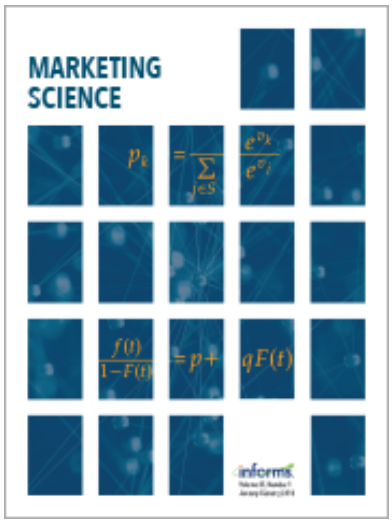

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Lead Offer Spillovers

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Abstract. Price promotions are typically offered in groups on websites, mailings, and circulars, but little is known about how promotional offers in near proximity affect each other. Across two large-scale field experiments (N = 66,184) conducted on a multibrand coupon website, we find that when lead promotions offer high-value deals, consumers are more likely to print *subsequent* offers, a finding we call "lead offer spillover." In the first field experiment, doubling the value of three lead offers increased the printing of subsequent offers by 18% and redemptions by 12%. In the second, doubling the value of a single lead offer increased subsequent offer prints by 12%. Additional analyses and experiments indicate that larger lead offers increase consumer search for subsequent offers and are not primarily driven by changes in evaluative judgments or complementarities between lead and subsequent offers.

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Keywords: price promotions • consumer search • attention • spillovers • field experiments • laboratory experiments

1. Introduction

Price promotions frequently appear in groups. For example, online retailers use splash pages to showcase deals from around their website, continuing a practice that remains widely used in direct mail, local newspaper advertisements, and retail circulars. Although price promotions are frequently presented in concert, little is known about possible spillovers between proximate offers or what considerations managers should make when arranging groups of promotions.

We hypothesize that the value of visually salient promotions influences the likelihood that a consumer selects *any* promotion from the group. We refer to particularly salient promotions as "lead offers," as these are typically the first offers viewed within the group.

We explore this question in the context of print-at-home coupons. In recent surveys, coupons are identified as the most frequent influence on purchase decisions (eMarketer 2016).[1] Eighty-six percent of grocery shoppers say they use shopping lists "at least sometimes," and 79% say they use coupons when developing those lists (AlixPartners 2011). U.S. firms distribute over 300 billion coupons per year and consumers redeem about $3 billion of coupons annually. The most common and fastest-growing digital coupon distribution tactic is a dual electronic and paper system called "print-at-home coupons," in which consumers acquire coupons online (e.g., Coupons.com, Redplum, or Retailmenot), print them at home, and redeem them in-store (Inmar 2014).[2] The printed coupons are then processed by legacy redemption and auditing systems.

Two field experiments executed in collaboration with two partner firms provide the first evidence that high-value lead offers increase consumers' engagement and usage of subsequent promotions. The first experiment manipulated three top-row offer values for a popular brand, holding all subsequent offers on the page constant. The second experiment tested a weaker manipulation, varying a single offer value for an unpopular brand presented in the top-left position.[3] Both experiments were run in situ on large samples (total N = 66,184) of real consumers. Because of the randomized nature of the experiments, we are able to estimate causal effects of the lead offer value on the printing and redemption of the subsequent offers. In the primary experiment, doubling the top row of three lead offer values increased printing of subsequent offers by 18% and increased redemption of subsequent offers by 12%. Larger lead offers generate spillovers by motivating more users to print, rather than encouraging users to print more; that is, the increase mainly comes from the extensive margin as opposed to the intensive margin. In the second experiment, doubling a single lead offer value increased printing of subsequent offers by 12% but did not detectably alter redemptions of subsequent offers.

Why does the organization of price promotions affect consumer choice? We utilize the field data and two

additional online experiments to explore three potential mechanisms related to extant work in economics, marketing, and psychology. First, high-value lead offers may generate positive spillovers by increasing consumers' attention and motivation to search for proximate offers, reminiscent of findings about product positioning within assortments (Chandon et al. 2009, Atalay et al. 2012). Similarly, experiments on consumer search in large choice sets typically find that the value of previously encountered items strongly influences future search and choice (Reutskaja et al. 2011). Second, lead offers may alter evaluative judgments (i.e., consumer perceptions and attitudes) of subsequent offers, independent of motivation to search.[4] Third, lead offers may increase engagement with the lead offer, which in turn could generate complementarities with subsequent offers. The process evidence indicates that lead offer spillovers are primarily driven by increased consumer search for subsequent offers and are not primarily driven by changes in evaluative judgments or complementarities between lead and subsequent offers.

The rest of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents the field experimental context, designs and main results from the two field experiments. Section 4 investigates the mechanisms underlying lead offer spillovers using the field data and two additional online experiments. Section 5 uses the field experiment data to explore how lead offer spillovers affect coupon profitability. Section 6 concludes with managerial implications, limitations, and directions for future research.

2. Relevant Literature

The current paper relates to several strands of literature. First, it contributes to the growing literature on spillovers. Spillovers occur when information affects beliefs that are not directly related to the original message (Ahluwalia et al. 2001). Previous literature has found evidence of perceptual spillovers between products under the same umbrella brand as well as for competing products from different brands (Erdem 1998, Erdem and Sun 2002, Balachander and Ghose 2003, Janakiraman et al. 2009). Particularly relevant is the work of Anderson and Simester (2013), who find found that advertisements can have positive spillovers on sales of competing retailers. Most recently, in the context of digital field experiments, Sahni (2016) manipulated the presence of restaurant advertising on a restaurant search website, showing that restaurant advertising generated significant positive spillovers to competing restaurants' sales. Sahni et al. (2017) examined data from 70 field experiments that manipulated price promotions emailed to customers of a ticket resale platform, finding that price promotions increased expenditures substantially, with 90% of the spillovers accruing from consumers who received, but did not redeem, the price promotions. Sales increases were particularly large for consumers with larger past purchases and for those who had not transacted on the platform in the past year, suggesting that the promotional emails served as a form of "reminder" advertising that encouraged consumers to return to the platform.

Fong et al. (2016) and Fong (2017) conducted field experiments that sent consumers personalized price promotions that matched, or did not match, the consumers' past purchases. Both studies found that targeted offers increased sales of the promoted products, as expected, but also decreased consumer search for nonpromoted products.

Second, our paper contributes to the substantial literature documenting how firm policies influence consumer sensitivity to price and response to price promotions. Anderson and Simester (2004) ran a series of field experiments in the context of catalog retailing, showing that the long-run effects of price promotion depth depend on consumers' purchase history. First-time customers who bought on a larger promotion made more purchases over the following 2-year period, whereas repeat customers who bought on a larger promotion made fewer purchases over the same horizon. Elberg et al. (2017) manipulated price promotion depth in a large-scale field experiment run across 10 stores of a major grocery retailer. They found that consumers exposed to larger initial promotions were more likely to purchase products on subsequent promotions. Venkatesan and Farris (2012) investigated coupon campaigns targeted to grocery stores' top customers, finding two types of positive effects on revenues: redeemed coupons were associated with larger basket sizes, and mere treatment with targeted coupons also increased customer purchases. Although this "mere exposure" effect of coupons had been long hypothesized by price promotion managers, it had never previously been reported in the academic literature. Taken as a whole, this literature proves convincingly that firm policies can influence the responsiveness of demand to price by changing consumers' forward buying and expectations of future promotions.

More generally, our paper contributes to a well-established experimental tradition in price promotions. Coupons and temporary price reductions have been the focus of numerous experimental studies (LeClerc and Little 1997, Raghubir 1998, Guimond et al. 2001). Raghubir et al. (2004) summarize the literature as showing that coupons can have affective, economic, and informational effects on consumers. While much of this previous work has taken place in laboratory experiments, other researchers have used randomized controlled trials to investigate the effectiveness of various coupon and price promotion treatments in the field (Chapman 1986, Bawa and Shoemaker 1987).

3. Field Experiments

3.1. Experimental Setting

We ran two field experiments in collaboration with a large consumer package goods (CPGs) manufacturer and a vendor that operates a print-at-home coupon website for the CPG manufacturer's brands. The CPG manufacturer manages a large brand portfolio that can be categorized into (1) baby products, (2) elder products, and (3) other, a catchall for remaining goods, which mostly includes nonperishable cleaning and household products. The manufacturer's product offerings each address different consumer needs; the product line did not contain any direct complements or substitutes. Our partners requested that we refrain from disclosing the firms, brands, or coupon values.

The website on which the experiment took place was designed and maintained by the vendor to exclusively carry coupon offers for the multicategory manufacturer's consumer product brands. The website was one of the most important online promotional tools for the manufacturer. Visitors came to the site through three primary means: (1) organic search for related keywords (e.g., "[brand name] + coupon"), (2) links promoted on the brands' social media pages, and (3) direct visitation by repeat users. After the initial log-in, the website typically conveyed 20–25 coupon offers for the major brands sold by the manufacturer. Promotion offers and offer values changed asynchronously with no fixed periodicity.

At the time of the first field experiment, 22 coupon offers were displayed in eight rows with three offers on each of the first seven rows (see Figure 1). Each offer consisted of a product image, a savings statement (e.g., "SAVE $X") and a checkbox. Consumers could select any desired combination of offers for printing with a maximum of two prints per coupon offer. Clicking the "print" button downloaded a series of coupon images for printing, triggering a request to the web server that enabled the vendor firm to directly measure which specific offers each consumer selected to print. Printed coupons resembled traditional paper coupons, including an offer value, product image, expiration date, quick response code, bar code, and legal terms (Figure 1 illustrates). Printed coupons could be redeemed with product purchase at any store that accepts paper coupons. All coupons expired 8 weeks after printing.

3.2. Experimental Design

The top row of three offers on the website were experimentally manipulated for a period of one month (see Figure 1). The three lead offers applied to three products within the most popular brand's product line. The lead offers applied to products that are purchased frequently, disposed of after use, storable, and relatively low price. To offer intuition, the nature of the blinded product category is similar to "baby wipes." All subsequent offers, including positions and offer values, below the first row were held constant for the duration of the experiment for all users.

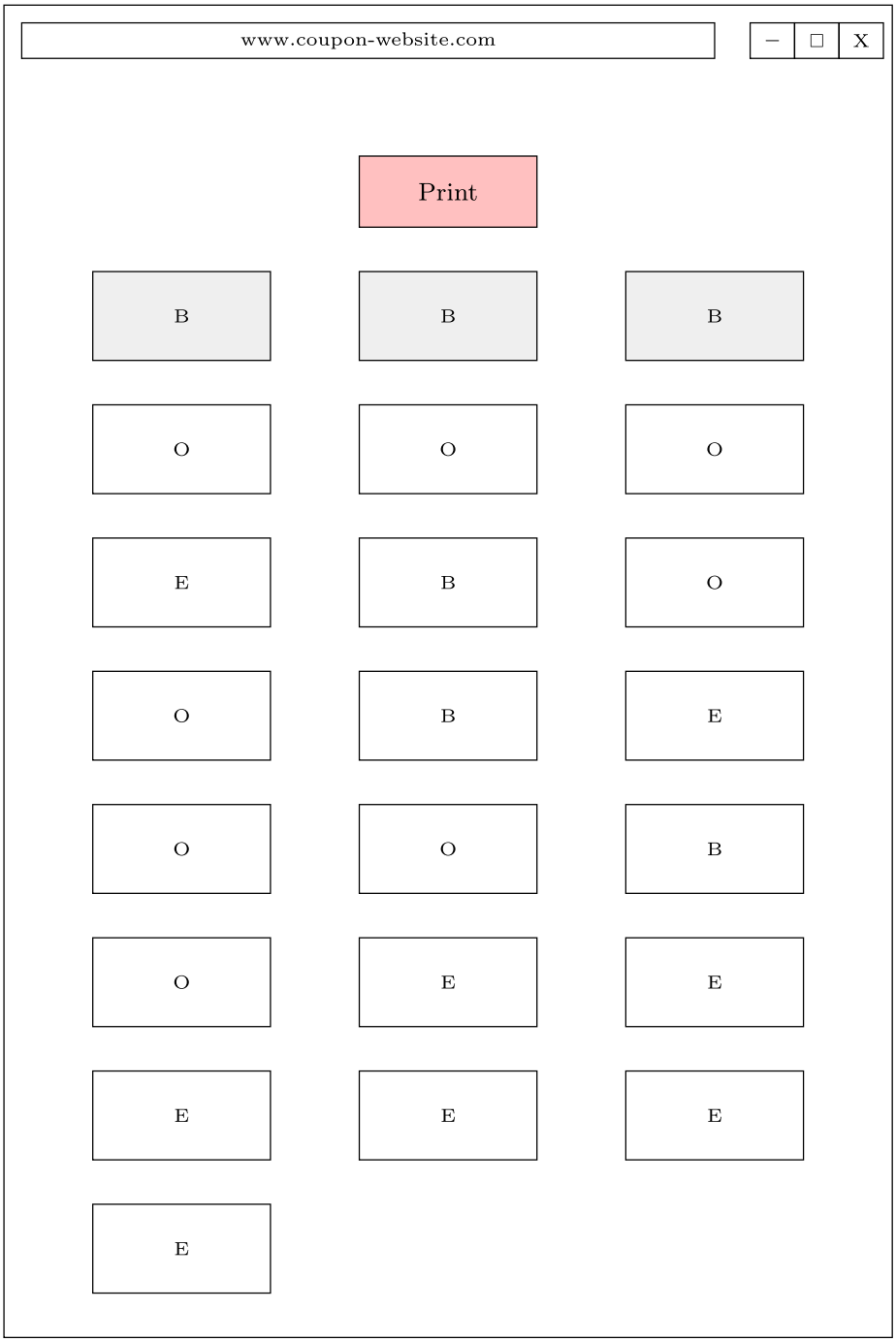
Users were randomized into one of four treatments: $V1, $V2, $V3, or $V4, where $V1 < $V2 < $V3 < $V4. A user in the $V1 group saw a top row consisting of three $V1 offers whereas a user in the $V4 group saw three $V4 offers for the same three products. $V1 was a below-average offer value; $V2 represented the historical average offer value on the website; $V3 was above average; and $V4 was a highly desirable offer equal to 2 times $V1. We primarily compare the $V4 and $V1 treatments as the results are directly interpretable as elasticities. The random assignment was made upon each user's first login to the website during the sample period (i.e., based on a unique email address) and held constant for the duration of the experiment.

The sample consisted of $N = 38{,}296$ website visitors. We observe complete user visitation, printing, and redemption data for each offer on the website during the sample period. Table 1 verifies random assignment by showing that users' pretreatment historical website usage was uncorrelated with offer value treatment.

Printing of promotional offers usually occurred within seconds of website visitation, thus the differences in printing behavior across different experimental manipulations ($V1, $V2, $V3, or $V4 treatments) should be interpreted as direct causal effects. Printing is more than just an intermediate step required for redemption; it is a costly action that signals consumer engagement with the promotion. We spoke with manufacturer promotions managers who expressed the belief that the act of coupon printing itself represents tangible value for the brand by increasing brand purchase intention and encouraging more favorable brand attitudes. Although this speculation remains untested, we consider it plausible, as it aligns with the "mere-exposure" effects of coupons reported in Venkatesan and Farris (2012), who provided the first quasi-experimental evidence that exposure to coupons increases revenues net of marketing costs even among nonredeemers.

Redemption of promotional offers is also an important behavior, but the causal effects of the experimental manipulation on redemptions are less straightforward and more difficult to estimate precisely. There are multiple factors that could be influenced by the random offer value treatment that could, in turn, also influence the redemption decision, such as purchase timing or store choice. Redemption behavior is also more sparse; 22% of coupons printed from the website were redeemed. Redemption is also more influenced by unobserved shocks, such as the current market conditions encountered within the retail store. The sparsity and noise decrease statistical power

Figure 1. (Color online) Web Page Layout for Field Experiment 1



Notes. Gray boxes indicate treated lead offers. White boxes represent nontreated subsequent offers. The letters inside the boxes designate the product type of the offer occupying that position. "B" stands for a baby category offer; "E" stands for an elder category offer; and "O" stands for other category offer.

to detect the causal effects of the offer value treatments on redemption behavior. Furthermore, unlike printing, redemptions may or may not be profitable to the manufacturer as they are a direct additional cost and hence, could be subsidizing loyal consumers who would have purchased the brand without the coupon (Neslin and Shoemaker 1983); the manufacturer, like most of its competitors, did not employ reliable methods to estimate coupon campaign profitability.[5] For these reasons, we report main effects of lead offer values on redemptions, but we focus more on printing behavior as the metric of primary interest, as its greater statistical power allows for deeper and more reliable exploration of the mechanisms driving the lead offer spillovers.

Table 1. Field Experiment 1, Randomization Checks

Historical variable	V1	V2	V3	V4	*p*-Value
All views	174.528 (159.583)	178.015 (171.089)	175.936 (168.584)	175.271 (164.277)	0.734
Lead offer product views	24.241 (22.864)	24.926 (25.093)	24.523 (24.344)	24.498 (24.822)	0.544
Nonlead offer product views	150.287 (138.182)	153.089 (147.459)	151.414 (145.801)	150.773 (141.204)	0.768
Baby product views	62.802 (57.133)	64.332 (62.487)	63.487 (60.933)	63.302 (60.082)	0.623
Elder product views	51.589 (48.34)	52.607 (51.696)	52.055 (51.424)	51.731 (49.209)	0.738
Other product views	60.138 (55.108)	61.077 (58.106)	60.395 (57.348)	60.238 (56.145)	0.833
All prints	13.149 (15.023)	13.211 (15.616)	12.939 (14.783)	13.124 (15.239)	0.819
Lead offer product prints	5.356 (6.659)	5.418 (6.573)	5.201 (6.343)	5.231 (6.611)	0.287
Nonlead offer product prints	7.792 (10.797)	7.793 (11.463)	7.737 (10.811)	7.893 (11.224)	0.918
Baby product prints	6.976 (8.803)	7.095 (9.023)	6.771 (8.49)	6.859 (8.831)	0.265
Elder product prints	0.617 (2.286)	0.631 (2.714)	0.671 (2.392)	0.654 (2.528)	0.684
Other product prints	5.556 (7.955)	5.485 (7.908)	5.496 (7.827)	5.611 (8.033)	0.847
User account age	115.128 (57.405)	116.45 (57.325)	114.122 (57.601)	115.424 (57.587)	0.230

Notes. This table reports means and standard deviations for historical (pre-experiment) user behaviors for each treatment group ($V1, $V2, $V3, or $V4). For each variable we conduct an ANOVA and report the resultant *p*-value, with the null hypothesis being that all means across the four treatment groups are equal.

3.3. Results

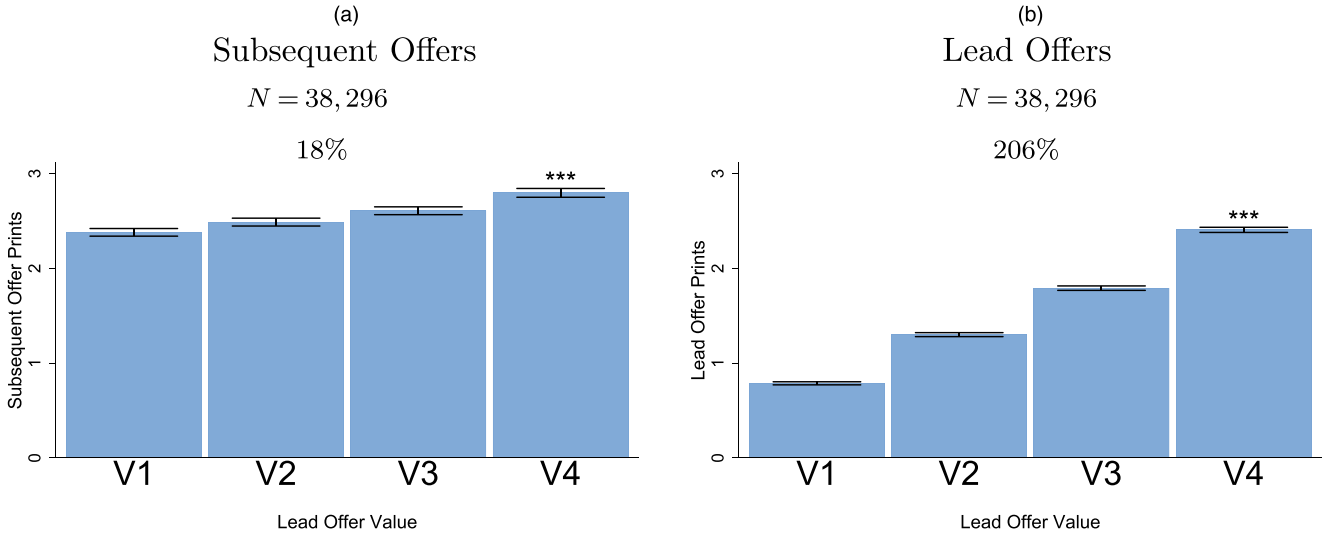
Figure 2 depicts the treatment effects of offer value on coupon printing. Panel (b) shows the number of lead offers printed increased from an average of 0.79 for the $V1 treatment to 2.41 for the $V4 treatment, a 206% increase ($t(19{,}086) = 52.54$, $p < 0.001$), confirming that website users were more likely to print higher-value offers, as one would naturally expect. Panel (a) shows that there was also a highly significant increase in the number of *subsequent* offers printed. Full printing and redemption results are summarized in Table 2.

The average number of subsequent offer prints in the $V1 treatment was 2.38, while the average number of prints for the $V4 treatment was 2.80, an 18% increase ($t(19{,}086) = 6.81$, $p < 0.001$). We can use the fact that $V4 was a 100% increase in offer value over $V1 to calculate an elasticity of printing subsequent offers with respect to lead offer value. The resultant elasticity of 0.18 indicates that increasing the lead offer value by 10% leads to around 2% more subsequent offer prints. Lead offer spillovers in printing behavior exist for all pairwise comparisons of treatment groups, and are monotonically increasing in lead offer value: the average number of subsequent offer prints in the $V2, $V3, and $V4 groups were 5%, 10%, and 18% greater than in the $V1 group, respectively ($t(19{,}606) = 1.87$, $p = 0.062$; $t(19{,}772) = 3.95$, $p < 0.001$; $t(19{,}086) = 6.81$, $p < 0.001$). When comparing $V3 and $V4 to the historically typical discount offer value of $V2, we calculate lead offer spillovers of 5% and 12%, respectively ($t(19{,}206) = 2.04$, $p = 0.059$; $t(18{,}520) = 4.94$, $p < 0.001$).

The positive spillovers between higher lead offer values and subsequent offer engagement persist in the redemption results as well: the data show that the $V4 lead offer treatment increased subsequent offer redemptions by 12% ($t(19{,}086) = 2.78$, $p = 0.006$) compared with the $V1 treatment, though redemptions of subsequent offers do not increase uniformly with lead offer value (see Table 2), as redemptions in the $V3 condition were slightly lower than in the $V2 condition, but the difference was not statistically significant.

Another way to quantify the spillover's magnitude is to compare the relative sizes of the main effect

Figure 2. (Color online) Field Experiment 1, Results



Notes. The figure shows average printing results with standard error bars for subsequent offers [panel (a)] and lead offers [panel (b)]. The percentage lift between $V1 and $V4 is presented on top of each chart. Stars indicate significance levels for a two-sided *t*-test comparing outcome variables between $V4 and $V1.

$^{\dagger}p < 0.10$; $^{*}p < 0.05$, $^{**}p < 0.01$; $^{***}p < 0.001$.

and the spillover effect. In this experiment, going from $V1 to $V4 yields an additional 1.62 lead offer prints and 0.42 additional subsequent offer prints. This 4-to-1 ratio is closer to 15-to-1 for redemptions, indicating the spillover effect is smaller than the main effect. The relative sizes of these effects may be influenced by numerous factors, including the relative offer values of lead and subsequent offers, the number of lead and subsequent offers, and the assortments of lead and subsequent products. Such relationships might be a fruitful area for further study.

3.3.1. Treatment Effects by Offer Row, Product Category, and Previous Website Usage. It is informative to investigate how lead offer spillovers vary across different dimensions on the page and types of users. For example, if lead offer spillovers were observed within just their own category ("Baby" products), the effect on subsequent offers could be driven by within-category complementarities. However, that is not the case. Figures 3 and 4 show the robustness of the spillover by position on the page and across different product categories, respectively. The effect across rows shows that high-value lead offers induce strong spillovers across the entire group of offers. Figure 4 indicates that lead offer spillovers to subsequent offers in the "elder" category were comparable in magnitude to the "baby" category, and subsequent offer prints in the "other" category also increased significantly with lead offer value.

Table 3 shows how lead offer spillovers vary with users' previous website usage. To consider these

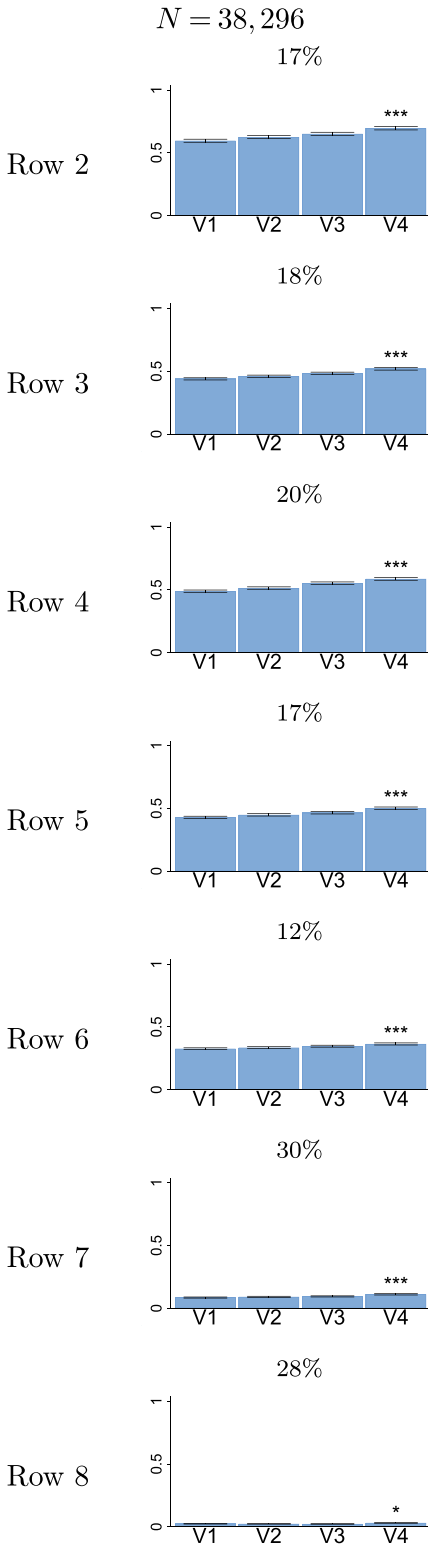
Table 2. Field Experiment 1, Main Effects

Lead offer Value	Subsequent offers				Lead offers			
	Prints	% lift	Redeems	% lift	Prints	% lift	Redeems	% lift
$V1	2.380 (4.041)	—	0.378 (1.121)	—	0.787 (1.625)	—	0.080 (0.568)	
$V2	2.488† (4.055)	4.537	0.419* (1.181)	10.980	1.301*** (2.062)	65.228	0.208*** (0.867)	162.088
$V3	2.607*** (4.07)	9.565	0.402 (1.097)	6.426	1.791*** (2.306)	127.524	0.343*** (1.179)	331.448
$V4	2.796*** (4.41)	17.500	0.423** (1.12)	11.948	2.406*** (2.572)	205.639	0.772*** (2.702)	870.720

Notes. Means and standard deviations for lead and subsequent offers. Stars indicate significance levels for a two-sided *t*-test comparing outcome variables between either $V2, $V3, or $V4 and $V1 (baseline).

$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Figure 3. (Color online) Subsequent Offer Prints by Row for Field Experiment 1



Notes. This figure shows average printing results with standard error bars for subsequent offer prints in each row of offers displayed. The vertical axis shows the average number of subsequent offer prints. The top-most chart (labeled "Row 2") depicts results for first row of subsequent offers (the first row on the web page consisting entirely of lead offers), the second bar chart is for the second row of subsequent offers, and so on. The drop-off in average printing behaviors for rows 7 and 8 is because of the featured products in these positions historically have lower printing rates. Row 8 only contained one coupon, whereas all other rows contained three coupons. The respective percentage lift between \$V1 and \$V4 is presented on top of each chart. Stars indicate significance levels for a two-sided *t*-test comparing the respective outcome variables between \$V4 and \$V1.

$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

effects, we first divide users into two groups: first-time visitors to the web page, and those who had visited at least once prior to the experiment. Columns (1) and (2) show that significant lead offer spillovers are present within each subsample and are larger for those visitors with previous website experience. Next, we again divide all experimental subjects into two groups: first-time coupon printers, and those who had printed at least one coupon prior to the experiment. Naturally, this second division is similar to the first, as previous website usage is a necessary condition for printing at least one coupon prior to the experiment. Columns (3) and (4) again show that lead offer spillovers are highly significant in both divisions and are larger for those who had printed coupons previously. Specifically, we find that the lead offer spillovers for new visitors are 12% versus 24% for return visitors and, similarly, 13% for new printers versus 23% for return printers. Return visitors have more information about the full distribution of coupon values typically offered on the website. Therefore, we suspect that they are better able to recognize that the \$V4 treatment is unusually large, are more likely to react to the high-value treatment by recalibrating their expectations, and respond by searching more for subsequent coupons. Another possible explanation is selection between the two groups, as preexisting differences between consumers may correlate with pre-experiment website usage and coupon printing.

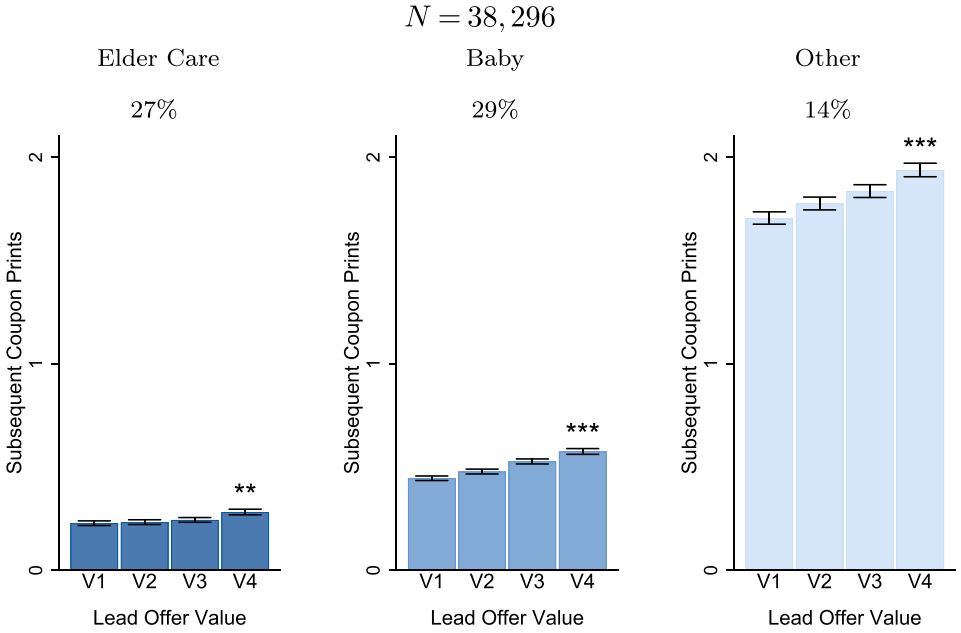
3.3.2. Extensive Margin. To analyze whether lead offer spillovers are driven more by the extensive margin (the number of users printing subsequent offers) or by the intensive margin (the number of subsequent offers printed per user), we investigate the effect of the lead offer value on the propensity to print any subsequent offer versus the total number of subsequent offer prints conditional on printing at least one subsequent coupon.

We model the probability that user i prints *at least one* subsequent offer during the experiment using a probit model:

$$\begin{aligned}&\text{Prob}(PRINT_i = 1 \mid VALUE_i)\\ &\quad = \text{Prob}(\alpha + VALUE_i'\beta + \epsilon > 0 \mid VALUE_i)\\ &\quad = \Phi(\alpha + VALUE_i'\beta),\end{aligned}$$

where $PRINT_i$ is a dummy variable for whether user i printed at least one subsequent product coupon, and $VALUE_i$ is a 3×1 vector containing indicator variables

Figure 4. (Color online) Subsequent Offer Prints by Product Category for Field Experiment 1



Notes. This figure shows the average printing results with standard error bars for subsequent offer prints within each product category. The respective percentage lift between $V1 and $V4 is presented on top of each chart. Stars indicate significance levels for a two-sided *t*-test comparing the respective outcome variables between $V4 and $V1.
$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

for each lead offer value treatment ($V1 being the control group). Φ denotes the cumulative distribution function of the standard normal distribution. The vector β includes the coefficients of interest, with higher elements of β indicating an augmented probability of printing at least one coupon. Table 4 presents the estimation results, standard errors, and marginal effects. The positive marginal effects indicate that seeing a higher lead offer made users more likely to print at least one subsequent offer. Specifically, users who saw $V4 lead offers were about 7% more likely to print a subsequent offer compared with users who saw $V1 lead offers.

3.3.3. Intensive Margin. We also look at the average number of subsequent offers printed, conditional on having printed at least one coupon. Relative to the extensive margin, the intensive margin expansion is

Table 3. Field Experiment 1, Lead Offer Spillovers Within User Subsamples

	Website visits		Coupon prints	
	No pre-exp. visits	1+ pre-exp. visits	No pre-exp. prints	1+ pre-exp. prints
$V2	0.139	0.0850	0.152†	0.0657
	(0.0900)	(0.0782)	(0.0852)	(0.0821)
$V3	0.101	0.338***	0.121	0.337***
	(0.0891)	(0.0783)	(0.0844)	(0.0822)
$V4	0.308***	0.511***	0.306***	0.530***
	(0.0908)	(0.0798)	(0.0861)	(0.0836)
Cons	2.490***	2.284***	2.409***	2.351***
	(0.0624)	(0.0548)	(0.0592)	(0.0574)
Observations	17,764	20,532	19,278	19,018

Notes. The dependent variable in each regression is the number of subsequent offer prints. Columns (1) and (2) show the lead offer spillovers estimated within two subsamples of the data: those users who had never previously visited the web page and those who had previously visited the web page. Columns (3) and (4) show the lead offer spillovers estimated within another two different subsamples of the data: those users who had never previously printed a coupon from the web page and those who had previously printed a coupon. Nested interaction models give qualitatively similar results. Standard errors are in parentheses.
$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 4. Probit Regression Results

Variable	Estimate	Marginal effects
$V2	0.06***	0.023
	(0.02)	(0.00)
$V3	0.13***	0.05
	(0.02)	(0.00)
$V4	0.18***	0.07
	(0.02)	(0.00)

Notes. Robust standard errors in parentheses. $V1 is the reference group. The dependent variable is a dummy variable for whether the user printed at least one subsequent offer.
$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

more modest: the average number of prints conditional on printing at least one subsequent offer shows only a 4% increase in the $V4 treatment group relative to users in the $V1 group, but no statistically significant change in the $V2 or $V3 treatment groups relative to $V1.

3.4. Replication with a Weaker Manipulation

We ran a second field experiment to test whether the lead offer spillovers effect would generalize within the same context under an intentionally weaker set of conditions, with (a) fewer lead offers manipulated, (b) a less popular brand offered as the lead offer, and (c) without a historically high value treatment comparable to $V4. The experiment took place on the same website as the first field experiment, with the help of the same two companies, and lasted for one month. Instead of randomizing the value on the entire top row consisting of three offers, we treated a single top-left offer for a low-share feminine personal care brand from the "other" category. The three high-popularity coupons treated in the first field experiment were present, untreated, and classified as "subsequent offers" in this second field experiment. Users visiting the website during this time period were randomly assigned to one of three offer value treatments: $W1, $W2, or $W3. $W1 was a below-average offer for the website; $W2 corresponded to the historical average offer value equal to 2 times $W1; and $W3 was an above-average offer value. Figure 5 illustrates the design and Table 5 confirms proper randomization by showing that historical website usage does not predict treatment assignment.

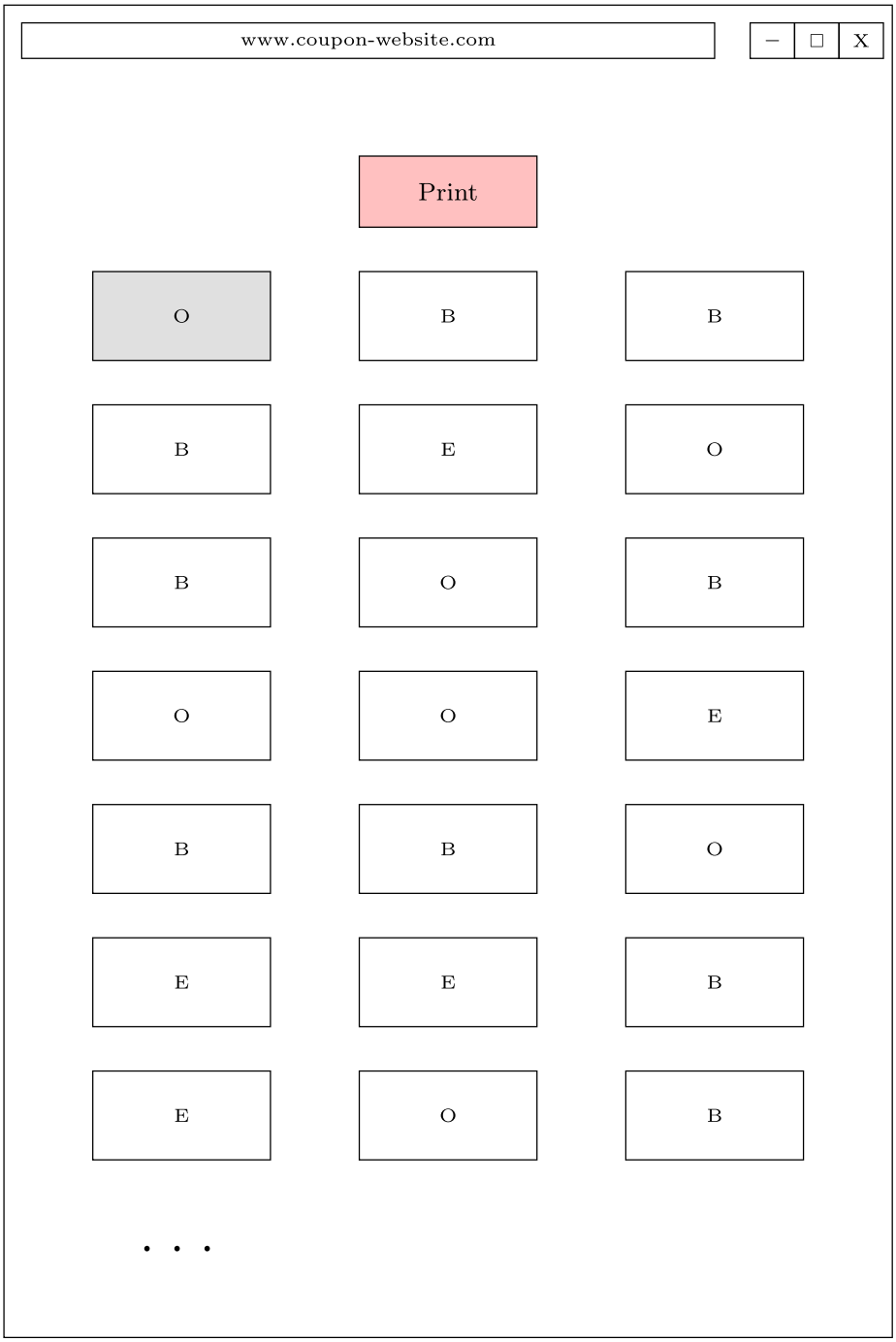
3.4.1. Results. In total, $N = 27{,}888$ users were exposed to the treatments. Table 6 contains summary statistics for the number of prints and redemptions for both lead and subsequent offers. Figure 6 depicts the lead offer spillovers. The positive, statistically significant spillovers from the treated lead offer values to subsequent offers replicate ($t(18{,}294) = 4.50$, $p < 0.001$). Specifically, consumers in the $W1 group printed 3.09 subsequent offers while consumers in the $W3 group printed 3.47 subsequent offers, a 12% increase. Paralleling the first field experiment, the differences in subsequent print behavior are explained mostly through the extensive margin (motivating consumers to print any coupons) rather than the intensive margin (encouraging consumers to print more coupons). Overall, these results reinforce the findings of the first field experiment: higher value lead offers increase subsequent offer printing.

Redemptions of lead offers in the $W2 condition were 117% higher than in the $W1 condition, a result that is not dissimilar to the 162% lift between the $V1 and $V2 conditions in the first field experiment. However, regrettably, an offline technical error occurred after the sample period that prevented the partner firms from measuring redemptions for the lead offer coupon in the $W3 treatment condition. This was an unusual occurrence related to processing of printed coupons by vendors. Although it affected one of the lead offer treatments, it did not affect any of the other 50+ coupon campaigns considered in the two field experiments. Most importantly, it did not prevent estimation of lead offer spillovers to subsequent offer redemptions or how they changed with lead offer values.

In the second field experiment, the effect of lead offer value on subsequent offer redemptions was not statistically significant. However, this null result may be affected by low statistical power due to a higher variance in the outcome variables. If we draw on the effect sizes of the first field experiment and the sample size as well as mean and variance of the outcome variables in the second experiment, we would predict only a 55% chance of estimating the same effect at a 95% confidence level, that is, a 45% chance of a false negative. If the treatment effect in the second field experiment was smaller due to the intentionally weaker manipulation, then statistical power would be even lower.

The size of the treatment effect on printing of lead offers when going from $W1 to $W3, relative to the spillover effect on printing of subsequent offers, is far smaller (roughly 1-to-2) compared with the 4-to-1 ratio observed in the first field experiment. It is worth remembering that the two field experiments differ in their numbers of lead offers manipulated (and therefore the number of subsequent offers included) and that the three popular lead offers in the first field experiment are classified as subsequent offers in the second field experiment. Moreover, the manipulated offer was from an "other" category that was considerably less popular than the "baby" brand offers used in the first experiment: the average historical print rate of the "other" offer is about one-third of the average historical print rate of the more

Figure 5. (Color online) Web Page Layout for Field Experiment 2



Notes. The gray box indicates the treated lead offer, and white boxes subsequent offers. The letters in the boxes designate the type of coupon occupying that position. "B" stands for a "baby" product offer; "O" stands for an "other" product offer; and "E" stands an elder care product offer.

popular "baby" category brand offers that were manipulated in the first field experiment. We speculate, but cannot prove, that the difference in spillover ratios is best explained by the status of the most popular product as either a lead offer or a subsequent offer. There may also have been changes in the consumer population visiting the website, macroeconomic conditions, or other market factors that may have changed between the two sample periods. As with any two experiments run in the field at different times, it is not possible to attribute the differences between the first and second field experiments exclusively to any single factor. Regardless, the fact that we still see significant spillovers in printing supplies reinforcing

Table 5. Field Experiment 2, Randomization Checks

Historical variable	W1	W2	V3	*p*-value
All views	134.492 (215.566)	133.104 (212.061)	129.987 (212.808)	0.342
Lead offer product views	5.901 (10.81)	5.935 (10.816)	5.709 (10.739)	0.308
Nonlead offer product views	128.591 (205.981)	127.169 (202.388)	124.278 (203.272)	0.344
Baby product views	28.224 (51.195)	28.226 (50.811)	27.448 (50.54)	0.487
Elder product views	29.187 (52.09)	29.08 (51.409)	28.46 (51.744)	0.588
Other product views	31.003 (54.66)	30.914 (54.254)	30.217 (54.445)	0.561
All prints	9.118 (19.378)	9.239 (19.975)	8.981 (18.857)	0.664
Lead offer product prints	0.682 (2.035)	0.654 (1.966)	0.622 (1.849)	0.113
Nonlead offer product prints	8.436 (18.234)	8.585 (18.801)	8.358 (17.826)	0.696
Baby product prints	2.936 (7.633)	2.981 (7.789)	2.929 (7.504)	0.882
Elder product prints	0.428 (2.321)	0.451 (2.764)	0.456 (2.382)	0.731
Other product prints	3.141 (7.446)	3.197 (7.701)	3.027 (7.25)	0.288
User account age	131.36 (184.042)	131.648 (183.727)	128.089 (183.687)	0.343

Notes. This table reports means and standard deviations for historical (pre-experiment) user behaviors for each treatment group ($W1, $W2, or $W3). For each variable, we conduct an ANOVA and report the resultant *p*-value, with the null hypothesis being that all means across the three treatment groups are equal.

evidence that even less pronounced lead offers for less desirable products can spill over to subsequent promotions, and that the first experiment's finding of lead offer spillovers is reasonably robust. In the next section, we investigate possible reasons why lead offers generate spillovers to subsequent offers.

4. Mechanisms and Online Experiments

Why do higher-value lead offers increase take-up of subsequent offers? We investigate three possible mechanisms: (1) search motivation: high-value lead offers increase consumers' motivation to search for subsequent offers; (2) spillovers of evaluative judgment:

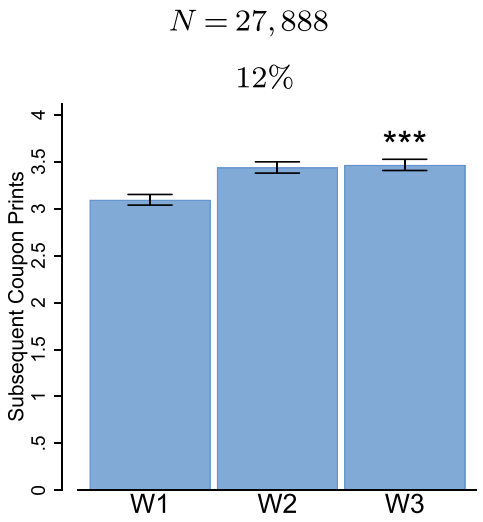
Table 6. Field Experiment 2, Main Effects

Lead offer Value	Subsequent offers				Lead offers			
	Prints	% lift	Redeems	% lift	Prints	% lift	Redeems	% lift
$W1	3.094 (5.379)	–	0.414 (1.666)	–	0.186 (0.529)	–	0.033 (0.364)	–
$W2	3.438*** (5.742)	11.123	0.472 (2.081)	14.039	0.272*** (0.621)	46.468	0.071*** (0.383)	117.242
$W3	3.466*** (5.874)	12.003	0.393 (1.537)	–5.005	0.388*** (0.739)	109.202	na	na

Notes. This table reports means and standard deviations for lead and subsequent offers. Stars indicate significance levels for a two-sided *t*-test comparing outcome variables between either $W2 or $W3 and $W1 (baseline). There were technical issues with tracking and processing the redemptions of individuals in the high-value treatment group in the follow-up field experiment (redemption levels are marked with na). This resulted in almost zero redemptions for lead offers with $W3. This was due to postexperiment *offline* redemption technology malfunction. Pre-experiment random assignment to the three treatment groups was implemented correctly (see Table 6 for randomization checks in the follow-up experiment) and *online* printing behavior was not affected by this malfunctioning.

$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Figure 6. (Color online) Field Experiment 2, Lead Offer Spillovers



Notes. This figure shows the average printing results with standard error bars for subsequent offer prints across the three lead offer treatment levels. The respective percentage lift between $W1 and $W3 is presented on top of the chart. Stars indicate significance levels for a two-sided *t*-test comparing average prints between $W3 and $W1 treatment groups.

$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

lead offer value influences users' evaluations of subsequent offers; and (3) complementarities: acting on a lead offer may make subsequent offers more attractive. The first two possibilities decompose the selection of subsequent offers into its constituent parts (search and evaluation) whereas the third speaks to motivation to select subsequent offers. We consider multiple mechanisms consistent with lead offer spillovers as we have no reason to believe a priori that the effect was limited to any single explanation.

We undertake these studies using a mixture of further analyses of the field experiment data and additional experiments run on subjects recruited from Mechanical Turk. The field data are generated by *in situ* behavior but it does not enable distinctions between the search and evaluation processes that lead to choice. The MTurk subject pool has well-known limitations but offers two distinct advantages and one weakness particular to this application. First, it allows for further replication by investigating whether lead offer spillovers can be found in a consumer population that did not self-select into a multibrand coupon website; this generalization is relevant because many coupon offers are distributed via paid media. Of course, subjects recruited from MTurk are also self-selected, but on a different basis; and, because they are likely to be income constrained, we think it is reasonable to believe that they may respond positively to price promotions and therefore constitute a relevant sample to study. Second, running experiments on MTurk subjects allows for more intrusive manipulations of attention and other factors, including two designs that would have interfered significantly with the partner firms' promotion campaigns if they had been run in-market and that allow for distinct measurement of the search and evaluation processes underlying promotion choice. Third, because our partner firms did not collect information about website users, we are not able to quantify similarity between the two pools.

4.1. Search Motivation

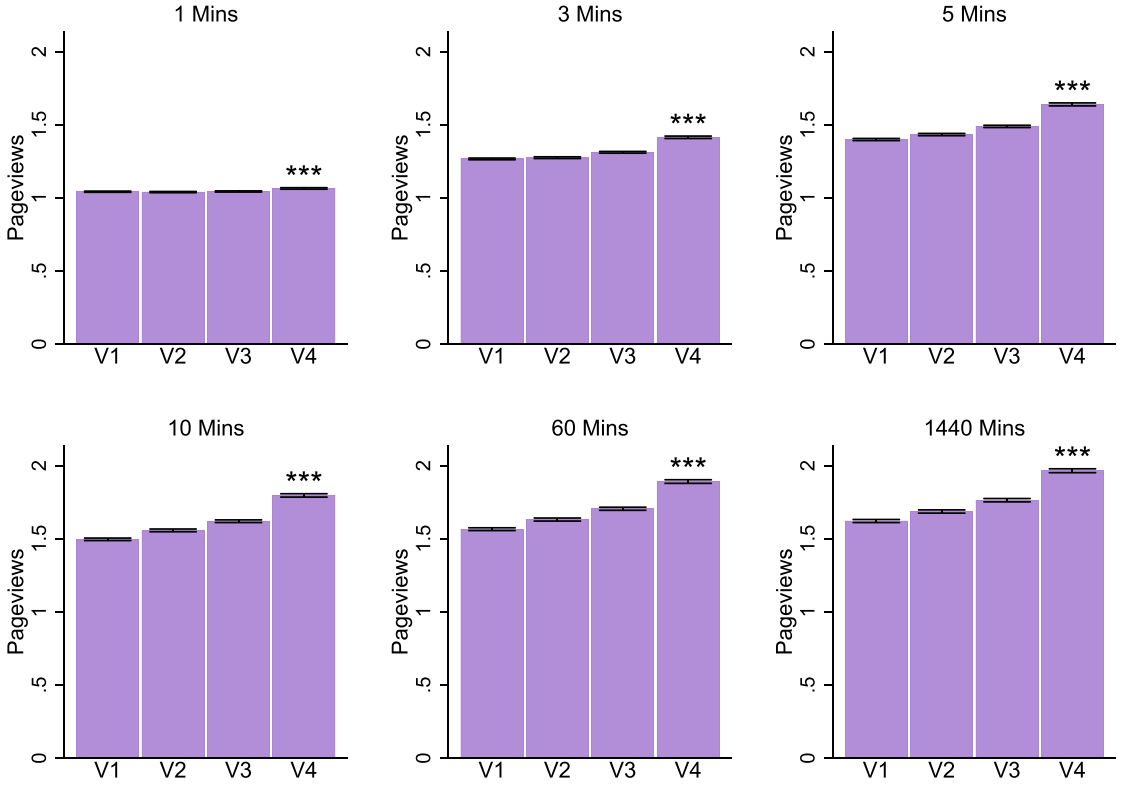
A user's willingness to search through subsequent offers might depend on their expectation about the value of subsequent offers on the web page. Under this framework, higher-value lead offers would increase consumers' expectation of the availability of high-value coupons in general and therefore make them more likely to explore subsequent offers on the page. Greater consideration of nonrivalrous offers would then lead to more printing of subsequent offers.

Evidence consistent with this hypothesis comes from several literatures. First, previous work has found that the attention a product receives depends on its physical location. For instance, shelf positions and the number of product facings influence which products consumers notice (Chandon et al. 2009). Additionally, products in more prominent positions are often rated as more desirable (Dreze et al. 1994, Torralba et al. 2006, Atalay et al. 2012). Second, when searching through large choice sets, the models that best explain behavior typically allow for consumers to search for an amount of time that depends on the value of previously encountered items (Reutskaja et al. 2011), suggesting that individuals often do not search exhaustively (Caplin et al. 2011).

Website usage data from the field experiments do not measure consumer attention and search motivation directly, but surrogate measurements are available, such as the number of website visits within 24 hours after the first treatment in the first field experiment. Figure 7 depicts the number of web page views by treatment group within each of six time horizons after initial treatment. The number of page views increased monotonically with increasing lead offer value in all time horizons considered. Users in the $V1 group visited the page on average 1.62 times in the first 24 hours after first site visit, whereas users in the $V4 group returned to the page 1.96 times, a 21% increase ($t(19{,}086) = 20.50$, $p < 0.001$).

To more directly test for spillovers in attention, we designed an incentive-compatible online experiment that first presents subjects with either high- or low-value lead offers and then directly measures search and choice behaviors.[6]

Figure 7. (Color online) Page Views for Users in Field Experiment 1



Notes. Bars depict the average number of page loads (with standard errors) for different treatment groups and for discrete periods of time after users' first visit during the experimental period. For example, the top-right panel depicts the average number of times a user loaded the page of offers within 5 minutes of first visiting the page. Stars indicate significance levels for a two-sided *t*-test comparing the respective outcome variables between $V4 and $V1.

$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

4.1.1. Experiment Design. Participants (612) were recruited from Amazon's Mechanical Turk platform. After providing consent, subjects were randomly placed into high- or low-value lead offer treatment groups. In both groups, subjects were presented with three pages that each displayed 27 offers in a nine row by three column grid (Figure 2; Table A.3). The top row on each page contained three experimentally manipulated lead offers while the 24 subsequent offers on each page were untreated. The three lead offers took on uniformly high or low values on all three pages of offers. The high-value offers provided four times the discount offered by the low-value offers. Directly beneath each offer was a check box that participants could mark in order to receive the offer later. A continuation button at the bottom of the screen submitted responses and advanced the subject to the next page of coupons.

Critical to the design, only the three lead offers were always visible to subjects. The 24 untreated subsequent offers were covered with gray boxes, initially occluding the offer they represented. In order to view each subsequent offer, subjects had to move their mouse cursor over the gray area and click the offer. Each occluded offer remained visible while the cursor hovered over the box and was obscured again when the cursor left the box, a design reminiscent of MouselabWEB (Johnson et al. 2008, Willemsen and Johnson 2010). Immediately before participating in the task, subjects were informed that some offers would be hidden and practiced how to view the hidden offers.[7]

Participants were incentivized to select all offers of interest. The larger incentive structure was designed to adhere to widely accepted methods in experimental economics, where a random subset of choices is binding. Specifically, while all subjects received a $1 participation payment, we randomly chose one lead offer and one subsequent offer, and subjects' decisions for those offers were implemented for one out of every 10 subjects. For example, if a randomly chosen offer was one that the subject chose to receive, then the participant received an email with a copy of the offer that could be redeemed. However, if the subject did not select the offers that were randomly chosen for compensation, then they received no additional compensation.

Because a modest level of effort was required to view subsequent offers, this design allowed us to

directly observe participant search for offers in a way that would be difficult to replicate in any more natural setting. Although the measurement technology may affect the external validity of the results, the key result is how the exogenously manipulated lead offer value changed the consumer search for subsequent offers within this experimental design. There are two natural outcomes of interest: the number of subsequent offers selected and the number of subsequent offers viewed.

4.1.2. Results: Offers Selected. Subjects selected 3.87 ($SD = 2.05$) lead offers in the high lead offer condition and 2.91 ($SD = 1.75$) in the low lead offer condition, pooled across all three pages ($t(611) = 18.78$, $p < 0.001$) (Table 7A). This relationship persisted across treatment conditions when analyzed separately by page, directionally reproducing the effect of lead offer value on lead offer take-up observed in the field experiments.

Next, we investigate whether lead offers altered selection patterns for subsequent offers. Table 7B reports the average number of subsequent offers selected by condition. Subjects in the high lead offer condition selected 13.97 ($SD = 13.34$) subsequent offers from across all three pages and those in the low lead offer condition selected 12.23 ($SD = 10.56$) subsequent offers ($t(611) = 1.80$, $p = 0.073$). The lift of 14% is quantitatively similar to the spillover estimates in the previously reported field experiments.

If lead offer values influence consumer inferences about the values of subsequent offers, then presumably the increased search motivation would be greatest for the subsequent offers that appear nearest to high-value lead offers. We analyze the results separately by page number to investigate whether lead offer spillovers change with the number of webpages evaluated. Examining only choices on the first page, subjects in the high lead offer condition selected 4.95 ($SD = 4.84$) subsequent offers and those in the low lead offer condition selected 4.15 ($SD = 3.76$) subsequent offers [$t(611) = 2.31, p = 0.021$] for an increase of 20%. Subjects did not show any significant differences in selection of subsequent offers on pages 2 or 3, suggesting that lead offer spillovers attenuate as consumers learn more about the distribution of available offer values.

4.1.3. Offers Viewed. To directly test for the search motivation mechanism, we examine differences in offer viewing patterns between treatment conditions. As depicted in Table 7C, subjects in the high lead offer condition viewed 51.65 ($SD = 26.96$) subsequent offers and those in the low condition viewed 47.13 ($SD = 28.98$) subsequent offers [$t(611) = 2.00, p = 0.046$]. Hence, high lead offers resulted in subjects viewing more subsequent offer values, consistent with a search motivation mechanism.

On the first page we found that participants in the high offer value treatment viewed 18.35 ($SD = 8.93$) subsequent offers, whereas participants in the low offer value treatment viewed 16.10 ($SD = 10.11$) subsequent offers [$t(611) = 2.91, p = 0.004$]. Treatment/control differences in viewing behavior on pages two and three are directionally consistent but are not statistically significant, again implying that lead offer spillovers attenuate as consumers gain greater knowledge about the distribution of available offer values.

Figure 8 depicts offer viewing probability by treatment visualized as a heat map. Offers situated in the first row of subsequent offers were viewed most frequently, and the viewing probability decreased by row until the final row where there was an increase in viewing likelihood, which is likely due to the location of the continuation button at the bottom of the page. This pattern of spillovers within the same page and across multiple pages suggests that consumers' interest in continuing to search diminishes over time.[8]

The experimental setup differs from the field experiment setup in that during the field experiment participants could costlessly scan multiple coupons; whereas in this experiment, participants had to explicitly click on coupon offers to ascertain information about them. Both setups have an implicit cost of search—the value of a participant's time and

Table 7. Search Motivation Experiment: Results Table

A. Number of lead offers selected

	All pages	Page 1	Page 2	Page 3
Low-value lead offers	2.91 (1.75)	1.05 (0.71)	0.77 (0.77)	1.09 (0.79)
High-value lead offers	3.87 (2.05)	1.39 (0.82)	1.00 (0.89)	1.47 (0.86)
p-Value	< 0.001	< 0.001	< 0.001	< 0.001

B. Number of subsequent offers selected

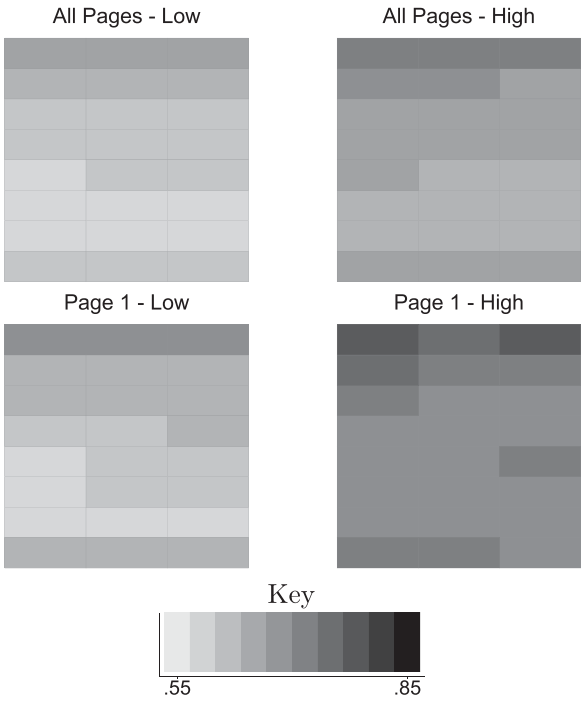
	All Pages	Page 1	Page 2	Page 3
Low-value lead offers	12.22 (10.56)	4.15 (3.76)	4.24 (3.79)	3.84 (3.94)
High-value lead offers	13.97 (13.34)	4.95 (4.84)	4.73 (4.75)	4.29 (4.63)
p-Value	0.0727	0.0210	0.1551	0.2025

C. Number of subsequent offers viewed

	All pages	Page 1	Page 2	Page 3
Low-value lead offers	47.13 (28.98)	16.10 (10.11)	15.79 (10.16)	15.24 (10.24)
High-value lead offers	51.65 (26.96)	18.35 (8.93)	17.00 (9.70)	16.31 (9.89)
p-Value	0.0462	0.0038	0.1331	0.1887

Notes. Standard deviations are in parentheses. *p*-values for *t*-tests assuming unequal variances between the high- and low-value lead offer groups.

Figure 8. Search Motivation Experiment Subsequent Offers Viewed: Heat Maps



Notes. Heat maps illustrate average viewing behavior across users by page. The dependent variable summarized in these figures is a binary variable for whether a participant viewed an offer in a given position, with darker shades of gray indicating a greater percentage of participants viewing an offer.

effort—but this setup allows us to concretely measure search in a way that was not possible in the field experiment. The trade-off to this design choice is that participants may pay more attention to each individual coupon they search through, and this contextual change might influence how judgments are formed across lead and subsequent offers. Despite these differences, the lead offer spillovers replicate.

The key takeaways from this online experiment are that subjects are more likely to view and select any offer in the high lead offer condition than in the low lead offer condition, and the differences in coupon viewing behavior between treatments are largest on the first page. Overall, these findings indicate that high-value lead offers increase consumer search for subsequent offers.

4.2. Spillovers of Evaluative Judgment

Spillovers of evaluative judgment occur if lead offers color consumers' perceptions or attitudes about subsequent offers, a fundamentally different concept than consumer search motivation. Search motivation refers to the number of subsequent offers attended to, whereas evaluative judgment is the evaluation of subsequent offers conditional on attending to them. It is possible that both mechanisms could simultaneously operate in lead offer spillovers, and that one could dominate the other.

Ex ante, it was not clear whether spillovers in evaluative judgment were likely to be positive or negative. High-value lead offers could increase perceptions of subsequent offers' value through anchoring, a literature that dates back to Tversky and Kahneman (1974), who found that participants primed with larger random numbers reported larger guesses of the number of African nations in the United Nations. Similar effects have been observed in a variety of economic contexts including certainty equivalents for gambles (Schkade and Johnson 1989), willingness to pay for public goods (Kahneman and Knetsch 1992, Green et al. 1998), and hypothetical purchases of goods (Ariely et al. 2003, Yoon et al. 2013).

Perhaps a stronger case can be made for predicting negative spillovers in evaluative judgments. Prior research finds that joint evaluations of goods, in comparison with single evaluations, can lead to preference reversals (Hsee et al. 1999). Similarly, heightened consumer expectations of product quality can lead to less favorable evaluations of product quality (Anderson 1973, Kőszegi and Rabin 2006). Additionally, recent work has found that incentive-compatible valuations of even highly familiar goods are inversely related to the value of recently observed items (Khaw et al. 2017).

The field experiment context did not allow for measurement of spillovers in evaluative judgment, so we designed an online experiment to measure those spillovers directly. We asked subjects to rate the desirability of coupons after viewing a varying number of high or low lead offers. The design of the experiment required every subject to view and evaluate every offer, eliminating variation in consumers' consideration sets in order to rule out search motivation as a confounding explanation.

4.2.1. Experiment Design.

We recruited participants from Amazon's Mechanical Turk platform and paid $1 for their participation. Each participant was presented with six pages containing four offers. Participants were asked to rate each of the four offers (i.e., "How good of a deal is the offer?") (Figure 3). Each offer was rated on a slider scale from zero ("horrible") to 100 ("excellent"). Participants were only allowed to proceed to the next page once all four offers on the page were rated, and they were reminded to do so if they tried to advance without rating all offers. Participants were presented with a limited number of offers at a time to encourage careful consideration of all offers. Between pages, participants were asked to complete an unrelated task. In total, 121 subjects participated in the experiment, each evaluating 6 pages with 4 offers per page.

Thus overall, we have $N = 121 \times 6 \times 4 = 2{,}904$ offer-rating observations.

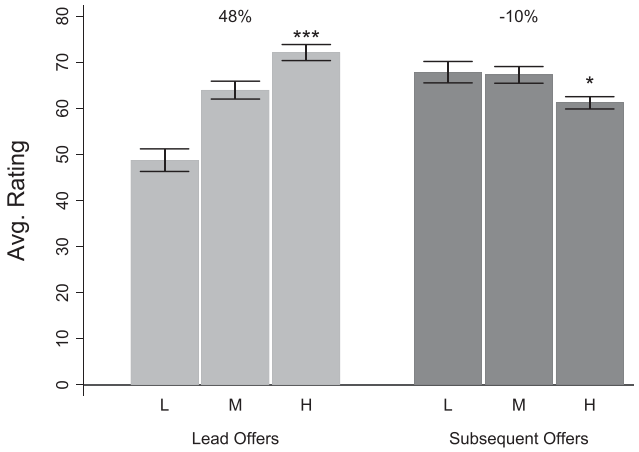
We exogenously manipulated two features in a 3×3 design on each page: the value of the lead offers (i.e., low, medium, or high) and the number of treated lead offers (one, two, or three). The value of the lead offers was such that the high lead offers provided four times the discount of the low lead offers, and 2 times the discount of the medium lead offers. The value of the lead offers was randomized between subjects, and the number of treated offers per page was randomized within subjects.

4.2.2. Results. Figure 9 depicts the average evaluations of the lead offers and subsequent offers. As expected, larger lead offers were rated far higher than smaller lead offers [$M_{Low} = 48.75$, $SD_{Low} = 15.68$; $M_{High} = 72.09$, $SD_{High} = 11.14$; $t(80) = 7.77, p < 0.001$] showing that the manipulation successfully changed evaluative judgments of the lead offers.

Subsequent offers shown after high lead offers were evaluated less favorably compared with subsequent offers that followed low lead offers [$M_{Low} = 67.84$, $SD_{Low} = 14.86$; $M_{High} = 61.18$, $SD_{High} = 8.54$; $t(80) = 2.49$, $p = 0.015$]. Specifically, on average, participants rated subsequent offers 10% lower when subsequent offers were preceded by high-value lead offers compared with low-value lead offers. This effect was directionally the same independent of the number of preceding treated lead offers, but was the most prominent with only one preceding lead offer (see Table A.2).

The direction of the experimental results conflicts with the direction of lead offer spillovers present in the field experiments and the search motivation experiment. We interpret these divergent results by noting that high-value lead offers may simultaneously increase search motivation while dampening evaluative judgements of subsequent offers, with the former effect dominating the latter. One potential alternative explanation for the effects here is that the representation or beliefs about subsequent offers remain unchanged, but lead offers directly distort the mapping of judgments to scale values for subsequent offers (Frederick and Mochon 2012, Mochon and Frederick 2013). However, when this effect has been previously documented the bias result moved in the direction that anchoring effects would predict whereas our findings move in the opposite direction.

Figure 9. Evaluative Judgment Experiment: Main Results



Notes. Bars show average ratings (with standard error bars) of lead and subsequent offers for the low (L), medium (M), and high (H) treatment groups.

$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

4.3. Complementarities

The third mechanism we investigate is potential complementarities between lead offers and subsequent offers, which hypothesizes that there is an interdependence between the actions of selecting a lead offer and a subsequent offer. For example, if the marginal cost of printing falls with the number of offers printed, and if users print more high value lead offers than low value lead offers, then it is reasonable to expect that more subsequent offers will be printed in the high value lead offer condition. This could occur for several reasons: the number of steps logistically required to print subsequent offers could fall when a lead offer is printed; or using multiple promotions could be complementary, for example if a consumer is planning an imminent trip to a grocery store to redeem a set of printed coupons; or the lead offer value could create an income effect which makes additional consumption and promotion usage more attractive.[9]

The ideal field experimental data to study the effect of complementarities would include identifiers for users who are, ex ante, never interested in the treated lead offer. Suppose that we could identify users who will never print the lead offer coupon regardless of its value. If those users still exhibited a change in subsequent offer prints across treatments, we could rule out changes in marginal costs as the sole driver of lead offer spillovers. Unfortunately, the field experiment data do not offer those identifiers.

A feasible alternative would be to consider consumers who did not print the lead offers during the field experiment, because their printing decisions on subsequent offers should not be driven by complementarities. Within this subset of users, lead offer spillovers are stronger overall [see Table 8, columns (1) and (2)]; in going from \$V1 to \$V4, the number of subsequent offers printed increases by 33% ($p < 0.001$), and the number of subsequent offers redeemed increases by 44.8% ($p < 0.001$). However, although this result suggests that complementarities are not driving lead offer spillovers, the evidence may not be causal, as consumers self-select into printing lead offers based partly on offer value treatment.

Table 8. Field Experiment 1, Conditional on Printing and Redemption Results

	(1) S.O. prints	(2) S.O. redeems	(3) S.O. redeems	(4) S.O. redeems
$V2	0.132*	0.0723***	0.0486	0.0588
	(0.0528)	(0.0194)	(0.0477)	(0.133)
$V3	0.360***	0.103***	0.0124	−0.172
	(0.0553)	(0.0203)	(0.0458)	(0.126)
$V4	0.618***	0.177***	0.0562	−0.162
	(0.0598)	(0.0219)	(0.0452)	(0.122)
Cons	1.851***	0.395***	0.496***	0.968***
	(0.0353)	(0.0129)	(0.0358)	(0.110)
N	23,151	23,151	8,790	2,411
Conditioning on:				
Printed L.O.	No	No	Yes	Yes
Printed S.O.			Yes	Yes
Redeemed L.O.				Yes

Notes. Columns (1) and (2) show printing and redemption spillovers for nonprinters of lead offers. Column (3) shows the conditional redemption results for users that printed at least one lead offer *and* at least one subsequent offer. Column (4) shows results for the subset of users in that group who also redeemed at least one lead offer. Nested interaction models give qualitatively similar results. Standard errors are in parentheses.

$^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

A second approach would be to consider users who printed at least one lead offer during the experiment; if they anticipate complementarities in coupon redemption, then they should be marginally more likely to print subsequent offers. Because most of the promoted products are available in the same stores, printing a lead offer may increase a forward-looking consumer's utility of printing subsequent offers and using them on the same shopping trip. We can investigate whether consumers behave in this manner by looking at redemption results for different subsets of users defined by their lead and subsequent offer coprinting and coredemption behavior during the experiment. While we should not treat these results as strictly causal, as users self-select into these subsets, they may provide insights into whether the spillover is motivated by complementarities. If such complementarities exist, we would expect to see positive coprinting *and* coredemption behavior between lead and subsequent offers. Table 8, columns (3) and (4), show the results for the subsets of users who printed at least one subsequent offer *and* printed [column (3)] or redeemed [column (4)] at least one lead offer. These specifications show no evidence of increased lead offer values resulting in increased subsequent offer redemptions.

A third possibility is to look at the subset of previous website visitors who never printed coupons for the lead offer brand prior to the first experiment, as this is suggestive that they may be uninterested in the lead offer coupons. This is a relatively small proportion of consumers ($N = 4{,}925$ or 13%) and therefore provides limited statistical power, but it still shows weak evidence of lead offer spillovers [8% lift; $t(4{,}926) = 1.54$, $p = 0.062$].

These three results—two descriptive and one causal—all suggest that potential complementarities are not a primary factor driving the lead offer spillovers uncovered in the field experiments. Lead offer spillovers are found among users who did not print the lead offer in the field experiment, were not found for those who did print the lead offer and at least one subsequent offer, and were found for those who declined to print coupons for the lead offer brand prior to the experiment.

5. Campaign Profitability

In this section we consider lead offer spillover effects on coupon campaign profitability. Coupon profitability is a complex problem which is difficult to unravel; to the best of our knowledge, it has never truly been measured in the literature. We regret that it is impossible for us to accurately measure profitability with the data that were available to us. We note that our partner manufacturer, like most of its competitors, did not have a high-quality system in place to gauge promotion profitability. Given the importance of the question and limited data available to answer it, we report a series of simulations to calculate coupon profitability under a variety of conditions. These simulations illustrate an approach to quantifying the effect of lead offer spillovers on campaign profitability.

There is an important trade-off when it comes to coupon profitability: while a higher lead offer generates positive externalities in the form of additional prints and redemptions of subsequent coupons, there are also direct costs associated with increasing the value of

lead offers. These direct costs arise both from the fact that the firm needs to remunerate retailers for more coupons redeemed and the increased value of each redeemed coupon, which cuts into the profit margins of the products sold. Thus, while increasing prints of subsequent coupons, all else equal, is essentially costless for the manufacturer, increasing redemptions is not.

A second important consideration when investigating the overall profitability of coupons is to consider who is using them and, specifically, to consider the counterfactual outcome and for what purpose: would the consumer would have bought the product without the coupon? If every consumer who redeemed a coupon when buying a product would have bought the product without the coupon, then the coupon transfers wealth from the manufacturer to the consumer. On the other hand, if higher-value lead offers primarily attract new category purchasers or steal business from rival manufacturers, then each redemption enhances the firm's profit, so long as the profit margin exceeds the discount margin. In all likelihood, the reality is somewhere in the middle, where some coupon users are swayed by the discount into buying the product, whereas other coupon users would have bought it without the coupon. Thus, simulating this trade-off is an important exercise that can quantify static coupon profitability and how it changes with lead offer spillovers.

Neslin and Shoemaker (1983) provide a helpful guide to calculating coupon profitability. Following their notation, the essence of the static profit maximization can be stated as follows:

$$\begin{aligned} PROFIT = {} & WNB * Q_{R,L.O.} * (P_{L.O} * Q_{R,L.O.} \\ & * MARGIN_{L.O.} - V_{L.O.}) \\ & - (1 - WNB) * Q_{R,L.O.} * V_{L.O.} \\ & + WNB * Q_{R,S.O.} * (P_{S.O.} * Q_{R,S.O.} \\ & * MARGIN_{S.O.} - V_{L.O.}) \\ & - (1 - WNB) * Q_{R,L.O.} * V_{L.O.} \\ & + (Q_{P,L.O.} * V_{P,L.O.} + Q_{P,S.O.} * V_{P,S.O.}), \end{aligned}$$

where P_X is the price, $MARGIN_X$ is the gross profit margin, $Q_{R,X}$ is the quantity of coupons redeemed, $Q_{P,X}$ is the quantity of coupons printed, V_X is the face-value of the coupon, and $V_{P,X}$ is the firm's intrinsic value of a coupon print, where X represents either lead offers ($L.O.$) or subsequent offers ($S.O.$). The percentage of users who would not have bought without the incentive of the coupon WNB_X represents the percentage of users who would not have bought without the incentive of the coupon. Lastly, $P_{L.O.}$ and $P_{S.O.}$ can be inferred from available pricing data, whereas $Q_{P,X}$ and $Q_{R,X}$ can be calibrated from the field experiments.

We make two simplifying assumptions. First, it is possible to extend this static framework to account for dynamic effects like loyalty or stockpiling, but for the current exercise we interpret $MARGIN_X$ as reflecting current profit impacts of customers' future purchases, to simplify the exposition. Second, we assume $V_{P,L.O.} = V_{P,S.O.} = 0$, thereby excluding the possibility that coupons generate cross-selling opportunities, mere-exposure effects, or other forms of brand awareness that might increase the firm's profits. We are not able to estimate such quantities with the available data, so we exclude them to make the profitability calculation conservative.

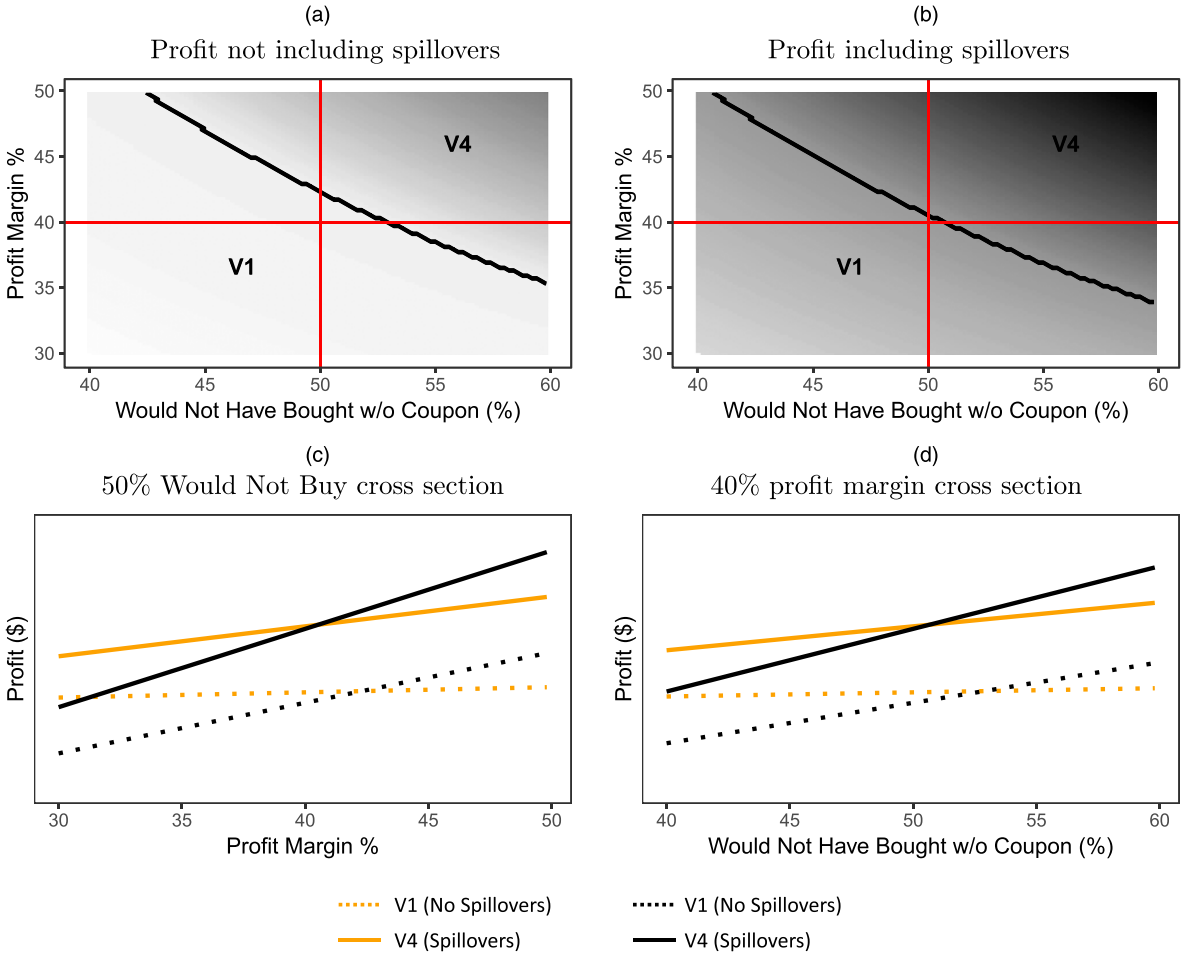
The percentage of users who would not have bought the product without the incentive of the coupon (WNB_X) and the profit margin (M_X) likely vary across products, segments and firms, so we show results for these parameters over large supports: 30%–50% for *MARGIN* and 40%–60% for *WNB*. The margin range is centered on 40%, the mean gross profit margin reported in the U.S. Census Bureau Annual Survey of Manufacturers for the NAICS industry code that is the closest to our studied product industry.[10] The *WNB* range centers on the 50% "would not have bought without coupon" percentage result reported in Neslin and Shoemaker (1983).

For these parameter ranges, we calculate the average profit per user and indicate what lead offer coupon value ($V1 or $V4) provides the profit-maximizing option to the firm. For simplicity, we assume that *WNB* and *MARGIN* are the same for both lead and subsequent offers.

Figure 10, panels (a) and (b), show simulated firm profits for different combinations of firm profit margin (y axis) and percentage of consumers who would not have bought products without a coupon (x axis). Profit is the third dimension represented by a shaded contour plot: darker areas represent higher profit levels, while lighter areas indicate lower profit levels. Panel (a) shows the results assuming that the firm does not include the spillovers in its analysis, and panel (b) provides the scenario if it does include spillovers. Panels (c) and (d) present two-dimensional cross sections of the graphs in (a) and (b), fixed at $WNB = 40\%$ and $M = 50\%$. Profits are higher as the gross profit margin increases, and higher with greater *WNB*, that is, the percentage of users redeeming the coupon who would not have bought the product without the coupon.

A key takeaway is the difference in crossover points between the dotted lines and the solid lines in panels (c) and (d). The horizontal distance between the two crossover points embodies the area in which the company would have misoptimized. This area grows as the relative value of lead offers to subsequent offers increases. Intuitively, if the amount of profit one stands to make from lead offers is small, and the amount of profit one stands to make from subsequent

Figure 10. (Color online) Profit Simulations



Notes. Panels (a) and (b): These three-dimensional graphs show the simulated firm profits for different combinations of firm profit margin (y axis) and the percentage of consumers who would not have bought products without coupon (x axis). Profit is the third dimension represented by a shaded contour plot: the darker color indicates higher profit levels, and the lighter color indicates lower profit levels. These simulations were calibrated using printing and redemption data from the first field experiment. For each X and Y combination, we calculate the average per-user profit for two coupon values, \$V1 and \$V4. The curved line is the indifference curve, it divides the region into two areas: lower left, where the \$V1 lead offer value is the profit-maximizing choice, and upper right, where \$V4 lead offer value is the profit-maximizing choice. Panel (a) shows this division when just considering the effect of the treatment on the treated products. Panel (b) shows the total treatment effect considering spillovers as well. The horizontal and vertical lines represent cross sections depicted in panels (c) and (d). Panels (c) and (d): These graphs present two separate two dimensional cross sections of the three-dimensional graphs depicted in panels (a) and (b). Panel (c) presents a two-dimensional cross section fixing the would not have bought without coupon percentage at 50%, whereas panel (d) depicts a two-dimensional cross section fixing the profit margin at 40%. The lines depict profits under \$V1 and \$V4 lead offers with and without including the spillovers.

offers is large, then the lead offer spillover can have substantial effects if it significantly increases the number of subsequent products moved.

6. Conclusion

This research provides the first evidence of lead offer spillovers and explores why they occur. A large-scale field experiment in the context of print-at-home coupons found that doubling three lead offer values increased the printing and redemption of subsequent offers by 18% and 12%, respectively. A second field experiment with an intentionally weaker manipulation produced a 12% lift in subsequent offer printing but a null result on subsequent offer redemptions. Additional analysis and further experimentation indicate that large lead offer values increase consumer search for subsequent offers, and are not primarily driven by changes in evaluative judgments or complementarities among coupons.

The results imply that lead offer spillovers are important to consider when designing groups of promotions. Design choice sets are very large, so to simplify the problem, marketers often choose between leading with their largest offers or leading with their most popular offers. This research helps to shed light on that choice, suggesting that leading with a high-value offer may help increase adoption of subsequent offers. Initiating an offer group with a particularly

high-value lead offer can help to attract additional users to search for subsequent offers, even if the lead offer is not particularly attractive to most consumers. However, we did not explicitly test the effects of manipulating the popularity of the lead product offered, so we cannot make relative statements about these strategies. Also, it is important to remember that promotions may vary in their profitability as well as their size, so the desirability of capitalizing on lead offer spillovers will depend on the marketer's objectives, margins, retention rates, ability to capture new business with promotions, and how all of those factors vary across the set of promotions available for various products. Therefore, a nuanced consideration of the entire group of promotions is required to determine the best possible ordering.

More generally, the finding of lead offer spillovers on a multibrand coupon web page could potentially relate to other settings in which consumers allocate attention and choose from among many options. Product assortments, both online and offline, may exhibit similar features in that placing particularly attention-catching options in prominent positions can alter consumer search and evaluations of subsequent products.

Future work could address many interesting questions regarding how to best design and present groups of offers. How do consumer characteristics and product attributes interact to generate larger or smaller spillovers from lead offers to subsequent offers? Should lead offers receive extra space and elaboration, and how would such designs affect lead offer spillovers? Are there asymmetric order effects in which sequencing a particular offer before another generates larger or smaller spillovers? How does the lead offer spillover vary as the relative offer values between lead and subsequent offers change? How do spillovers relate to price expectations or reference points, and might spillovers be asymmetric around those points? Can firms influence reference point formation by sequencing offers strategically?

An important limitation of the current analysis is its absence of a precise measure of coupon profitability. In this, we have substantial company in both the scholarly literature on coupons as well as among practicing managers designing complex promotional campaigns in dynamic market environments. In fact, private conversations with executives indicate an (untested) belief that the sales volume lift from coupons is better explained by measures of coupon distribution than actual redemption behavior, consistent with the "mere exposure" effects of Venkatesan and Farris (2012). The typical annual volume of distributed coupons exceeds the volume of redeemed coupons by a factor of about 30 (Inmar 2014), lending some plausibility to such beliefs. Because of the complexity of the profitability question and limited data available to us to answer this question, we simulate coupon campaign profits under various conditions. The key takeaway from our simulations is that there is a trade-off between the lead offer value and the additional profits gained from spillovers, but that there exist regions (within reasonable industry parameter levels) where these profit gains are large.

In summary, this paper has uncovered and explained a new result in how consumers respond to groups of price promotions. We are optimistic that marketers' increasing ability to track consumer behavior across purchase and consumption occasions, along with increasing opportunities for digital experimentation, will continue to generate insights into holistic effects of price promotions on shopping and purchasing behaviors.

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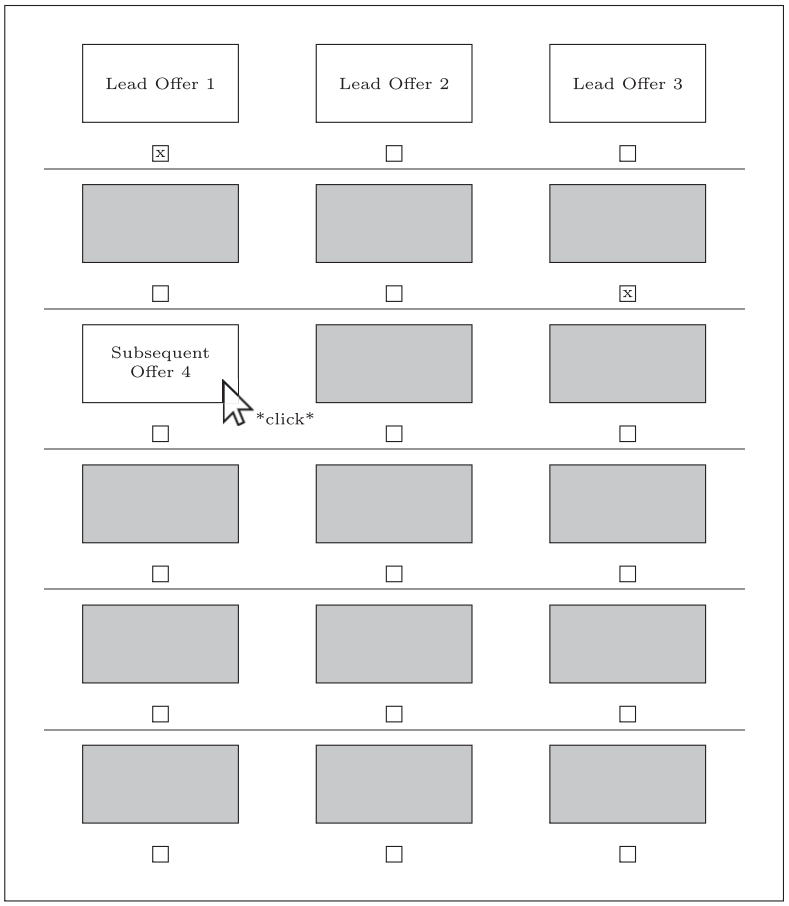
Appendix. Supporting Figures and Tables

Figure A.1. (Color online) Example of Printed "Print-at-Home" Coupon

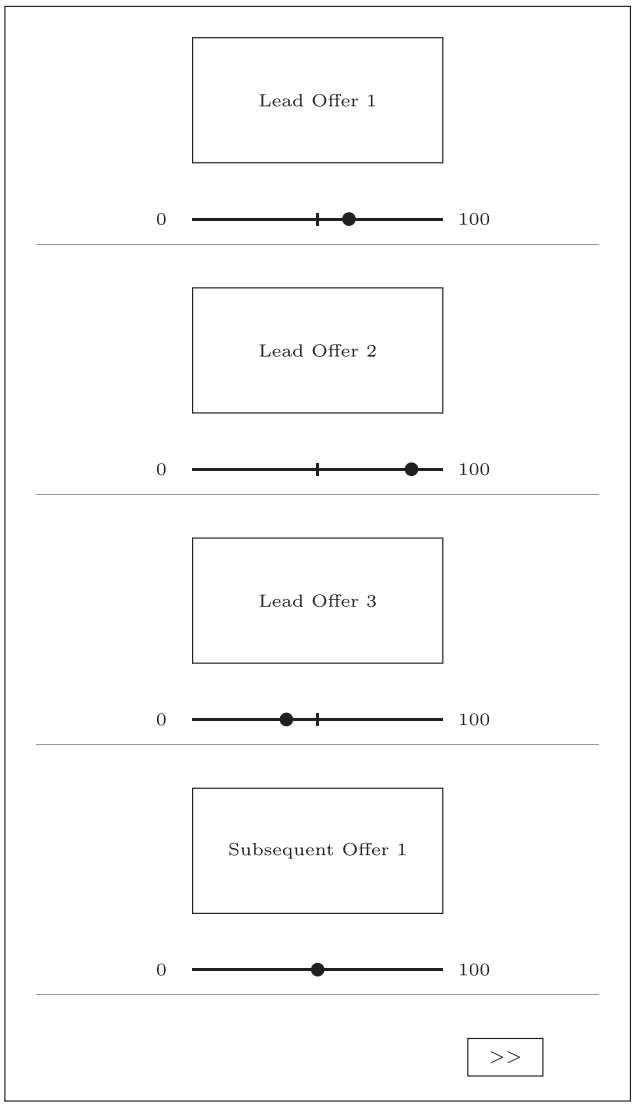
Notes. Printed coupons show product images and text, barcodes and QR codes, legal text, an expiration date, and the value of the coupon, here depicted as "SAVE $V2." The product category shown in the picture is related to, but not the same as, the lead offer product in the first field experiment.

Figure A.2. Online Experiment 1 (Search Motivation) Design



Notes. White boxes indicate offers visible to the participant; gray boxes indicate hidden offers. To reveal a hidden offer, the participant had to click on it. The offer was visible so long as a participant's mouse hovered over it. Participants indicated they were interested in receiving a particular offer by clicking the checkbox beneath the respective offer.

Figure A.3. Online Experiment 2 (Valuation Spillover) Design



Notes. Participants were shown six pages with four offers per page. Across the six pages, two pages had one treated coupon, two had two treated offers, and two had three treated offers. The above example shows a page with three treated (lead offers) and one subsequent offer. Paralleling the treated offers, there were one, two, or three subsequent offers (4 – number of treated offers) on each page. Lead offers always preceded subsequent offers. In between each page, there was a 15-second "cleansing task" in which participants were asked to play a "Find the Differences" game. For each of the offers, participants were asked to evaluate the coupon on a scale from 0 (horrible) to 100 (excellent). Participants could not proceed to the next page unless all slider bars had been touched.

Table A.1. Search Motivation Experiment Regressions

			Viewed			Selected
	All pages	Page 1	All pages	All pages	Page 1	All Pages
Treatment	0.063 *	0.093 **	0.065 *	0.024 †	0.034 *	0.012
	(0.031)	(0.032)	(0.031)	(0.013)	(0.015)	(0.015)
Row3			–0.02 **			0.004
			(0.008)			(0.009)
Row4			–0.042 ***			–0.008
			(0.009)			(0.01)
Row5			–0.061 ***			–0.011
			(0.01)			(0.01)
Row6			–0.072 ***			–0.011
			(0.01)			(0.009)
Row7			–0.087 ***			–0.015
			(0.012)			(0.009)
Row8			–0.084 ***			–0.021 *
			(0.011)			(0.01)
Row9			–0.061 ***			–0.003
			(0.011)			(0.01)
Treatment x Row3			–0.015			0.008
			(0.011)			(0.013)
Treatment x Row4			–0.009			0.024 †
			(0.013)			(0.013)
Treatment x Row5			–0.006			0.019
			(0.014)			(0.013)
Treatment x Row6			–0.004			0.006
			(0.015)			(0.013)
Treatment x Row7			0.012			0.009
			(0.016)			(0.013)
Treatment x Row8			0.009			0.024 †
			(0.016)			(0.014)
Treatment x Row9			–0.003			0.007
			(0.016)			(0.014)
Cons	0.655 ***	0.671 ***	0.708 ***	0.17 ***	0.173 ***	0.178 ***
	(0.023)	(0.024)	(0.023)	(0.008)	(0.009)	(0.01)
No. observations	44,064	14,688	44,064	44,064	14,688	44,064

Notes. Robust standard errors (clustered at the participant ID) are in parentheses. Row 2 is the reference group for all specifications. The unit of observation is always at the participant-coupon level. The dependent variable is a dummy variable for whether the user viewed or selected a particular coupon.

†$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table A.2. Evaluative Judgment Experiment Summary Statistics

Panel A. Average rating of all subsequent coupons				
Value treatment	1	2	3	Number of treated coupons Pooled
Low	68.11 (14.93)	67.25 (16.12)	68.17 (18.5)	67.84 (14.86)
Medium	67.29 (11.91)	66.21 (14.28)	69.17 (13.48)	67.24 (11.3)
High	59.55 (10.05)	61.77 (11.55)	64.91 (15.54)	61.18 (8.54)
Panel B. Rating of first subsequent coupon				
Value treatment	1	2	3	Number of treated coupons Pooled
Low	66.51 (17.62)	67.59 (16.31)	68.17 (18.5)	67.42 (15.69)
Medium	69.17 (14.35)	64.73 (17.14)	69.17 (13.48)	67.69 (11.47)
High	58.3 (15.31)	63.18 (14.53)	64.91 (15.54)	62.13 (10.1)
Panel C. Rating of last subsequent coupon				
Value treatment	1	2	3	Number of treated coupons Pooled
Low	69.27 (15.75)	66.91 (18.1)	68.17 (18.5)	68.12 (15.84)
Medium	68.5 (15.76)	67.68 (16.76)	69.17 (13.48)	68.45 (12.2)
High	59.4 (14.18)	60.37 (14.67)	64.91 (15.54)	61.56 (10.53)

Notes. In panel A, cells represent averages of participant-level ratings of subsequent offers as a function of 1, 2, or 3 leading coupons reported separately by low, medium, or high lead offer treatment. Panel B reports averages of participant-level ratings for the first subsequent coupon. Panel C report averages of participant-level ratings for the last subsequent coupon (which always occupied the fourth coupon position on the page). Standard deviations are in parentheses.

Table A.3. Coupons Used in Online Experiments

Company name	Product	Value off (high/low)
Applebee's	Any appetizer	$3.00/$0.75
Bed Bath and Beyond	Any large bath towel	$4.00/$1.00
CVS	Any brand pain reliever (24 ct or more)	$2.00/$0.50
Dominos	Any large pizza	$3.00/$0.75
Lowes	Any gardening department item	$4.00/$1.00
Starbucks	Any Grande (16 oz) beverage	$2.00/$0.50
Subway	Any foot-long sandwich	$3.00/$0.75
Target	Any hair care product	$3.00/$0.75
Walmart	Any dish soap	$3.00/$0.75
7-Eleven	Any size coffee	$0.50
7-Eleven	Any size Slurpee	$0.50
Ace Hardware	LED bulbs (4 pk or more)	$2.00
Ace Hardware	Bird feeders and bird food	$2.00
Amazon Music	A digital music album	$1.00
Amazon Video	Any digital movie rental	$1.00
AMC Theatres	Any large popcorn	$1.00
AutoZone	Any new car battery	$9.00
AutoZone	Replacement wiper blades	$3.00
Barnes & Noble	Any fiction book	$2.50
Barnes & Noble	Any nonfiction book	$2.50
Bass Pro Shops	Camping gear	$2.00

Table A.3. (Continued)

Company name	Product	Value off (high/low)
Bass Pro Shops	Fishing rods or reels	$3.00
Best Buy	Printer cartridges	$2.00
Best Buy	Any small kitchen appliance	$5.00
Burger King	Any whopper meal	$1.00
Burger King	Any breakfast sandwich	$1.00
Chili's	Any entrée	$2.00
Chili's	Any appetizer	$1.50
Chipotle	Any burrito	$1.50
Chipotle	Chips and salsa	$0.50
Dick's Sporting Goods	Any dozen golf balls	$2.50
Dick's Sporting Goods	Camping gear	$2.50
Dollar General	Any 12-pk cans of Coke	$1.00
Dollar General	Any brand coffee (20 oz or more)	$1.00
Dunkin' Donuts	Any breakfast sandwich	$1.00
Dunkin' Donuts	Any size coffee	$1.00
Exxon Gas	Any 6+ gallon purchase	$2.00
Family Dollar	Any cleaning product	$1.00
Family Dollar	Any brand toilet tissue (6 ct or more)	$1.00
Fandango	Movie tickets	$2.00
Home Depot	Any power tool	$5.00
Home Depot	Any smart thermostat	$5.00
iTunes	Any digital movie rental	$1.00
iTunes	Any digital music album	$1.00
Kohl's	Any bedding set	$4.00
Kohl's	Any 3-pack of socks	$2.00
Kroger	Any brand paper towels (2 ct or more)	$1.00
Kroger	Any men's or women's deodorant	$2.00
Macy's	Any cosmetics item	$2.00
Macy's	Any men's or women's fragrance	$2.00
McDonalds	Any combo meal	$1.00
McDonalds	Any breakfast sandwich	$1.00
Old Navy	Classic flip flops	$1.00
Old Navy	Any graphic t-shirt	$1.50
Panera Bread	Any soup or salad	$1.00
Panera Bread	Any You-Pick-2 deal	$2.00
Papa Johns	Any style wings or bread sticks	$1.00
Papa Johns	Any large pizza	$2.00
PetSmart	40+ lb bag of dog food	$3.00
PetSmart	20+ lb bag of cat food	$2.00
Pizza Hut	Any pasta dish	$2.00
Pizza hut	Any large pizza	$2.00
Red Lobster	Any entrée	$3.00
Red Lobster	Any appetizer	$1.50
Rite Aid	Any brand toothpaste	$0.75
Rite Aid	Any first aid kit	$2.00
Shell Gas	Any 6+ gal purchase	$2.00
Staples	Envelopes or stationary	$2.00
Staples	Pens	$1.00
Taco Bell	Any combo meal	$2.00
Taco Bell	Any dollar cravings item	$0.50
TJMaxx	Any pair of Levi's jeans	$3.00
TJMaxx	Any pair of Under Armour athletic shoes	$4.00
Toys R Us	Any board game	$2.00
Toys R Us	Any video game	$3.00
Trader Joe's	Any frozen entrée	$1.00
Trader Joe's	Any breakfast cereal	$1.00
Walgreens	Any first aid kit	$1.50
Walgreens	Any candy	$1.00
Wendy's	Any size Frosty	$0.50
Wendy's	Any combo meal deal	$1.00

Endnotes

[1] The second- and third-ranked factors were suggestions from friends and family (40%) and advertisements (35%).

[2] The share of redeemed coupons delivered via free-standing inserts (FSI) fell by 16% from 2009 to 2013, whereas the share delivered via print-at-home channel rose by 420% during the same time period (Inmar 2014).

[3] Eye-tracking studies of consumer search show that, in a sequence of similar items arranged on a page, the top row is the most visually salient row, and the top-left position is the most visually salient individual placement. For example, Krajbich et al. (2010) find that subjects are likely to make a first fixation to the left feature in a binary choice task when the location of features or items are randomly displayed, and Fisher (2017) finds subjects first look to the top-left region when additional features are added. Sütterlin et al. (2008) and Lu and Hutchinson (2017) find that items at the top of a list receive more attention than those at the bottom. See Orquin and Loose (2013) for a thorough review.

[4] The evaluative judgment mechanism is implied by findings that initial numerical values influence judgments across a variety of tasks (Tversky and Kahneman 1974, Johnson and Schkade 1989, Ariely et al. 2003, Yoon et al. 2013).

[5] Additionally, an offline technical error prevented the partner firms from measuring redemptions accurately for one of the 50+ coupon offers, as discussed in Section 3.4.

[6] Any mechanism we investigate with online experiments has the potential to show different results than the same experiment conducted on the (self-selected) deal-prone subjects from the field studies; however, the sample in these follow-up studies provide some advantages. First, replicating the main effect in a different, potentially more general, population is valuable in and of itself. Second, the participants used in these follow-up studies regularly complete tasks at a relatively low wage (Goodman et al. 2013, Paolacci and Chandler 2014, Buhrmester et al. 2018). If this frugality extends to other areas of their life, then they might exhibit other frugal tendencies, such as an increased interest in claiming good deals, a property that is potentially shared with the field study participants. Still, this limitation applies to field experiments in marketing more generally.

[7] As some real-world promotional spreads or circulars are completely visible to consumers in their entirety, the design here might increase the marginal cost of search which can emphasize an intermediate effect on expectations. However, the size of this potential search cost increase may be relatively small. For instance, many firms offer printed promotional booklets that require physically unfolding and flipping through multiple pages, while other online promotions might necessitate multiple clicks to view either offer details or additional offers with potential delays due to website loading. Given this, a mouse click to immediately view an offer may not substantially increase marginal search costs compared with more traditional environments.

[8] We ran regressions that included the interactions between the treatment effect and the row number and found no significant interaction effects, suggesting that the lead offer spillover persisted across all rows of the page. See Table A.1. This result parallels what we saw in the field experiment.

[9] Coupons for nonrivalrous products are nonrivalrous in printing and redemption, and the products offered on our experiments all address distinct consumer needs and therefore are not substitutable; therefore, we know of no reason to expect negative portfolio effects among coupons.

[10] We cannot reveal the exact NAICS industry number without deanonymizing the product category.

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