to controlling for the separate effect of attentive shoppers, the impacts of different promotional emails in different weeks, as well as item categories (e.g. apples, milk, eggs, etc.). Controlling for individual shopper fixed effects, shrinks the measured effect from 15 percentage points (s.e. 6.4) to 10 percentage points (s.e. 6). We estimate a very similar effect when focusing on attentive shopping trips, a sale effect of 13.4 percentage points (s.e. 5.9) on the treatment group which remains*

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<sup>14</sup>It is important to note that while each individual is defined as either treatment or control and assigned to either attentive shopper or inattentive shopper, we will also discuss our results when focusing on attentive shopping trips where we allow the same shopper to hold different levels of attentiveness.

*consistent across all specifications.*

Table (13) estimates equation (1) for a range of specifications. Part A defines attentiveness at the shopper level, while Part B allows shoppers to change their level of attentiveness across different trips. Overall, our estimate of  $\hat{\beta}_1$  (see equation (1)) implies that individuals are roughly 10 to 15 percentage points more likely to buy a target item when it is on sale (on average, the purchase rate of target items prior to the experiment was 25%). If anything, attentive shoppers are generally less likely to purchase target items (which are more expensive outside the promotional period) suggesting that these individuals may be more price sensitive than other shoppers ( $\hat{\beta}_2 < 0$ ). When focusing on attentive shoppers in Part A, we find that attentive shopper types in the treatment group are generally more likely to purchase the target item even when it is not on-sale ( $\hat{\beta}_3 > 0$ ).

The main coefficient of interest is  $\beta_4$ , which measures the impact of providing summarized information to attentive shoppers or shoppers on attentive shopping trips. In Part B, we find that individuals in the treatment group on attentive shopping trips are 13.4 percentage points (s.e. 5.9) more likely to purchase the on-sale target item. This effect is separate, from the 5-10 percentage point increase in the probability of purchasing the on-sale target item across all attentive shoppers ( $\hat{\beta}_5$ ). Our results in Part A are of similar signs and magnitudes despite losing roughly half of the sample of shoppers who fall between the definition of attentive and inattentive shoppers. Thus, our estimate of  $\beta_4$  in part A implies a 10.3 percentage point change for attentive shoppers (s.e. 6).<sup>15</sup> Since the average purchase rate of the target items was 25 percent prior to experiment, this implies that supplying summarized information increased the purchasing probability of an on-sale target item by 41 to 54 percent. This result is robust to controlling for whether individuals opened the promotional email. It is also robust to controlling for weeks in which the treatment group also received personalized nudges. In summary, shoppers in the treatment group (who by definition received additional information) and were conducting attentive shopping

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<sup>15</sup>The significant impact of including fixed effects in the analysis by shopper type suggests that there are considerable unobserved differences in purchasing preferences between individuals who are being defined as attentive or inattentive for all shopping trips.

trips were *more likely* to buy on-sale target items.

**Observation 9.** *The Treatment Sale Effect (Observation 8) measures the effect of a sale on an attentive shopper or on an attentive shopping trip. This effect is larger:*

- (i) on trips that occurred during the high discount period,*
- (ii) on trips that occurred during weeks with personalized nudges,*
- (iii) on trips that occurred during weeks where the four highest discounts were listed for specific items (as opposed to categories),*
- (iv) when purchasing items with non-neighboring substitutes, and*
- (v) when spending at most \$60 on trip.*

The results discussed thus far suggest that increased information results in better financial choices (e.g. buying the on-sale target item). Intuitively, information on bigger sales (part (i) of Observation 9), or more relevant information (parts (ii) and (iii)), or information that is more difficult to attain (part (iv)) should have a larger impact, and indeed, that's exactly what we find. We also find that the cheaper shopping trips, totalling below \$60, are where the treatment shoppers seem to be most affected by the additional information provided to them. This effect could seem surprising as those that are making more expensive trips, may have more to gain by purchasing more sale items. A possible explanation for this finding is that shoppers are more price sensitive as they are constraining themselves to cheaper trips.

Part (i) of Observation 9 relates to the fact that in weeks 6-10 the listed discounts were significantly *lower* than in all other weeks, while in the last three weeks the discounts were significantly *higher* than in all other weeks. During periods of high discounts, attentive shoppers (shopping trips) in the treatment group exhibited an increase of 28.7 (20.8) percentage points (s.e. 6 (7.1)) in purchasing discounted target items relative to all other shoppers, at a base purchase rate of 26.2 (s.d. 45). The effect was substantially smaller and not statistically significant from zero at the 10 percent level when examining the impact during the low discount period (see columns (1) and (2) of Table (14)).

Part (ii) of Observation 9 is shown in specifications (3) and (4), which estimate that attentive shoppers from the treatment group increased their probability of pur-

chasing on-sale target items by 15 percentage points (s.e. 7.9) during the period in which they received personalized nudges. The effect is much smaller (1.6 percentage points, s.e. 8.8) during the basic email weeks. Interestingly, when focusing on attentiveness at the shopping trip level, there is only an 8 percentage point difference in behavior of treatment versus control during the basic and detailed email weeks. One explanation for the disparity could be that the ability to process the information supplied in the email is fixed across shoppers (i.e. does not change across trips), while the amount of attention used to select items within a shopping trip can change across trips (e.g. neighboring/non-neighboring items, low and high discount periods).

Part (iii) of Observation 9 follows from observing that attentive shoppers in the treatment group increased their purchasing rate of on-sale target items by 0.412 (s.e. 0.138) during the specific item period relative to other shoppers, and by 0.022 (s.e. 0.067) during the broad category period (see columns (5) and (6) of Table (14)). We find a similar trend when focusing on attentive shopping trips.

Columns (7) and (8) of Table (14) illustrate Observation 9(iv). This result implies that it may be more costly for shoppers to compare items that are not located right next to each other and therefore information on non-neighbors is more helpful. Observation (v) is illustrated in columns (9) and (10), where individuals in the treatment group who are attentive (on attentive shopping trips) are more likely to include an on-sale target item specifically in lower cost trips (below \$60).

## 5 Concluding remarks

Comparing prices across a large variety of products is a non-trivial task, especially when prices are constantly changing. Much of the economic analysis is based on the premise that individuals are attuned to all the price fluctuations and perfectly process signals about these price changes. In contrast, the results of our field experiment show that individuals can miss opportunities to save and tend to focus on price comparisons that are more salient. Moreover, a significant proportion of individuals forego opportunities to save that are brought to their attention. Indeed, a surprising conclusion that arises from our findings is that it is not straightforward

to draw individuals' attention to price changes that can help them save, even when they are provided with personalized messages. Our data hints at the existence of a typology of shoppers where one type is better at processing information on savings opportunities. We find that while summarizing information is useful for that group of attentive shoppers, it seems to result in worse decision making for the "less attentive" group of shoppers. This suggests a promising direction for future research aimed not only at better understanding the characteristics of shoppers who are more and less "attentive", but also in identifying strategies that can improve information processing across all consumers.

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Table 1: Experimental Design

<b>Trial</b>	<b>Control</b>	<b>Treatment</b>
1 <sup>st</sup> – <i>weeks</i> 1-3	Free shipping when buying rebate item and total purchase exceeds \$20	Free shipping when buying rebate item and total purchase exceeds \$20; General notification on discounted types of items, and that they are marked with **; Information on specific <u>categories</u> with biggest discounts appears in <b>bold</b> (discount in percentages) – largest discount appears first.
2 <sup>nd</sup> – <i>weeks</i> 4-5, 7	Free shipping when buying rebate item and total purchase exceeds \$20	General notification on discounted types of items, and that they are marked with **; \$10 off purchase when buying rebate item and total purchase exceeds \$20 appears as part of paragraph that highlights rebate item; Information on specific <u>categories</u> with biggest discounts appears in <b>bold</b> (discount in percentages), categories appear in opposite order relatively to the first trial – largest discount appears last.
3 <sup>rd</sup> – <i>weeks</i> 6, 8-10	Free shipping when buying rebate item and total purchase exceeds \$20	General notification on discounted types of items, and that they are marked with **; Received personalized information pointing them to consider alternatives to items they previously purchased in certain categories (appeared in <b>bold</b> ). \$10 off purchase when buying rebate item and total purchase exceeds \$20 appears in separate paragraph in <i>italics</i> after personalized information. Information on specific <u>categories</u> with biggest discounts <b>no longer appears in bold</b> (discount in percentages) – largest discount appears last.
4 <sup>th</sup> – <i>weeks</i> 11-13	\$10 off purchase when buying rebate item and total purchase exceeds \$20	General notification on discounted types of items, especially organic sale items that are cheaper than the non-organic alternative, and that they are marked with **; Received personalized information pointing them to consider alternatives to items they previously purchased in certain categories (appeared in <b>bold</b> ). \$10 off purchase when buying rebate item and total purchase exceeds \$20 appears in separate paragraph in <i>italics</i> after personalized information. Information on specific <u>items</u> with biggest discounts <b>no longer appears in bold</b> (discount in percentages) – largest discount appears last.

Table 2: Purchasing Frequency of Target and Substitute Items Prior to Experiment

Product Name	Quantity Purchased
<b>Bananas</b>	<b>357</b>
Bananas (Organic)	72
<b>Onions</b>	<b>191</b>
Onions (Organic)	42
<b>Kroger: Bread</b>	<b>139</b>
Aunt Millie's Bread	56
<b>Kroger: Eggs - 12ct</b>	<b>134</b>
Egg-Lands Best: Cage Free Large Brown Eggs - 12ct	14
Kroger: Grade A Large Brown Eggs - 12ct	19
Simple Truth: Natural Cage Free Large Brown Eggs - 12ct	78
<b>Kroger: Milk (1gal)</b>	<b>114</b>
Kroger: Milk (0.5gal)	96
Horizon: Organic Milk (0.5gal)	22
Simple Truth Organic: Milk (0.5gal)	43
<b>Apple (Lg)</b>	<b>103</b>
Apple (Organic)	69
Apple Bag - 3 lb bag	65
<b>Bell Pepper</b>	<b>99</b>
Bell Pepper (Organic)	15
<b>Blueberries</b>	<b>94</b>
Blueberry (Organic)	11
<b>Avocado</b>	<b>76</b>
Jumbo Avocado	28
<b>Cucumber</b>	<b>75</b>
Cucumber (Organic)	15
<b>Ice Mountain: Water - 24pk</b>	<b>74</b>
Kroger: Purified Drinking Water - 24pk	11
Dasani: Water - 24pk	20
Aquafina - 24pk	11
<b>Chobani: Greek Yogurt</b>	<b>71</b>
Fage: Greek Yogurt	55
<b>Raspberries</b>	<b>62</b>
Raspberries (Organic)	10
<b>Roma Tomato</b>	<b>41</b>
Roma Tomato (Organic)	4
<b>Romaine Lettuce</b>	<b>33</b>
Romaine Lettuce (Organic)	3

Broccoli, Kiwi, Lime, Kale, Pineapple, and Lemon were excluded from this table for lack of space.

Table 3: Target and Substitute Produce Items

Weeks	Target Item	Price	Sale Price	Substitute Item	Price
1-5	Organic Banana	0.49	0.39	Conventional Banana	0.39
1-5	Organic Blueberries	5.49	4.99	Conventional Blueberries	4.99
1-5	Organic Kiwi	0.99	0.79	Conventional Kiwi	0.79
1-5	Organic Apple (Fuji)	1.49	1.25	Conventional Apple (Fuji)	1.25
1-5	Organic Apple (Gala)	1.49	1.25	Conventional Apple (Gala)	1.25
1-5	Organic Apple (Granny Smith)	1.49	1.25	Conventional Apple (Granny Smith)	1.25
1-5	Organic Lime	1.29	0.89	Conventional Lime	0.89
1-5	Organic Broccoli	3.49	3.25	Conventional Broccoli	3.25
1-5	Organic Romaine Lettuce	3.29	2.59	Conventional Romaine lettuce	2.59
1-5	Organic Cucumber	1.89	0.99	Conventional Cucumber	0.99
1-5	Jumbo Ripe Avocado	2.25	1.49	Jumbo Unripe Avocado	2.25
6-9	Organic Tomato	0.79	0.59	Conventional Tomato	0.59
6-9	Organic Red Bell Pepper	2.79	2.59	Conventional Red Bell Pepper	2.59
6-9	Organic Onion	2.59	1.99	Conventional Sweet Onion	1.99
6-9	Organic Kale	2.19	1.99	Conventional Kale	1.99
6-9	Organic Green Onion	0.99	0.95	Conventional Green Onion	0.95
6-9	Apples 3 lb bag (~4 ct.)	5.39	4.49	Conventional Apple	1.25
6-9	Organic Lemon	1.49	1.29	Conventional Lemon	1.29
6-9	Organic Pineapple	6.49	5.49	Conventional Pineapple	5.49
10-13	Organic Banana	0.49	0.24	Conventional Banana	0.39
10-13	Organic Blueberries	5.49	4.00	Conventional Blueberries	4.99
10-13	Organic Apple	1.49	1.00	Conventional Apple	1.25
10-13	Organic Apple (Fuji)	1.49	1.00	Conventional Apple	1.25
10-13	Organic Raspberries	5.49	3.89	Conventional Raspberries	3.99
10-13	Organic lemon	1.49	0.99	Conventional Lemon	1.29
10-13	Organic Broccoli	3.49	2.00	Conventional Broccoli	3.25
10-13	Organic Cucumber	1.89	0.75	Conventional Cucumber	0.99
10-13	Roma Tomato Organic	0.79	0.20	Conventional Tomato	0.59
10-13	Red Bell Pepper Organic	2.79	1.99	Conventional Red Bell Pepper	2.59
10-13	Sweet Onion Organic	2.59	1.00	Conventional Sweet Onion	1.99
10-13	Organic Green Onion	0.99	0.50	Conventional Green Onion	0.95

Table 4: Target and Substitute Dairy, Egg, and Durable Items

*Dairy*

Weeks	Target Item	Price	Sale Price	Substitute Item	Price
1-5	Kroger: Milk (0.5gal)	2.99	1.75	Kroger: Milk (1gal)	3.99
1-5	Horizon Organic: 0% fat free Milk (0.5gal)	5.45	4.49	Simple Truth Organic: Fat Free Milk	4.49
1-5	Fage: 0% and 2% fat Yogurt (plain and cherry)	1.89	1.50	Chobani: Yogurt, Fage: Yogurt (Other)	1.89
6-9	Fage: 0% and 2% fat Yogurt (plain and cherry)	1.89	1.50	Chobani: Yogurt, Fage: Yogurt (Other)	1.89
10-13	Simple Truth Organic: Milk (0.5gal)	4.49	2.99	Horizon Organic: Milk	5.45

*Eggs*

Weeks	Target Item	Price	Sale Price	Substitute Item	Price
1-5	Kroger: Grade A large Brown Eggs-12ct	3.69	2.89	Kroger Grade A Large Eggs-12ct	2.99
1-5	Egg-Land's Best: Cage Free Large Brown Eggs-12ct	5.49	4.35	Simple Truth: Natural Cage Free Grain Fed Large Brown Eggs-12ct	4.45
10-13	Kroger: Grade A Large Brown Eggs-12ct	3.69	1.89	Kroger Grade A Large Eggs-12ct	2.99
10-13	Simple Truth: Natural Cage Free Grain Fed Large Brown Eggs-12ct	4.45	2.50	Kroger Grade A Large Eggs-12ct	2.99

*Durables*

Weeks	Target Item	Price	Sale Price	Substitute Item	Price
6-9	Kroger: Multigrain Bread	2.59	1.99	Kroger: 100% Whole Wheat Bread	2.59
6-9	Kroger: Wheat Bread	2.45	1.99	Kroger: Buttermilk Bread	2.19
6-9	Dasani: Water	6.99	5.49	Ice mountain: Water	5.99
				Aquafina: Water	6.99
				Kroger: Water	5.49
				Niagara: Water	5.99
12-13	Aunt Millie's Bread: 100% Whole Wheat	3.65	2.19	Aunt Millies: 12 Whole Grain, Honey & Crunch Oat, Honey Wheat, Multi Grain	3.65
			35	Kroger 100% Whole Wheat	2.59
12-13	Aunt Millie's Bread: Butter Top White	3.65	2.19	Kroger: Buttermilk Bread, Wheat Bread	2.45
12-13	Aunt Millie's Bread: Whole Grain White	3.65	2.19	Aunt Millies: Italian	3.65
				Kroger: White, Italian	2.19

Table 5: Offered Rebate Items By Week

Week	Rebate Item	Rebate Item Price (in \$'s)	Rebate Item Refund Control Group	Rebate Item Refund Treat Group
1	Bananas	0.39	2.99	2.99
2	Blueberries	4.49	2.99	2.99
3	Apples	1.25	2.99	2.99
4	Broccoli	3.25	2.99	10
5	Bananas, Blueberries, Apples, or Broccoli	See Prices Above	2.99	10
6	Tomatoes	0.59	2.99	10
7	Red bell pepers	2.59	2.99	10
8	Bread	1.99	2.99	10
9	Yogurt	1.5	2.99	10
10	Bananas	0.24	2.99	10
11	Apples	1	10	10
12	Bread	2.19	10	10
13	Eggs	2.49	10	10

Table 6: Sample Characteristics in Pre Experiment Period

	Original Full Sample			Relevant Base Sample		
	Control <sup>a</sup>	Treat <sup>a</sup>	Diff <sup>b</sup>	Control <sup>a</sup>	Treat <sup>a</sup>	Diff <sup>b</sup>
Number of Shopping Trips	4.373 (5.814)	4.264 (5.678)	-0.109 (0.610)	7.188 (7.824)	6.800 (6.965)	-0.388 (1.283)
Number of Items Purchased	12.566 (7.157)	13.056 (8.537)	0.491 (0.836)	13.041 (6.196)	13.382 (6.411)	0.341 (1.089)
Number of Target Items Purchased	2.545 (2.039)	2.702 (2.224)	0.157 (0.226)	2.482 (1.543)	2.923 (1.755)	0.441 (0.285)
Number of Substitute Items Purchased	2.031 (1.795)	2.132 (2.074)	0.101 (0.206)	1.809 (1.408)	2.236 (1.698)	0.427 (0.269)
Total \$ Amount Spent on Purchase	66.153 (38.566)	65.267 (40.101)	-0.886 (4.176)	67.884 (33.647)	66.780 (31.818)	-1.104 (5.665)
Number of Shoppers	177	178		69	65	

<sup>a</sup>Standard deviations are presented in parenthesis

<sup>b</sup>Standard errors are presented in parenthesis

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

Table 7: Shopping Behavior During Experiment Period

	Open email = 0 <sup>a</sup>	Open email=1 <sup>a</sup>	Difference <sup>b</sup>
Number of Items Purchased	7.532 (7.224)	11.301 (8.965)	3.769*** (0.707)
Total Purchase (\$'s)	74.032 (40.266)	65.829 (40.972)	-8.203** (3.523)
Did Buy Rebate Item	0.312 (0.464)	0.595 (0.492)	0.283*** (0.041)
Number of Target Items Purchased on Sale	0.529 (0.828)	0.885 (1.145)	0.356*** (0.087)
Number of Substitute Items Purchased	2.779 (2.118)	2.933 (2.070)	0.154 (0.182)
Number of Target Items Purchased when not on Sale	0.422 (0.694)	0.394 (0.734)	-0.028 (0.062)
Number of Shopping Trips	263	269	

<sup>a</sup>Standard deviations are presented in parenthesis

<sup>b</sup>Standard errors are presented in parenthesis

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

Table 8: Purchasing Trends for On-Sale Items

	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Post Sale <sup>a</sup>	Difference <sup>b</sup> Pre-Sale	Difference <sup>b</sup> Post-Sale
Buy Target Item	0.238 (0.426)	0.352 (0.478)	0.210 (0.408)	0.114*** (0.015)	-0.142*** (0.031)
Buy Target Item Neighbors	0.185 (0.389)	0.337 (0.473)	0.115 (0.320)	0.152*** (0.026)	-0.223*** (0.051)
Buy Target Item Different Lines	0.258 (0.438)	0.359 (0.480)	0.256 (0.438)	0.101*** (0.019)	-0.103*** (0.038)
Buy Target Item Produce	0.199 (0.400)	0.350 (0.477)	0.152 (0.360)	0.151*** (0.019)	-0.199*** (0.042)
Buy Target Item Refrigerate <sup>c</sup>	0.317 (0.466)	0.341 (0.476)	0.170 (0.379)	0.024 (0.040)	-0.171** (0.072)
Buy Target Item Durable <sup>d</sup>	0.145 (0.352)	0.257 (0.440)	0.182 (0.395)	0.113** (0.046)	-0.075 (0.105)
Buy Target Item Bulk Comparison <sup>e</sup>	0.382 (0.486)	0.447 (0.500)	0.366 (0.485)	0.065 (0.053)	-0.080 (0.076)
Buy Target Item (Target History)	0.466 (0.500)	0.623 (0.487)	0.250 (0.438)	0.156*** (0.054)	-0.373*** (0.084)
Buy Target Item (Substitute History)	0.174 (0.379)	0.306 (0.462)	0.121 (0.329)	0.132*** (0.034)	-0.186*** (0.065)
<b><u>Organic Items:<sup>f</sup></u></b>					
Buy Target Item Organic	0.224 (0.417)	0.353 (0.478)	0.148 (0.356)	0.129*** (0.018)	-0.206*** (0.041)
Buy Target Item (Target History)	0.409 (0.493)	0.646 (0.481)	0.136 (0.351)	0.237*** (0.063)	-0.510*** (0.110)
Buy Target Item (Substitute History)	0.143 (0.351)	0.313 (0.466)	0.077 (0.272)	0.170*** (0.039)	-0.237** (0.094)
Number of Items	3,477	1,071	291		

<sup>a</sup>Standard deviations are presented in parenthesis

<sup>b</sup>Standard errors are presented in parenthesis

<sup>c</sup>Refrigerate Items include eggs, milk, and yogurt.

<sup>d</sup>Durable Items include bread and water.

<sup>e</sup>Bulk Comparison Items include bags of apples and different sizes of milk.

<sup>f</sup>Organic items include produce, milk, and eggs.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%



Table 9: The Probability of Purchasing an On-Sale Target Item By Shopper Types

	Buy Rebate Item Type=0 <sup>a</sup>	Buy Rebate Item Type=1 <sup>a</sup>	Difference <sup>b</sup>
Buy Target Item	0.367 (0.484)	0.455 (0.498)	0.088* (0.047)
Buy Target Item Neighbors	0.354 (0.483)	0.391 (0.490)	0.037 (0.081)
Buy Target Item Different Lines	0.373 (0.486)	0.489 (0.501)	0.117** (0.057)
Buy Target Item Produce	0.385 (0.489)	0.441 (0.497)	0.057 (0.059)
Buy Target Item Refrigerate <sup>c</sup>	0.450 (0.510)	0.441 (0.500)	-0.009 (0.128)
Buy Target Item Durable <sup>d</sup>	0.154 (0.376)	0.526 (0.513)	0.372** (0.167)
Buy Target Item Bulk Comparison <sup>e</sup>	0.346 (0.485)	0.586 (0.501)	0.240* (0.133)
Buy Target Item (Target History)	0.389 (0.494)	0.911 (0.288)	0.522*** (0.088)
Buy Target Item (Substitute History)	0.400 (0.498)	0.349 (0.480)	0.051 (0.103)
<b>Organic Items:<sup>f</sup></b>			
Buy Target Item Organic	0.396 (0.492)	0.452 (0.498)	0.056 (0.057)
Buy Target Item (Target History)	0.478 (0.511)	0.914 (0.284)	0.436*** (0.104)
Buy Target Item (Substitute History)	0.524 (0.512)	0.317 (0.469)	-0.206* (0.121)
Number of Items	150	440	

Rebate Item Type=1 when shopper purchased rebate item in at least 70% of shopping trips, Type=0 when shopper purchased rebate item in no more than 30% of shopping trips. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

<sup>a</sup>Standard deviations are presented in parenthesis

<sup>b</sup>Standard errors are presented in parenthesis<sup>10</sup>

<sup>c</sup>Refrigerate Items include eggs, milk, and yogurt.

<sup>d</sup>Durable Items include bread and water.

<sup>e</sup>Bulk Comparison Items include bags of apples and different sizes of milk.

<sup>f</sup>Organic items include produce, milk, and eggs.

Table 10: Purchasing Trends - By e-mail Detail

	Early Weeks (1-5)			Later Weeks (6-13) Individualized Info for Treatment			DID <sup>b</sup>
	Control <sup>a</sup>	Treat <sup>a</sup>	Diff <sup>b</sup>	Control <sup>a</sup>	Treat <sup>a</sup>	Diff <sup>b</sup>	
Number of Items Purchased	11.024 (8.412)	12.367 (9.067)	1.343 (1.251)	8.789 (7.300)	12.131 (8.522)	3.342*** (1.051)	2.000 (1.623)
Total Purchase (\$'s)	73.729 (40.248)	71.974 (47.609)	-1.754 (6.238)	66.201 (42.035)	64.677 (32.058)	-1.524 (5.088)	0.230 (7.981)
Did Buy Rebate Item	0.439 (0.498)	0.557 (0.500)	0.118 (0.072)	0.477 (0.501)	0.485 (0.502)	0.008 (0.067)	-0.110 (0.098)
Target Items Purchased (Sale)	0.537 (0.803)	0.658 (0.830)	0.122 (0.117)	0.953 (1.273)	0.838 (1.131)	-0.115 (0.162)	-0.236 (0.205)
Substitute Items Purchased	2.675 (2.074)	2.937 (2.451)	0.262 (0.321)	2.625 (1.960)	2.970 (1.832)	0.345 (0.255)	0.083 (0.406)
Opened E-mail	0.650 (0.479)	0.646 (0.481)	-0.005 (0.069)	0.555 (0.499)	0.677 (0.470)	0.122* (0.065)	0.127 (0.095)
N Shopping Trips	123	79		128	99		

<sup>a</sup>Standard deviations are presented in parenthesis

<sup>b</sup>Standard errors are presented in parenthesis

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

Table 11: Purchasing Trends for Attentive Shoppers

<b>Part A: Attentive Shoppers</b>						
	<b>TREATMENT</b>			<b>Control</b>		
	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>
Buy Target Item	0.250 (0.435)	0.484 (0.501)	0.234*** (0.064)	0.288 (0.454)	0.438 (0.497)	0.150*** (0.049)
Buy Target Item Neighbors	0.333 (0.483)	0.434 (0.500)	0.101 (0.128)	0.200 (0.407)	0.357 (0.482)	0.157 (0.097)
Buy Target Item Different Lines	0.224 (0.420)	0.509 (0.502)	0.286*** (0.074)	0.310 (0.465)	0.483 (0.501)	0.173*** (0.058)
Buy Target Item Target History	0.625 (0.518)	0.833 (0.389)	0.208 (0.202)	0.600 (0.500)	0.938 (0.246)	0.338*** (0.101)
Buy Target Item Substitute History	0.125 (0.338)	0.394 (0.496)	0.269** (0.117)	0.143 (0.355)	0.320 (0.471)	0.177* (0.094)
Number of Items	88	159		146	274	
<b>Part B: Inattentive Shoppers</b>						
	<b>TREATMENT</b>			<b>Control</b>		
	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>
Buy Target Item	0.242 (0.435)	0.385 (0.490)	0.142 (0.101)	0.119 (0.327)	0.380 (0.488)	0.260*** (0.070)
Buy Target Item Neighbors	0.300 (0.483)	0.333 (0.480)	0.033 (0.178)	0.250 (0.447)	0.444 (0.511)	0.194 (0.166)
Buy Target Item Different Lines	0.217 (0.422)	0.421 (0.500)	0.204 (0.125)	0.078 (0.272)	0.361 (0.484)	0.282*** (0.076)
Buy Target Item Target History	0.600 (0.548)	0.313 (0.479)	-0.287 (0.253)	0.333 (0.516)	0.450 (0.510)	0.117 (0.238)
Buy Target Item Substitute History	0.000 (0.000)	0.357 (0.497)	0.357 (0.227)	0.100 (0.316)	0.438 (0.512)	0.338* (0.181)
Number of Items	33	65	42	67	79	

Attentive shoppers are individuals who purchased the rebate item in at least 70% of their trips.  
 Inattentive shoppers are individuals who purchased the rebate item in no more than 30% of trips.

<sup>a</sup>Standard deviations are presented in parenthesis

<sup>b</sup>Standard errors are presented in parenthesis

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

Table 12: Purchasing Trends - By Shopping Trip Type

<b>Attentive Shopping Trips</b>						
	<b>TREATMENT</b>			<b>Control</b>		
	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>
Buy Target Item	0.123 (0.330)	0.432 (0.497)	0.310*** (0.054)	0.264 (0.443)	0.412 (0.493)	0.148*** (0.050)
Buy Target Item Neighbors	0.053 (0.229)	0.391 (0.492)	0.338*** (0.117)	0.250 (0.442)	0.349 (0.480)	0.099 (0.109)
Buy Target Item Different Lines	0.138 (0.347)	0.455 (0.500)	0.317*** (0.062)	0.267 (0.444)	0.444 (0.498)	0.177*** (0.058)
Buy Target Item Target History	0.500 (0.577)	0.708 (0.464)	0.208 (0.259)	0.571 (0.507)	0.828 (0.384)	0.256** (0.126)
Buy Target Item Substitute History	0.130 (0.344)	0.475 (0.506)	0.345*** (0.119)	0.143 (0.356)	0.348 (0.482)	0.205* (0.105)
Number of Items	106	185		140	245	
<b>Inattentive Shopping Trips</b>						
	<b>TREATMENT</b>			<b>Control</b>		
	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>	Pre Sale <sup>a</sup>	Sale <sup>a</sup>	Diff <sup>b</sup>
Buy Target Item	0.196 (0.401)	0.238 (0.427)	0.041 (0.066)	0.197 (0.399)	0.339 (0.475)	0.142*** (0.049)
Buy Target Item Neighbors	0.375 (0.500)	0.240 (0.431)	-0.135 (0.129)	0.172 (0.384)	0.412 (0.500)	0.239** (0.114)
Buy Target Item Different Lines	0.125 (0.335)	0.237 (0.427)	0.112 (0.076)	0.203 (0.404)	0.321 (0.469)	0.118** (0.054)
Buy Target Item Target History	0.571 (0.535)	0.273 (0.467)	-0.299 (0.239)	0.556 (0.511)	0.480 (0.510)	-0.076 (0.158)
Buy Target Item Substitute History	0.000 (0.000)	0.136 (0.351)	0.136 (0.126)	0.130 (0.344)	0.219 (0.420)	0.088 (0.107)
Number of Items	56	143		157	171	

Attentive shopping trips refer to whether or not rebate item was purchased.

<sup>a</sup>Standard deviations are presented in parenthesis

<sup>b</sup>Standard errors are presented in parenthesis

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

Table 13: Do Consumers React to Sales?

	(1)	(2)	(3)	(4)	(5)	(6)
<b>Part A: Defining Attentiveness at the Shopper Level</b>						
On-Sale	0.151*** (0.021)	0.149*** (0.022)	0.122*** (0.041)	0.141*** (0.044)	0.148*** (0.042)	0.125*** (0.042)
Attentive Shopper (AS) <sup>a</sup>		-0.011 (0.031)	-0.085** (0.043)	-0.089 (0.061)	-0.084 (0.058)	-0.086 (0.062)
AS×Treat <sup>b</sup>		0.062*** (0.019)	0.061*** (0.021)	0.060*** (0.021)	0.049** (0.021)	
AS×Treat×On-Sale			0.156** (0.064)	0.137** (0.066)	0.149** (0.063)	0.103* (0.060)
AS×On-Sale			0.005 (0.051)	0.000 (0.051)	-0.013 (0.049)	0.068 (0.049)
N Items	2,809	2,809	2,809	2,809	2,809	2,809
<b>Part B: Defining Attentiveness at the Shopping Trip Level</b>						
On-Sale	0.116*** (0.015)	0.106*** (0.016)	0.067*** (0.019)	0.071*** (0.020)	0.061*** (0.019)	0.100*** (0.020)
Attentive (A) <sup>c</sup>		-0.039 (0.032)	-0.111** (0.048)	-0.150*** (0.056)	-0.121** (0.055)	-0.062 (0.058)
A×Treat		0.051** (0.023)	0.013 (0.033)	0.026 (0.039)	-0.001 (0.038)	0.039 (0.039)
A×Treat×On-Sale			0.135** (0.065)	0.131** (0.065)	0.123* (0.063)	0.134** (0.059)
Attentive×On-Sale			0.095** (0.047)	0.088* (0.047)	0.100** (0.046)	0.045 (0.044)
N Items	4,839	4,839	4,839	4,839	4,839	4,839
Email Controls <sup>d</sup>	No	No	No	Yes	Yes	Yes
Item FE's	No	No	No	No	Yes	Yes
Shopper FE's	No	No	No	No	No	Yes

Standard errors are presented in parenthesis.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

<sup>a</sup>AS refers to attentive shoppers who purchased the rebate item in at least 70% of their trips. We exclude individuals who were sometimes attentive (purchased rebate item in more than 30% but less than 70% of shopping trips).

<sup>b</sup>AS×Treat is only equal to 1 if the shopper opened the weekly email.

<sup>c</sup>A refers to attentive shopping trips where the rebate item was purchased.

<sup>d</sup>Includes controls for whether or not email was opened that week, whether or not it was in the personalized format, as well as the interaction: personalized×attentive×treat.

Table 14: A Closer Look at How Consumers React to Sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Low Discount Period =25%	High Discount Period >25%	Basic e-mail Weeks	Detailed e-mail Weeks	Category Level Discount e-mail Weeks	Product Level Discount e-mail Weeks	Neighbor Items	Non Neighbor Items	Large Shopping Trips Total >\$60	Small Shopping Trips Total = \$60	
<b>Part A: Defining Attentiveness at the Shopper Level</b>										
AS×Treat×On-Sale <sup>a</sup>	-0.074 (0.114)	0.287*** (0.077)	-0.016 (0.088)	0.148* (0.079)	0.022 (0.067)	0.412*** (0.138)	-0.065 (0.099)	0.136* (0.075)	0.063 (0.101)	0.148* (0.080)
AS×On-Sale	0.043 (0.107)	0.054 (0.056)	0.056 (0.063)	0.121* (0.072)	0.043 (0.053)	0.136 (0.117)	0.072 (0.075)	0.070 (0.063)	0.073 (0.068)	0.047 (0.079)
N Items	1,973	2,498	2,220	2,251	2,577	1,894	898	1,911	1,458	1,351
<b>Part B: Defining Attentiveness at the Shopping Trip Level</b>										
A×Treat×On-Sale <sup>b</sup>	0.074 (0.121)	0.208*** (0.071)	0.149* (0.086)	0.157** (0.080)	0.110* (0.066)	0.357*** (0.133)	0.030 (0.107)	0.120* (0.071)	0.056 (0.080)	0.222** (0.089)
Attentive×On-Sale	0.075 (0.104)	0.010 (0.049)	-0.070 (0.064)	0.115* (0.060)	0.001 (0.050)	0.128 (0.092)	0.065 (0.081)	0.070 (0.053)	0.030 (0.057)	0.057 (0.069)
N Items	3,292	4,273	3,760	3,805	4,443	3,122	1,387	3,452	2,766	2,073

Standard errors are presented in parenthesis. All specifications include a control for whether or not the item is on-sale, attentiveness controls, email controls, item fixed effects, and shopper fixed effects.

<sup>a</sup>AS refers to attentive shoppers who purchased the rebate item in at least 70% of their trips. We exclude individuals who are sometimes attentive (purchased rebate item in more than 30% but less than 70% of shopping trips).

<sup>b</sup>A refers to attentive shopping trips where the rebate item was purchased.

\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%

Figure 1: Examples of email Format in First Trial (weeks:1-3)

### **Control email example**

Got a banana? Get a one-time refund on shipping for a purchase of over \$20 if you buy one banana or more!<sup>1</sup>(Click here)

<sup>1</sup> Offer valid on all bananas. Use this email address when placing your purchase and a refund of \$2.99 will be applied within 24 hours of purchase. Valid until ---

### **Treatment email example**

Got a banana? Get a one-time refund on shipping for a purchase of over \$20 if you buy one banana or more!<sup>1</sup> (Click here)

... and if that's not enough, make sure you check our [only on week 1: early bird] discounts for the month of February [only on week 3: especially on organic products] (discounted items are marked by \*\*).

#### **Our biggest discounts are in the following categories:**

1. Vegetables – up to 45% off select items (Click here)
2. Milk – up to 40% off select items (Click here)
3. Fruits – up to 30% off select items (Click here)
4. Eggs – up to 20% off select items (Click here)

<sup>1</sup> Offer valid on all bananas. Use this email address when placing your purchase and a refund of \$2.99 will be applied within 24 hours of purchase. Valid until ---

Figure 2: Examples of email Format in Second Trial (weeks:4,5,7)

### **Control email example**

Got broccoli? Get a one-time refund on shipping for a purchase of over \$20 if you buy one broccoli bunch or more!<sup>1</sup>(Click here)

<sup>1</sup> Offer valid on all fresh broccoli bunches. Use this email address when placing your purchase and a refund of \$2.99 will be applied within 24 hours of purchase. Valid until ---

### **Treatment email example**

Don't miss out on this great deal to stock up on all your favorites! When making your purchase, check out our February discounts, [only on weeks 4 & 7: especially on organic products] (discounted items are marked by \*\*). To use your \$10 refund - simply click on one of the links below to the site, purchase at least one of the eligible items (bananas, apples, fresh blueberries, or fresh broccoli bunches), and insert the coupon code found below.<sup>1</sup>

#### **Our biggest discounts are in the following categories:**

1. Eggs – up to 20% off select items (Click here)
2. Fruits – up to 30% off select items (Click here)
3. Milk – up to 40% off select items (Click here)
4. Vegetables – up to 45% off select items (Click here)

<sup>1</sup> Offer valid on all bananas, apples, fresh blueberries, and fresh broccoli bunches. Use the coupon code "dcash" when placing your purchase and you will receive a \$10.00 refund on your purchase of \$20 or more. The code can be used only once. The refund will be applied within 24 hours. Valid until ---



Figure 3: Examples of email Format in Third Trial (weeks:6,8-10)

### **Control email**

Got Roma tomatoes? Get a one-time refund on shipping for a purchase of over \$20 if you buy one Roma tomato or more!<sup>1</sup> (Click here)

<sup>1</sup> Offer valid on all Roma tomatoes. Use this email address when placing your purchase and a one-time refund of \$2.99 will be applied within 24 hours of purchase. Valid until ---

### **Treatment email with additional information**

We are devoted to helping our customers get the "best bang for the buck".

That means you should make sure to check out our BRAND NEW MARCH discounts, especially on organic products! (discounted items are marked by \*\*)

**Don't forget to consider some alternatives to your last purchase of water that we have on sale this month.**

*To use your \$10 refund - simply click on one of the links below to the site, purchase at least one Roma tomato and insert the coupon code found below.*

Our biggest discounts are in the following categories:

1. Yogurt – up to 20% off select items (Click here)
2. Water – up to 21% off select items (Click here)
3. Bread – up to 23% off select items (Click here)
4. Vegetables – up to 25% off select items (Click here)

Make sure to purchase one or more Roma tomatoes and enter coupon-code dcash at checkout!<sup>1</sup>

<sup>1</sup>Offer valid on all Roma tomatoes. Use this email address and the dcash coupon code when placing your purchase and you will receive a \$10.00 one-time refund on your purchase of \$20 or more. The refund will be applied within 24 hours. Valid until ---

Figure 4: Examples of email Format in Fourth Trial (weeks 11-13)

### **Control email**

Got apples? Get a \$10 refund by simply purchasing at least one apple and inserting the coupon code dcash at checkout! <sup>1</sup> (Click here)

<sup>1</sup> Offer valid on all apples. Use this email address and the dcash coupon code when placing your purchase and you will receive a \$10.00 one-time refund on your purchase of \$20 or more. The refund will be applied within 24 hours. Valid until ---

### **Treatment email with additional information**

We are devoted to helping our customers get the "best bang for the buck". So don't miss out on our April discounts! Our April sale prices are so low that organic sale items are often even cheaper than the non-organic alternative! (discounted items are marked by \*\*)

**Don't forget to consider some alternatives to your last purchase of eggs that we have on sale this month.**

*To use your \$10 refund - simply click on one of the links below to the site, purchase at least one apple and insert the coupon code found below.*

Our biggest discounts are on the following products:

1. Milk – Simple Truth Organic Milk (0.5gal) 33% off! (Click here)
2. Eggs – Kroger Grade A Large Brown Eggs (12ct) 49% off! (Click here)
3. Fruit – Organic Bananas 51% off! (Click here)
4. Vegetables – Organic Roma Tomatoes 75% off! (Click here)

Make sure to purchase one or more apples and enter coupon-code dcash at checkout!<sup>1</sup>

<sup>1</sup>Offer valid on all apples. Use this email address and the dcash coupon code when placing your purchase and you will receive a \$10.00 one-time refund on your purchase of \$20 or more. The refund will be applied within 24 hours. Valid until ---

Figure 5: The Distribution of Total Purchase Amount

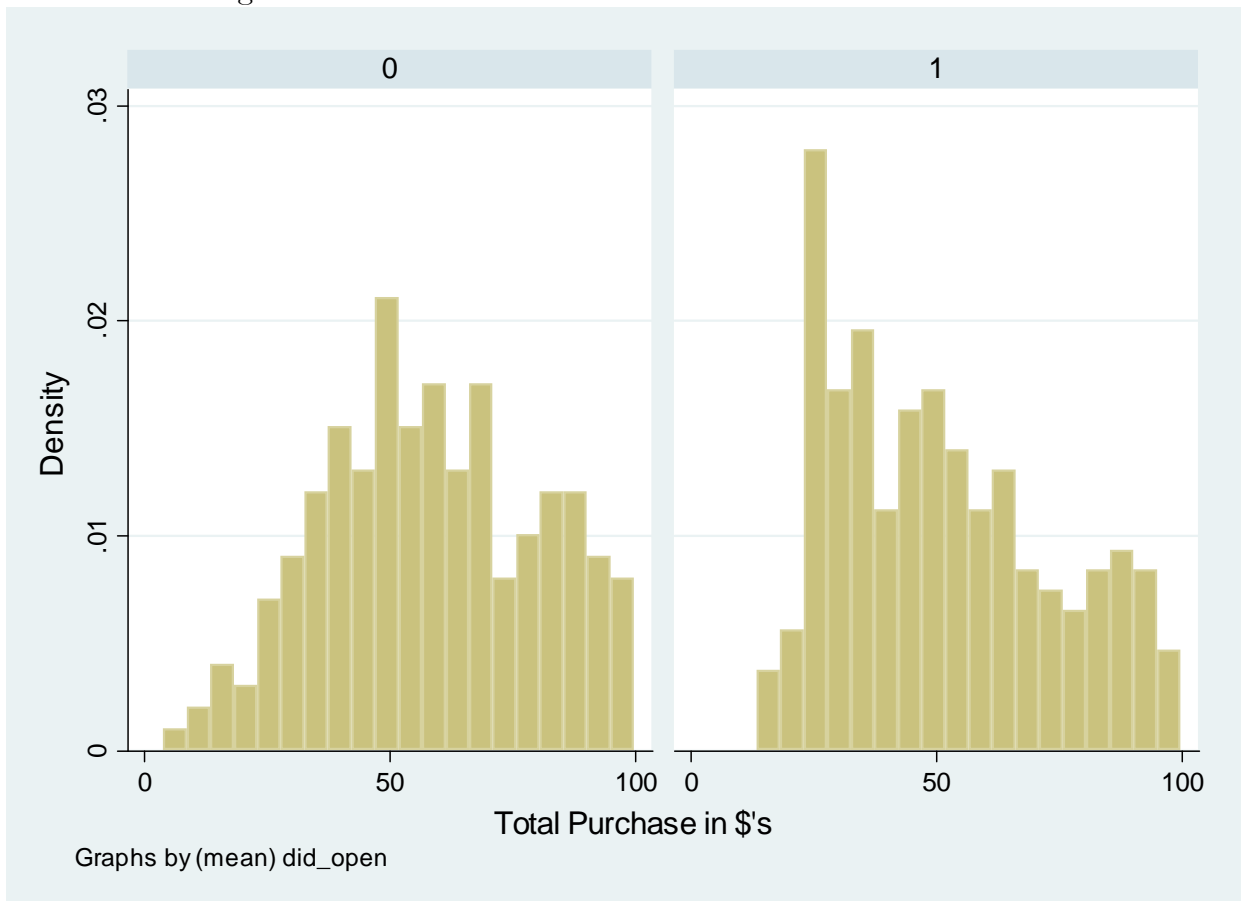


Figure 6: Distribution of Shoppers By Fraction of Shopping Trips in which they Purchased Rebate Item

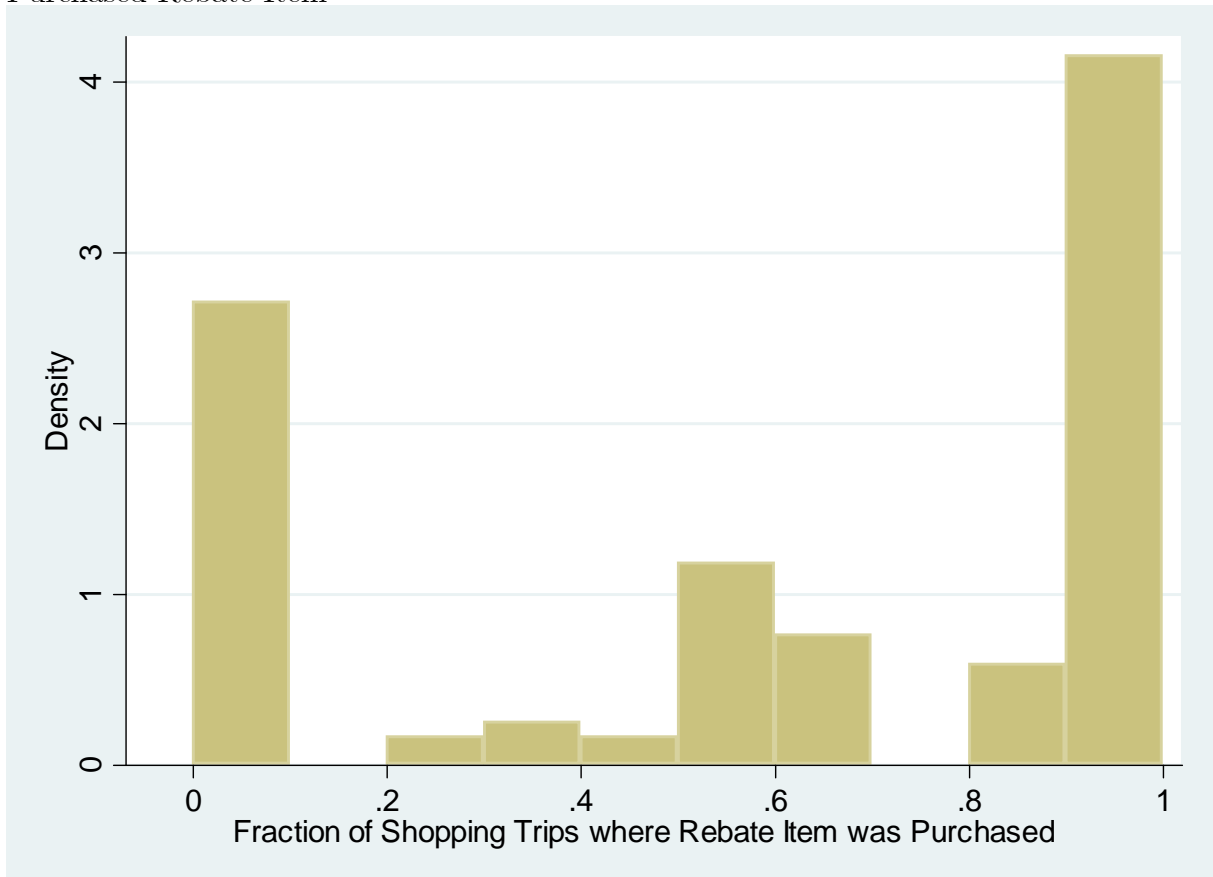






Figure 7: Example of Target versus Substitute Item During Sale Period

Q Search

## Fresh Fruits

			
<b>Banana - Ripe</b> \$0.39	<b>Banana - Mild Green</b> \$0.39	<b>Bananas (Organic)**</b> \$0.24	<b>Blueberries</b> \$4.99
each	each	each	each carton
Quantity: <input type="text" value="1"/>	Quantity: <input type="text" value="1"/>	Quantity: <input type="text" value="1"/>	Quantity: <input type="text" value="1"/>
<a href="#">Add To Cart</a>	<a href="#">Add To Cart</a>	<a href="#">Add To Cart</a>	<a href="#">Add To Cart</a>