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The Impact of Coupons on the Visit-to-Purchase Funnel

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Abstract. Firms use coupons to stimulate demand. Although couponing is popular in practice, limited research has examined the causal effects of coupons on visit, search, and purchase behaviors among heterogeneous customers. In this paper, we examine coupon effects using data from a randomized field experiment with an online retailer in which customers were divided into two heterogeneous customer segments (low value and high value) with two types of coupon discounts (base value and better value). We find couponing is effective in increasing revenue, primarily by attracting customers who purchase without coupon redemption, and the lift in revenue per customer is larger for the high-value segment. Using clickstream data of customer visit and search behavior, we find most of the revenue lift arises from a corresponding lift in the likelihood of visiting the website under couponing. Though the lift in visit likelihood is relatively homogeneous across customer segments under the base coupon, the high-value segment has a higher purchase conversion rate than the low-value segment, leading to an amplified revenue lift. We also find a deeper discount leads to higher redemption and purchase conversion for the high-value segment but does not change visit likelihood. Finally, most of the search behaviors are unchanged under couponing, suggesting the mix of customers brought in under couponing are similar to those who visit without receiving coupons.

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1. Introduction

Firms across many industries use coupons to stimulate demand. Although couponing is a long-standing practice in brick-and-mortar retailing, its use in the digital economy has continued to grow at a steady clip, even as evidence for how coupons affect consumer behavior remains limited in the literature and in practice. Because firms—online and offline, large and small—actively run several promotions concurrently, including storewide mass promotions, as well as targeted email or mobile coupons, it is challenging to uncover the actual performance of any given promotion as the baseline sales that would have resulted in the counterfactual scenario is usually unavailable.¹

The traditional couponing literature has leveraged price discrimination (e.g., Narasimhan 1984) as the primary driver of sales lift. In other words, coupons are meant to generate sales from those who redeem them (e.g., Neslin 1990), albeit at a lower margin. This focus on coupon redemption (à la Neslin and Shoemaker 1983) has been challenged by recent research (e.g., Venkatesan and Farris 2012 and Sahni et al. 2017) that suggests coupons may generate sales lift from customers who do not redeem them (thus

avoiding margin erosion) but who would not have bought in the absence of coupons.

Even if we can decompose sales lift from coupons into redemption and nonredemption effects, a general set of questions remains unanswered. Does a coupon affect the likelihood that a customer visits a store? Does she search less or more under a coupon upon visiting? Does a coupon increase or decrease the chance she converts to a purchase from a visit, or some combination thereof? That very limited insights are available on these fundamental questions is one key motivator for this paper.

A second category of motivating questions, beyond how a coupon affects consumer behavior, also emerges. How are coupon effects moderated by customer heterogeneity and coupon value? Should coupons be targeted in light of differential effects on customers in terms of their past behavior? Furthermore, how does the face value of the coupon play into these considerations?

In order to gather causal evidence on these questions, a study must meet a number of requirements. First, it should allow the measurement of the entire visit-to-purchase funnel of customers, which starts at the top with the proportion of customers who visit the

website (which we hereafter refer to as *visit likelihood*). In the middle of the funnel, customers engage in search activity on the website upon visiting. At the bottom of the funnel, customers decide whether to convert their visit and search into purchase (which we hereafter refer to as *purchase likelihood* among visitors, because this measure is conditional on visit). Second, a randomized field experiment is required to assign customers to coupon treatment and control groups to address selection concerns. Such an experiment would also need to avoid confounds with other promotions by ensuring that the only systematic difference between the treated and control groups is the couponing that is the focus of the study. Doing so requires a firm to be able to cordon off the customers involved in the experiment from additional communications, which is often challenging to execute in practice. Third, the study should allow for the design of coupons with varying levels of discount depths for a heterogeneous customer base.

Our primary contribution is designing and implementing a randomized field experiment with an online retailer that satisfies the above-mentioned requirements and therefore overcoming measurement, randomization, and implementation challenges faced in the extant literature.² As a result, we obtain novel empirical evidence on the causal effects of coupons on website visit, search, and purchase behaviors on a heterogeneous customer base that builds on the literature (e.g., Venkatesan and Farris 2012, Fong 2017, and Sahni et al. 2017).

Our retail partner for this study (whose name is not disclosed for confidentiality purposes) is a large e-commerce website in Asia selling personal care products. This retailer was able to track website visits, search activity, products purchased, and any discounts applied to purchases across the set of customers involved in the study. The visit and search data enabled us to investigate coupon effects at a more detailed level than in the prior literature. Additionally, the retailer was able to ensure that customers involved in our experiment received either a coupon designed for this study or no other targeted coupons. That is, although all customers had access to storewide mass promotions available on the website, none of the customers would have access to targeted promotions other than the ones designed for this experiment.

The customers in our experiment were divided into high-value and low-value segments with two types of treatments: a base-level coupon and a better-level coupon offering a higher value than the base coupon. Customers were expected to meet a condition for the purposes of redemption (e.g., Lee and Ariely 2006). One treatment group involved making a base coupon offer to both high-value and low-value segments. In addition, we had a treatment group with

targeted couponing in which the high-value segment received a better coupon offer. Finally, to provide a baseline for comparing treatment effects, we also had a control group that did not receive any coupons. Importantly, our design allows for the analysis at the segment level, which increases statistical power (Simester et al. 2020). We present the overall sales lift from couponing using the typical outcome measures (e.g., purchase likelihood and revenue per customer) reported in past literature, and we explain the sales lift using clickstream data that shed light on the visit-to-purchase funnel among heterogeneous customers.

We find couponing was effective in increasing revenue, primarily by attracting customers who purchased without coupon redemption, and the lift in revenue per customer was larger for the high-value segment. Most of the revenue increase was driven by a lift in visit likelihood under couponing accompanied by no change in purchase conversion for the base coupon and an increase in purchase conversion for the better coupon. That is, our coupon's primary effect was to drive website visits, and customers who visited under the coupon were at least as likely to make purchases as those who did not receive the coupon promotion because nonredeemers were still able to avail of other storewide mass promotions available on the website.

Furthermore, although revenue lift under the base coupon was higher for the high-value segment, we find visit likelihood lifts for both customer segments were similar, and the apparent higher performance of the base coupon for the high-value segment was due to higher baseline purchase conversion rates for this segment. We also find a deeper discount led to higher redemption and purchase conversion for the high-value segment but did not change visit likelihood compared with the base coupon.

Finally, the base coupon resulted in fewer web pages searched by the low-value segment compared with the control group, and the better coupon increased search for products promoted by the coupon for the high-value segment. Much of the other search behaviors we examined were unchanged under couponing, suggesting that the mix of customers brought in under couponing were not significantly worse in terms of their search activity.

To the best of our knowledge, our research is the first to examine the causal effects of coupons (of varying discount depths) to a heterogeneous customer base along the visit-to-purchase funnel, using a randomized field experiment. We also contribute to a newly emerging stream of literature that examines how firms can influence the consumer visit-to-purchase funnel (e.g., Seiler 2013 and Fong 2017) through promotions.

The remainder of this paper is organized as follows. In Section 2, we lay out a research framework based on the extant literature of how a coupon can affect consumer behavior. In Section 3, we describe the experimental design. In Section 4, we present the findings from the experiment. We conclude in Section 5.

2. Research Framework

In this section, we lay out a research framework to describe the components of the visit-to-purchase funnel that we study. We find past literature is limited in the study of coupon effects on consumer behavior along the visit-to-purchase funnel and does not directly address our research questions. Much of the prior literature focuses on outcome measures such as sales lift from coupons (e.g., Neslin 1990). Bawa and Shoemaker (1989) and Venkatesan and Farris (2012) both find a substantial portion of revenue lift from couponing occurs as a result of customers who purchase without redemption. Sahni et al. (2017) study coupon effects on customer purchases at an online ticket marketplace and find coupons can have an advertising effect that goes beyond the price discrimination mechanism (e.g., Narasimhan 1984) by stimulating purchases from customers that do not involve coupon redemption but would not have occurred without coupons.

This paper adds to the literature by using data from a randomized field experiment to measure the causal effects of coupons on the visit-to-purchase funnel and identifying the mechanisms driving the effects that have not been considered at the same level of granularity in the previous literature. We build on the work by Sahni et al. (2017) by decomposing the nonredemption and redemption effects of coupons and further examining how such effects arise as customers decide whether to visit an e-commerce website and their activities in search and/or purchase upon visit. We also seek to explore how coupon effects are moderated by customer heterogeneity and coupon value. Because our data are generated from a randomized field experiment, we are able to alleviate selection concerns resulting from the use of observational data in much of the past literature. This is important for establishing causal evidence for how coupons work along the visit-to-purchase funnel. We stress that our study is specific to our retail partner and the coupons we tested such that empirical generalizations about any of our findings will require replication of the study across firms and coupon types.

We next describe the visit, search, and purchase decisions that are part of our study and how they may be impacted under couponing.

2.1. Visit Decision

The first stage of consumer decision making is whether to visit the e-commerce website. In this stage, the effect of coupons is the extent to which customers who receive a coupon choose to visit the website compared with the control group that does not. We note that any change in the decision to visit could occur for a variety of reasons. For instance, coupons may serve to reduce the consumer's cost of time and cognitive resources to consider a visit to the website (e.g., Merisavo and Raulas 2004). Alternatively, coupons may increase expected utility for customers from potential purchases of products under coupon promotion upon visiting the website (e.g., Martin et al. 2003). Interestingly, Seiler and Yao (2017) find in an offline supermarket setting that store visits made by customers are unchanged with feature advertising. Because of our online setting, coupons may have more of a bearing on a customer's decision to visit the website because of the greater ease of visiting online as compared with offline.

Furthermore, any change in visit decision may be moderated by customer heterogeneity. A question that then arises is whether high-value customers would be less or more responsive to coupons than low-value customers. One argument is that low-value customers may be more responsive to coupons because they are likely more price sensitive. On the other hand, high-value customers may be more responsive because they have more experience with the firm's offerings. We do not have an *a priori* hypothesis about which type of customers will be more responsive to visiting the website under couponing and treat this as an empirical question.

2.2. Search Decision

Conditional on visit, a customer engages in search activity. Customers may browse information for products and offerings across different web pages (e.g., landing pages or web pages displaying a gallery of multiple product images), search for detailed information about a specific product, and also explore web pages of those products promoted by the coupon. In assessing coupon effects on search decisions, we are interested in both the number of web pages viewed by a customer who visits the website and the specific search activity relating to products featured by the coupon.

Much of the search literature has focused on estimating the search cost that customers incur to search for a product, but not on coupon effects on online search decisions (e.g., Kim et al. 2010, Bronnenberg et al. 2016, and Chen and Yao 2016). Coupons may stimulate greater search because customers may get

motivated to find suitable deals. On the other hand, if those who visit as a result of coupons focus on deals, they may search less than those in the control group (e.g., Fong 2017). As coupons may increase or decrease search activity on the website (e.g., Sahni et al. 2017), we do not have an a priori hypothesis on the magnitude or direction of these effects. We note that any change in search decisions upon visit is likely reflective of the mix of customers who visit under coupons versus in the control group. Therefore, a null effect in search decision upon visit would indicate that consumers who visit under couponing behave no differently in terms of search than if they had visited without coupons. A null effect then is a better outcome for the firm than less search because it would reflect that customers behave similarly under couponing as in its absence.

2.3. Purchase Decision

Extant literature has limited predictions on customer purchases relating to our empirical setting. Anderson and Simester (2001a) find promotions that involve only a subset of items at a store have a larger effect on demand. Anderson and Simester (2001b) suggest that promotions to price-insensitive customers may reduce demand because of the perception of these discounts as an adverse quality signal. In line with these results, several researchers suggest high-value customers do not require inducements to purchase products, and coupons can therefore be targeted at new and low-loyalty customers (e.g., Lal and Bell 2003, Anderson and Simester 2004, and Musalem and Joshi 2009). Shin and Sudhir (2010), by contrast, show a set of conditions under which rewarding high-value customers is more profitable for the firm than inducing low-value customers. Homburg et al. (2008) also suggest targeting high-value customers. Making a different argument, Acquisti and Varian (2005) show a firm can do as well without using past purchase history to set prices in the presence of forward-looking consumers. Put together, we find a lack of convergence on whether coupons would increase demand among heterogeneous customers and how coupons would affect customer purchases with or without coupon redemptions upon visit. Similar to search decisions, a null effect for purchase decisions would indicate that the mix of customers who purchase upon visit under couponing is about the same as the control group. On the other hand, customer purchases could increase if customers are motivated to redeem coupons or decrease if they are dissatisfied with the offers that initially motivated them to visit the website.

To summarize, we note that all of these effects can be credibly measured only with a field experiment in which customers are randomly assigned to treated

and control groups. With our goal of also examining potential moderation of coupon effects by customer heterogeneity and coupon value, a custom-designed experiment that allows for the appropriate set of groups to receive various coupons (or none) is required. Our paper contributes to the literature by uncovering causal evidence of the coupon effects along the visit-to-purchase funnel among heterogeneous customers by leveraging the field experiment described next.

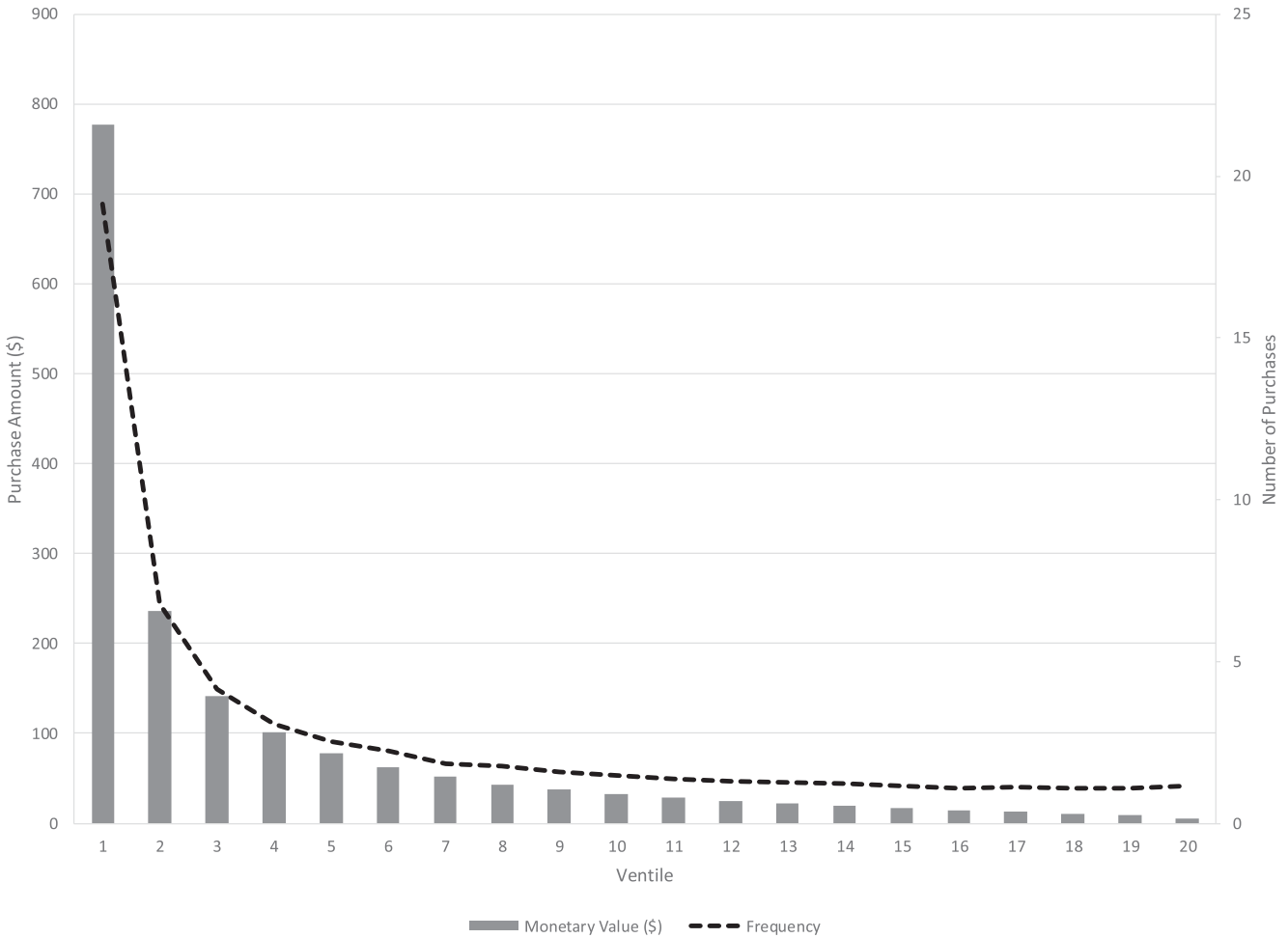
3. Field Experiment

3.1. Experiment Setting

In this section, we describe a randomized field experiment that was conducted with the cooperation of an online retailer in Asia that sells personal care products. The cooperating retailer, which prefers to remain anonymous, offers a wide assortment of brands and products, ranging from low-end to high-end goods at varying prices. The retailer also spends a significant portion of its marketing budget on promotions and personalized offers. Therefore, we see this setting as appropriate to examine the causal effects of coupons on the visit-to-purchase funnel.

The customers of the firm vary considerably in their purchase patterns. To design the experiment, we focused on the customers who had purchased at least once over a period of 12 months prior to the experiment. We divided the customers into 20 equal-sized groups (i.e., ventiles) based on the purchase amount spent by each customer in the past 12 months prior to the experiment.³ Figure 1 presents the purchase amount (monetary value) across the groups in the pretest period. Figure 1 also presents the number of purchases (frequency) across 20 ventiles in the pretest period. Upon discussion with the firm, we decided that customers in the first ventile (top 5%) and ventiles 15–20 (bottom 30%) should be excluded from consideration for the experiment because they were either too valuable or had purchased too little. We categorized the remaining ventiles into two segments: the high-value type, with those in ventiles 2–4 (comprising 15% of the customer base), and the low-value type, with those in ventiles 5–14 (comprising 50% of the customer base). Because purchase frequency and monetary value are highly correlated across the groups, a segmentation based on monetary value is appropriate to examine the impact of coupons among heterogeneous customers.

The coupons in the experiment offered a price discount if customers made a purchase that meets a redemption condition (e.g., Lee and Ariely 2006). Examples of such types of promotions typically used in practice are “\$X off for purchases of \$Y or more,” “\$X off for select brands or products,” and so on. In collaboration with the retailer, we chose “\$X off for select products” for the experiment, in which a

Figure 1. Pretest Descriptive Statistics

customer could redeem the coupon for a product priced at \$20 or higher. Using managerial guidance from the firm, we had two types of coupons with different discount depths: a base offer with a \$7 discount and a better offer with a \$10 discount.

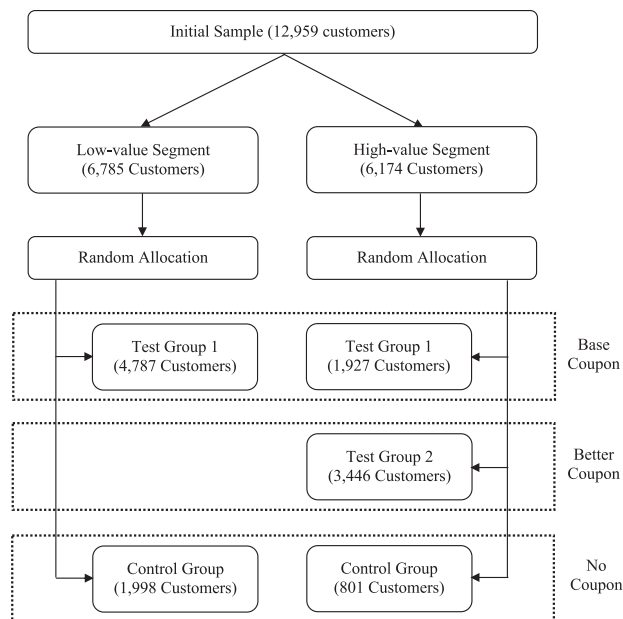
3.2. Experiment Design

With two types of customers (high-value and low-value segments) and three types of coupons (base coupon, better coupon, and no coupon), an ideal experiment would be a 2×3 design with six conditions. However, the firm was unwilling to offer the better coupon to the low-value segment; therefore, we did not implement this condition in our experiment.

Our sampling plan was to obtain sample sizes that would provide adequate statistical power for estimating heterogeneous segment-level treatment effects (Simester et al. 2020). The low-value segment is about 3.3 times as large as the high-value segment. Therefore, we decided to oversample from the high-value segment because it also has a better-coupon condition, and we obtained a sample of 12,959 customers

consisting of 6,785 low-value and 6,174 high-value customers. Figure 2 shows the design of the study and the number of high-value and low-value customers and the coupon type across the conditions. We assigned about 70% of the low-value customers to the base-coupon condition (T1) and the remaining 30% to the control (no-coupon) condition (CG). Because redemption likelihood could be potentially low, this assignment helps examine both purchase and redemption behaviors with adequate statistical power, whereas CG, by definition, did not involve any redemption. High-value customers were randomly assigned to three conditions: base coupon, better coupon, and no coupon. Our partner firm was keen to allocate a majority of the high-value customers to the better-coupon condition: About 56% of the customers were assigned to the better-coupon condition (T2). Of the remaining high-value customers, similar to the ratio for the low-value segment, about 70% were assigned to the base-coupon condition (T1) and the remaining 30% to the control (no-coupon) condition (CG).

Figure 2. Design of the Study



We note that our control group features the absence of any communication during the experiment period because the firm preferred not to send any communication to the control group. The difference between the coupon and control conditions therefore reflects a communication of a coupon offer as well as the option to use the coupon during the course of visiting the website. A useful avenue for future research would be the inclusion of an alternate control group with a generic communication (but without any promotional offer), which could help measure the baseline effect of such a generic message.

We note that designing a large-scale field experiment in the course of commercial operations at a large firm requires compromise to maximize the value of the field experiment subject to the constraints of the firm's requirements and preferences. We proceeded to implement the experiment, because the design was adequate to address our research questions.

3.3. Implementation

All customers in the test conditions were contacted by the firm on the same day at the same time via their mobile phones in the fall of 2016 for a campaign spanning one week. The campaign offered a price-discount coupon that recipients could redeem within the campaign period when purchasing a product priced at \$20 or more. As an example, the message sent to a customer in one of the test conditions typically conveyed the following (translated to English): "\$7 off with any purchase of a product priced at \$20 or more."

This coupon was made available to customers when they shopped, thus simplifying the process for redeeming them compared with paper coupons (e.g., Andrews et al. 2016). The communication (e.g., content, creative) was the same between the test groups. Only the discount depth differed. We controlled for other marketing efforts during the test period, because no customers included in the study were exposed to any other targeted promotions. Although other storewide mass promotions were available to all customers in the study, the absence of any additional communication about other promotions to any customer and the absence of any differential exposure to mass promotions across customers upon the website visit ensure that we do not have concerns about potential interplay of mass promotions with the focal coupons in the study.

4. Findings

We begin by presenting randomization checks for the low-value and high-value segments in Table 1. We assigned the low-value segment to either a base coupon offer (T1) or a control group (CG). We assigned the high-value segment to a base coupon offer (T1), a better coupon offer (T2), or a control group (CG). These tables demonstrate the face validity of our randomization, because the average purchase amount in the pretest period was not statistically different across the conditions for each segment. Furthermore, Table 1 shows the order statistics closely match, such that we find no evidence of selection bias that may affect our results.⁴

The rest of the section is organized as follows. In Section 4.1, we use detailed individual-level transaction data and describe the purchase behaviors that resulted from the experiment. Our goal is to establish stylized facts about how coupons performed in our field test. In Section 4.2, we use clickstream data containing customer visit and search behaviors to examine the causal effects of coupons on the visit-to-purchase funnel.

4.1. The Effect of Coupons on Customer Purchase

In examining the causal effects of coupons on purchase behavior, we construct multiple dependent measures: the proportion of customers who purchased (purchase likelihood) and the proportion of customers in the test groups who redeemed the coupon (redemption likelihood). Note that these two measures are different: In the former, purchasers may or may not have redeemed the coupon, but purchases were made; in the latter, purchases were made by redeeming the coupon. In addition, conditional on purchase, we observe the purchase amount net of any discount. From this measure, we compute the average

Table 1. Pretest Descriptive Statistics of Purchase Amount (in Dollars)

Panel A: Low-value segment						
	T1	CG	Difference			
			T1 – CG			
Mean	40.30	39.88	0.42 (0.48)			
Min	17.60	18.60	–1.00			
p10	20.96	20.83	0.13			
p25	25.35	25.60	–0.25			
p50	34.60	35.00	–0.40			
p75	51.90	51.15	0.75			
p90	69.80	67.70	2.10			
Max	87.40	87.20	0.20			
Observations	4,787	1,998				

Panel B: High-value segment						
	T1	T2	CG	Difference		
				T2 – T1	T2 – CG	T1 – CG
Mean	160.49	160.75	162.26	0.26 (1.79)	–1.51 (2.47)	–1.77 (2.65)
Min	87.50	87.50	87.50	0.00	0.00	0.00
p10	96.61	95.00	97.60	–1.61	–2.60	–0.99
p25	107.91	109.07	110.80	1.16	–1.73	–2.89
p50	139.75	141.13	140.36	1.38	0.77	–0.61
p75	201.36	200.05	204.10	–1.31	–4.05	–2.74
p90	263.45	261.62	264.80	–1.83	–3.18	–1.35
Max	325.08	333.00	381.32	7.92	–48.32	–56.24
Observations	1,927	3,446	801			

Notes. Standard errors appear in parentheses. p, percentile.

revenue per customer (ARPC) for each condition, which is defined as total revenue divided by the number of customers in the group.⁵ ARPC is used in the literature because it accounts for the effect of margin loss as a result of coupon redemption (e.g., Venkatesan and Farris 2012 and Sahni et al. 2017). We also compute the average revenue per buyer (ARPB). We report both absolute lift (denoted as lift) and relative lift (percentage change from baseline) in the outcome measures to provide a more comprehensive picture of the results.

4.1.1. Low-Value Segment. Table 2, Panel A shows that purchase likelihood increased by 1.47% (a relative lift of 147%) for T1 compared with CG, whereas ARPB was not statistically different. As a result of the lift in purchase likelihood, ARPC increased by \$0.46 (a relative lift of 184%).

In the absence of the base coupon, we would expect a purchase likelihood of 1% (performance in CG). Under T1, the lift in purchase likelihood (1.47%) is only partially explained by the redemption likelihood of 0.48%, because only 19.4% ($\frac{0.48}{2.47}$) of purchases

Table 2. Customer Purchase

Panel A: Low-value segment						
	T1	CG	Difference			
			T1 – CG			
Purchase (%)	2.47	1.00	1.47*** (0.38)			
Redeem (%)	0.48	—	—			
ARPC (\$)	0.71	0.25	0.46*** (0.14)			
ARPB (\$)	28.94	25.43	3.51 (5.52)			
Observations	4,787	1,998				

Panel B: High-value segment						
	T1	T2	CG	Difference		
				T2 – T1	T2 – CG	T1 – CG
Purchase (%)	6.59	9.52	3.37	2.93*** (0.79)	6.15*** (1.08)	3.22*** (0.97)
Redeem (%)	0.83	1.89	—	1.06*** (0.35)	—	—
ARPC (\$)	2.56	3.13	1.20	0.58 (0.41)	1.93*** (0.47)	1.36** (0.62)
ARPB (\$)	38.77	32.92	35.57	–5.85 (3.80)	–2.65 (5.33)	3.20 (10.59)
Observations	1,927	3,446	801			

Notes. Standard errors appear in parentheses. The number of observations for ARPB is the number of customers who make a purchase (i.e., Purchase (%) × Observations).

*** $p < 0.001$; ** $p < 0.01$.

were made by redeeming the coupon. In other words, if increased demand came only from redeemers, the lift should have been no higher than 0.48%. Therefore, much of the lift can be attributed to those customers who made purchases without redemption of the base coupon.

4.1.2. High-Value Segment. As shown in Table 2, Panel B, purchase likelihood increased by 3.22% (a relative lift of 96%) for T1 compared with CG, whereas ARPB was not statistically different. As a result of the increase in purchase likelihood, ARPC increased by \$1.36 (a relative lift of 113%). The redemption likelihood was only 0.83% in T1; that is, 12.6% ($\frac{0.83}{6.59}$) of purchases were made by redeeming the coupon. Hence, we observe a similar pattern of the lift primarily being driven by those customers who purchased without redemption of the base coupon.

In determining what type of customers performed better under the base coupon, we note that, on the one hand, the difference in the lifts of purchase likelihood was 1.75% in favor of the high-value segment and the redemption likelihood conditional on purchase was

lower for the high-value segment, which made the investment less costly. On the other hand, relative lift was higher for the low-value segment because of the lower baseline in purchase likelihood for this segment. In both segments, the base coupon contributed an economically and statistically significant lift in ARPC.

Under the better coupon, we find purchase likelihood increased by 6.15% (a relative lift of 182%) for T2 compared with CG, whereas ARPB was not statistically different. As a result of the lift in purchase likelihood, ARPC increased by \$1.93 (a relative lift of 161%). The redemption likelihood was 1.89%, which means 19.9% ($\frac{1.89}{9.52}$) of purchases were made by redeeming the coupon. The better coupon therefore significantly lifted both purchase and redemption likelihoods relative to the base coupon. This finding suggests that a deeper discount generated higher revenue (mostly still from nonredeemers) but increased the redemption likelihood conditional on purchase from 12.6% in T1 to 19.9% in T2. Interestingly, the redemption likelihood conditional on purchase for the low-value segment under the base coupon was similar to that of the high-value segment under the better coupon.

4.1.3. Summary of Findings on Customer Purchase.

We find that couponing is effective. For both high-value and low-value segments, we find much of the lift in purchase likelihood and revenue as a result of couponing is driven by those customers who purchased without redeeming the base or better coupons. Additionally, the high-value segment had a lower redemption likelihood conditional on purchase than did the low-value segment for the base coupon. The better coupon increased both purchase and redemption likelihoods for the high-value segment relative to the base coupon. Taken together, customer purchases are moderated by customer value (heterogeneity) and coupon value.

4.2. The Effect of Coupons on the Visit-to-Purchase Funnel

In this section, we explore possible explanations of our findings reported in Section 4.1. A novel aspect of our study is that we are able to examine the causal effects of coupons on the visit-to-purchase funnel, starting with whether customers visited the website, how much they searched, and whether they purchased conditional on visiting the store. The observed increase in purchase likelihood as a result of couponing can arise in multiple ways. For example, a coupon could lift purchase likelihood by increasing visit likelihood or purchase likelihood among visitors. The changes in visit likelihood and purchase likelihood among visitors could also occur in opposite

directions that lead to an overall lift in purchase. To examine the effect of coupons on customer purchase along the visit-to-purchase funnel, we construct the following measures, which we delineate by whether they focus on visit, search, or purchase decisions.

The visit decision is captured by the proportion of customers who visited the website (visit likelihood). The search decision has multiple facets because visitors can navigate the website by browsing a web page with a gallery of multiple products, examining a product page with an extensive description of its features, or visiting other web pages such as order history to check products purchased in the past.⁶ We measure the extent of search activity by computing the time duration of search and number of unique web pages viewed by a customer. We note that web pages include any web page on the website, including landing pages, multiproduct gallery pages, and product pages that contain detailed information about a product. We also measure more specific search activity by computing the number of unique product pages viewed as well as how many of them were products promoted by the coupon. The value of this latter metric is to understand if the coupon can stimulate search activity for the promoted products.

We examine purchase decisions using (1) the proportion of visitors who purchased (purchase likelihood among visitors), (2) the number of unique products in the basket, which allows us to understand if basket composition is affected by a coupon, (3) the number of purchased products whose detailed product page was searched, which allows us to understand if customer search affects product purchase, and (4) discounts received for purchase, including storewide mass promotions available on the website and our focal coupon, which allows us to examine any margin erosion as a result of couponing.

We note that visit likelihood is an unconditional measure based on randomization of customers into test and control groups, and the remaining are conditional upon visit or purchase.

4.2.1. Baseline Heterogeneity. Table 3 shows that in the absence of a coupon (CG), the high-value segment was nearly twice as likely as the low-value segment to visit (20.85% versus 11.21%, p -value < 0.001). Furthermore, the high-value segment was much more likely to purchase (16.17% versus 8.93%, p -value = 0.036).

As we measure the time duration of search and number of unique pages viewed upon visiting the store, we examine the extent to which these may account for the above-mentioned patterns. For example, if search behavior varied considerably between the segments, customer search could explain some of the difference in purchase likelihood among

Table 3. Customer Visit-to-Purchase Funnel

Panel A: Low-value segment						
	T1	CG	Difference		T1 – CG	
Unconditional						
Visit (%)	35.12	11.21			23.90***	(1.16)
Duration (min.)	3.82	1.49			2.33***	(0.34)
Pages viewed (no.)	3.17	1.41			1.77***	(0.21)
Conditional on visit						
Duration (min.)	10.88	13.26			–2.38	(1.58)
Pages viewed	9.04	12.54			–3.50***	(0.88)
Product pages viewed	1.25	1.51			–0.27	(0.19)
Promoted product pages viewed	0.68	0.86			–0.17	(0.11)
Purchase (%)	7.02	8.93			–1.91	(1.84)
Conditional on purchase						
Products purchased	2.14	2.45			–0.31	(0.39)
Products purchased with search	0.31	0.20			0.11	(0.16)
Discount (%)	32.86	34.94			–2.08	(3.68)
Observations	4,787	1,998				
Panel B: High-value segment						
	T1	T2	CG	Difference		
				T2 – T1	T2 – CG	T1 – CG
Unconditional						
Visit (%)	44.11	43.76	20.85	–0.35 (1.42)	22.91*** (1.88)	23.26*** (1.98)
Duration (min.)	7.98	8.40	3.85	0.42 (0.75)	4.55*** (1.02)	4.12*** (0.98)
Page views (no.)	6.32	6.60	3.25	0.28 (0.44)	3.35*** (0.60)	3.07*** (0.58)
Conditional on visit						
Duration (min.)	18.08	19.18	18.49	1.10 (1.60)	0.70 (3.15)	–0.41 (3.02)
Pages viewed	14.32	15.08	15.59	0.76 (0.89)	–0.51 (1.76)	–1.27 (1.66)
Product pages viewed	2.20	2.56	2.01	0.36 (0.22)	0.55 (0.45)	0.19 (0.31)
Promoted product pages viewed	1.31	1.69	1.20	0.37** (0.16)	0.49* (0.33)	0.11 (0.19)
Purchase (%)	14.94	21.75	16.17	6.81*** (1.69)	5.58 (3.33)	–1.23 (3.04)
Conditional on purchase						
Products purchased	2.27	1.98	2.26	–0.29 (0.16)	–0.28 (0.26)	0.01 (0.39)

Table 3. (Continued)

Panel B: High-value segment						
	T1	T2	CG	Difference		
				T2 – T1	T2 – CG	T1 – CG
<i>Products purchased with search</i>	0.31	0.22	0.19	–0.09 (0.06)	0.03 (0.10)	0.12 (0.13)
<i>Discount (%)</i>	33.95	36.45	31.34	2.49 (1.34)	5.10 (2.58)	2.61 (2.93)
Observations	1,927	3,446	801			

Notes. Standard errors appear in parentheses. The number of observations for conditional measures such as, for example, conditional on visit, is the number of customers who visit the website (i.e., *Visit (%)* × Observations).

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

visitors. Although visitors from the high-value segment spent approximately 40% more time (18.49 minutes versus 13.26 minutes, p -value = 0.133) and viewed about 24% more pages (15.59 versus 12.54, p -value = 0.112) than visitors from the low-value segment, the differences in search behavior on the website were not statistically different. Given that the high-value segment was 86% more likely to visit and 81% more likely than the low-value segment to convert a visit into a purchase, the difference between two segments was not driven by the difference in search activity at the website.

As a result of the baseline heterogeneity in visit likelihood and purchase likelihood among visitors, disentangling the causal effects of coupons on the visit-to-purchase funnel among heterogeneous customers is important. For example, a coupon effect that increases visit likelihood could have an amplified effect on the high-value segment because those customers are also more likely to purchase upon visiting. Hence, the results described in Section 4.1 can be due to both coupon effects and baseline heterogeneity, and our analysis in this section aims to shed more light on how coupons affect customer behavior.

4.2.2. Low-Value Segment. Panel A of Table 3 shows that visit likelihood (*Visit* in Panel A) increased by 24% (a relative lift of 213%) for T1 compared with CG. The purchase likelihood among visitors (*Purchase* in Panel A), however, reduced by 1.91% from 8.93% in CG to 7.02% in T1 but is not statistically significant. The number of unique pages viewed by customers who visited (*Pages viewed* (conditional on visit) in Panel A) also reduced by 3.50 pages (a relative drop of 28%), which is statistically significant. Therefore, the impact of the base coupon on the low-value segment was a substantial and significant increase in visit likelihood but with no significant change in purchase likelihood among visitors.

We note that under the coupon, the time spent and number of pages viewed by visitors reduced.

Furthermore, the number of unique product pages viewed (*Product pages viewed*, conditional on visit" in Panel A) and the subset of these under couponing (*"promoted product pages viewed*, conditional on visit" in Panel A) also reduced (but these effects are not statistically significant). This finding may indicate a selection effect in which the coupon may have attracted some customers who were not as motivated as in the case in which no coupons were offered. It is consistent with an explanation that some of these customers had a weaker incentive to search beyond targeted items (e.g., Fong 2017). However, the purchase likelihood among visitors was not statistically different between T1 and CG. Because 19.4% of purchasers in T1 redeemed the coupon, we find evidence of a modest but positive redemption effect. Interestingly, across all purchasers in T1, the average discount, including storewide mass promotions available on the website, was about 33%, indicating that purchasers benefited from other mass promotions that might have provided attractive offers for customers. Therefore, the overall null effect for the purchase likelihood among visitors is likely a combination of a positive redemption effect, a selection effect on customers who searched and purchased less than those in CG, and the utilization of other mass promotions compared with coupons studied in the experiment. Put together, the visit likelihood lift dominated redemption for the low-value segment, and no margin erosion was observed.

4.2.3. High-Value Segment. Panel B of Table 3 shows that the visit likelihood (*Visit* in Panel B) increased by 23% (a relative lift of 112%) for T1 compared with CG. The purchase likelihood among visitors (*Purchase* in Panel B) reduced slightly from 16.2% in CG to 14.9% in T1 but is not statistically significant. The number of page views for visitors (*Pages viewed* (conditional on visit) in Panel B) reduced by 1.27 pages, which is also not statistically significant. Although the number of unique product pages viewed (*Product pages viewed* in

Panel B) and the subset of these under couponing (*Promoted product pages viewed* in Panel B) both increased slightly in T1, the effects are not statistically significant. However, the lack of changes in purchase likelihood among visitors relative to the large gain in visit likelihood is again indicative of the coupon's primacy in driving visits to the website without attracting less responsive customers in terms of purchase upon visit.

We next examine how T2 differs from T1 and CG for the high-value segment in terms of the visit-to-purchase funnel. Panel B in Table 3 shows that visit likelihood increased by a similar magnitude (of 23%) for T2 compared with CG, with virtually no difference in lift between T1 and T2. Put differently, discount depth does not appear to have affected visit likelihood for the high-value segment. However, we also find that the purchase likelihood among visitors was statistically higher under T2 than T1. On a percentage basis, we note that the better coupon administered to T2 could have a discount rate of up to 50% (if she purchased a promoted product priced at \$20), which is higher in terms of discount rate than the average discount level from other website-wide mass promotions. Thus, the better coupon “moves the needle” compared with the base coupon and is able to increase coupon redemption, which has the effect of a slight increase in the discount rate (though the change in margin is not statistically significant). However, as the redemption rate among buyers is still only about 20% (compared with 12.6% in T1), much of the increase in demand is not simply because of the higher face value of the coupon but the ability to convert visitors to buyers utilizing other promotions on the website.

Interestingly, the high-value customers under T2 did not exhibit statistically significant differences in the time duration spent and number of pages viewed in search compared with those in T1. However, the high-value customers in T2 viewed more detailed product pages of those products under couponing (*Promoted product pages viewed* in Panel B) than those in T1 or CG (a statistically significant increase). Thus, customer search for promoted products under couponing appears to have been influenced by the better coupon for the high-value segment, whereas the base coupon had no such effect. However, the increase in search for the products under couponing did not translate into an increase in purchases of these products that were perused at a detailed level.

4.2.4. Summary of Findings on the Visit-to-Purchase Funnel. We find the base coupon increased purchases primarily as a result of a lift in visit likelihood, which was about 23% for both high-value and low-value segments. On the other hand, purchase likelihood

among visitors remained largely unchanged. Furthermore, there was no difference in the level of discounts obtained under the base coupon versus the control condition, suggesting that much of the increase in demand is due to utilization of other store-wide mass promotions available to customers and margin erosion is minimal. Interestingly, the difference in the lift of purchase likelihood (1.75%) for the high-value segment over the low-value segment, in fact, resulted from a relatively homogeneous lift in visit likelihood and baseline heterogeneity in customer behavior conditional on visit. In other words, apparent heterogeneous treatment effects when examining purchase lift as a result of the base coupon are, in fact, an outcome of customer heterogeneity.

The better coupon lifted both visit likelihood and purchase likelihood among visitors for the high-value segment relative to the control group. However, visit likelihood was no higher than that for the base coupon, which means the lift in purchase likelihood for the better coupon relative to the base coupon was primarily because of a higher purchase likelihood among visitors. This finding suggests a larger role of coupon redemption for the better coupon than the base coupon. Furthermore, customer search in terms of detailed product pages that were products eligible under the coupon increased under the better coupon.

5. Conclusions

Extant literature presents mixed results on promotions for a heterogeneous customer base. In this study, we focus on the causal effects of coupons on the visit-to-purchase funnel, and we present empirical evidence in the context of our partner retailer that can add to this important topic. Specifically, we study the effect of coupons on purchase and redemption behaviors among heterogeneous customers and examine the drivers of these effects through how coupons affect visit, search, and purchase decisions in an online setting. Our experiment design allows us to tease apart coupon effects and heterogeneity to causally infer where in the visit-to-purchase funnel the coupons used in our experiment have the greatest impact.

In our study, the primary effect of coupons was a lift in visit likelihood; the magnitude of this lift was about the same for both low-value and high-value segments under the base coupon in absolute terms, and the lift remained similar under the base and better coupons for the high-value segment. There was no adverse effect on purchase conversion under couponing, which results in an increase in customer purchase under couponing because of a larger proportion of customers visiting the website. Because the high-value segment had a higher baseline conversion rate than did the low-value segment, the increase in

website visits was magnified when examining revenue lift. Thus, the fact that the high-value segment had a higher lift in revenue than the low-value segment did is not because the coupon effect was stronger for the high-value segment but because purchase conversion rates were heterogeneous.

Furthermore, we find coupon redemption rates were under 20% among buyers in each treatment group. Thus, the majority of increased demand in the treatment groups arose from customers who bought without redeeming coupons made available in this experiment. We find, especially for the base coupon, that other website-wide mass promotions generated a similar amount of discount, and customers took advantage of those offers rather than the base coupon. For the better coupon, redemption rates increased for the high-value segment but without significantly increasing the discount applied to purchases. The main impact of the coupons in our experiment therefore was an increase in website visits while allowing shoppers to choose other mass promotions available on the website, as these could provide better deals for baskets of products chosen by customers.

We find that the base coupon had a negative effect on the number of page views for the low-value segment but not the high-value segment. The better coupon increased the number of page views for products promoted by the coupon for the high-value segment. The number of products whose pages were browsed, however, did not change under either coupon.

For our focal firm, these findings suggest couponing can increase demand with minimal impact on margin erosion. Furthermore, couponing to both low-value and high-value segments can substantially lift visit likelihood for both segments. However, the higher baseline in purchase conversion for the high-value segment amplifies the effect of increased visits for this segment to achieve higher lift in revenue than the low-value segment (on an absolute basis). As our findings are specific to the retail partner involved in this experiment and the type of coupons that we tested, these effects are but one example of the role coupons may play for this particular retailer and may not necessarily generalize in other contexts. However, we suggest that consideration of the lift in website visits as a result of couponing, in addition to redemption rates, can allow for a more holistic evaluation of how coupons impact customer revenue.

Next, we discuss how our key findings relate to the extant literature in Section 5.1. In Section 5.2, we discuss limitations of our study and suggest areas for future research.

5.1. Discussion

Our findings both corroborate and expand on existing literature. The literature documents a promotion-as-

advertising effect in which coupons stimulate purchases that mostly do not involve redemption (e.g., Venkatesan and Farris 2012 and Sahni et al. 2017). Our study provides a demonstration of how such an advertising effect (i.e., demand increase without coupon redemption) can arise through a combination of a lift in website visits and little to no change in both purchase conversion and margin.

Our findings go against the notion that high-value customers who want to buy would visit regardless, such that coupons represent margin erosion (e.g., Lal and Bell 2003, Anderson and Simester 2004, and Musalem and Joshi 2009). This notion is based on the principle of price discrimination (e.g., Narasimhan 1984); coupons expand demand to those who are unwilling to buy without discounts, and therefore additional demand above the baseline should involve coupon redemption. We do find some evidence of a redemption effect, but less than 20% of purchasers redeemed the coupon in our treatment conditions (for either the high-value or low-value segment). As a result, these coupons created demand by driving more visits to the store, upon which a significant number of purchases occurred that would otherwise not have been made (for which the control group acted as the counterfactual), largely by taking advantage of other storewide mass promotional offers on the website.

Seiler and Yao (2017) find null effects for coupon impact on visits to the locations of product categories in a grocery store and subsequent purchases. We reconcile the stronger effects found in our online setting with their study by considering that the cost of visiting a website is likely much lower than the cost of visiting a brick-and-mortar store (or a particular aisle in that store). On the other hand, our findings on the search activity of the low-value segment upon a visit are consistent with those reported in Fong (2017), who finds customers who visit through targeted promotions search less because they focus on deals featured on targeted promotions.

5.2. Limitations and Future Work

A number of limitations should be acknowledged and perhaps addressed in future research. First, an interesting question that our study was not designed to answer is how much of the coupon effects could be obtained through a generic communication that does not include a coupon offer to customers (i.e., a reminder effect). As a result, it is not possible to separate how much of the coupon effects on visit likelihood are due to coupons acting as a reminder to visit as opposed to motivating customers because of the potential discount. Such a condition would provide an alternative baseline to measure sales lift from coupons, although recent studies (e.g., Sahni et al. 2018)

suggest seemingly trivial modification to a communication can change its efficacy, thus opening up a large degree of freedom in how to craft the message for the control group.

Second, we only studied the impact of coupons during the experiment period. We are therefore unable to comment on whether gains resulting from coupons are persistent beyond the experiment period or if intertemporal substitutions exist such that increased demand within the experiment period may be offset by reductions in the postexperiment period (e.g., Neslin et al. 1985). Although challenging, conducting experiments over multiple periods to study dynamic effects of coupons on both immediate and future demand (e.g., Anderson and Simester 2004 and Elberg et al. 2019) as well as on the visit-to-purchase funnel would be fruitful. Third, as our study focused on a single e-commerce website and one type of coupon (“\$X off for selected products”), replication across various industries and coupon types would be needed to build empirical generalizations on this topic.

We hope our work will provide a template for researchers to build on in designing randomized field

experiments involving coupons and that future studies can expand the field’s collective understanding of coupon effects on the visit-to-purchase funnel among heterogeneous customers.

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Appendix. Additional Pretest Descriptive Statistics

Here, we present additional pretest descriptives of the study, which we discussed in Section 4. Panel A of Table A.1 summarizes the individual-level data in the randomized field experiment across the conditions for the low-value segment; Panel B summarizes those for the high-value segment. As shown in both panels, the evidence provides further support that no systematic variation is present in the test.

Table A.1. Additional Pretest Descriptive Statistics

Panel A: Low-value segment						
	T1	CG	Difference			
			T1 – CG			
Recency (days)						
<i>All purchases</i>	188.10	192.27	–4.17			
			(2.96)			
<i>Purchases of a product priced at \$20 or higher</i>	230.19	231.24	–1.05			
			(4.37)			
Frequency						
<i>All purchases</i>	1.66	1.62	0.04			
			(0.03)			
<i>Purchases of a product priced at \$20 or higher</i>	1.25	1.24	0.01			
			(0.02)			
Observations	4,787	1,998				
Panel B: High-value segment						
	T1	T2	CG	Difference		
				T2 – T1	T2 – CG	T1 – CG
Recency (days)						
<i>All purchases</i>	116.29	117.74	121.25	1.45	–3.51	–4.96
				(2.78)	(3.80)	(4.13)
<i>Purchases of a product priced at \$20 or higher</i>	123.77	126.74	132.23	2.97	–5.50	–8.46
				(2.88)	(3.97)	(4.40)
Frequency						
<i>All purchases</i>	4.05	4.12	4.11	0.07	0.01	–0.06
				(0.08)	(0.11)	(0.12)
<i>Purchases of a product priced at \$20 or higher</i>	3.36	3.41	3.42	0.05	–0.01	–0.06
				(0.06)	(0.08)	(0.08)
Observations	1,927	3,446	801			

Note. Standard errors appear in parentheses.

Endnotes

¹ See “How retailers can improve promotion effectiveness,” available at <https://www.bcg.com/en-us/publications/2015/retail-pricing-how-retailers-can-improve-promotion-effectiveness.aspx>, last accessed on November 11, 2019.

² Although conceptually this funnel could be applied equally to both offline and online settings, we focus on an online setting in this paper because it allows for the tracking of data on customer visits to a website, as well as search and purchase conversion within the website (e.g., Fong 2017) at a level of specificity not typically available in offline retailing (an exception being Seiler and Yao 2017).

³ All transactions were recorded in the currency of the country in which the headquarters of the company was located. We converted the purchase amount to U.S. dollars using the average exchange rate over the data period.

⁴ In the appendix, we also present randomization checks for recency and frequency metrics and find customer behavior in the pretest period did not vary across the conditions.

⁵ ARPC is similar to the average revenue per user, which is defined as the total revenue divided by the number of subscribers in industries such as consumer communications, digital media, and network companies.

⁶ Our clickstream data contain detailed information (e.g., product code) on product pages viewed by a customer but do not include information of products displayed in a multiproduct gallery web page.

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