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Rewarding Volunteers: A Field Experiment

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We conducted a field experiment with the American Red Cross (ARC) to study the effects of economic incentives on volunteer activities. The experiment was designed to assess local and short-term effects as well as spatial and temporal substitution, heterogeneity, and spillovers. Subjects offered $5, $10, and $15 gift cards to give blood were more likely to donate and more so for the higher reward values. The incentives also led to spatial displacement and a short-term shift in the timing of donation activity, but they had no long-term effects. Many of the effects were also heterogeneous in the population. We also detected a spillover effect whereby informing some individuals of rewards through official ARC channels led others who were not officially informed to be more likely to donate. Thus, the effect of incentives on prosocial behavior includes not only the immediate local effects but also spatial displacement, social spillovers, and dramatic heterogeneity. We discuss the implications of these findings for organizations with activities that rely on volunteers for the supply of key inputs or products as well as for government agencies and public policy.

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1. Introduction

Volunteering is a large industry. In the United States the estimated value of volunteer time is more than $240 billion. Organizations such as the American Red Cross (ARC) and United Way run campaigns that rely on large and diffuse groups of people to supply valuable resources; 27% of Americans volunteer with formal organizations, for a total of about eight billion hours per year (Corporation for National and Community Service 2012, Independent Sector 2012).[1] Managing these activities is challenging, and consequently the supply of many of these activities often falls short of demand.

One potential solution to address these shortages is to offer economic rewards, but there is debate about their effectiveness. Theory shows that the effects of incentives on the supply of activities in which agents have intrinsic motives can depend on context (e.g., what is or is not observed), on which motives are dominant (e.g., pure altruism, warm glow, self-image, reputation), and on how context and motives interact with each other (Andreoni 1989, Bénabou and Tirole 2006, Exley 2013). Given the complexity of the theoretical issues, the evidence on the effects of incentives on prosocial behavior is mixed.[2]

This paper presents the most comprehensive study to date on the effects of economic incentives on prosocial behavior for a volunteer activity, blood donation, which saves lives, has no substitute supply, and experiences frequent shortages (Oakley 1996, WHO 2011). We ran a field experiment with the ARC Blood Service Unit in Northern Ohio involving 98,278 blood donors. The donors were offered $5, $10, and $15 gift cards to present at blood drives and were randomized to receive or not receive reward offer advertisements both across and within blood drives. We have individual-level data for all subjects including demographics, donation behavior, and the entire potential donation possibility set before, during, and after the intervention. What makes our study comprehensive is that we not only assess (a) the immediate effects at the location and time of the offer, (b) the shape of the "blood supply curve," and (c) heterogeneous effects, but we also assess (d) spillover effects regarding whether incentive offers to some subjects increased donations of others, (e) whether rewards generated genuine new donations or instead displaced donations that would have occurred elsewhere, (f) whether

[1] The diffuse supply of goods and services by intrinsically motivated agents has also been studied in a variety of contexts; see Ashraf et al. (2013), Boudreau et al. (2011), Cohen and Dupas (2010), and Jeppesen and Lakhani (2010).

[2] Gneezy et al. (2011) and Kamenica (2012) review the literature on incentives and prosocial behavior.

rewards generated genuine new donations or displaced future donations, and (g) whether rewards affected longer-term donations. Addressing all these questions in the same setting and at the same time is crucial to fully gauge the effects of economic incentives on prosocial behavior. For instance, an incentive offer for volunteering at a specific location may affect the supply at other locations, over time, and the supply of related activities. This has been shown to occur in a few workplace and market settings (e.g., Kumar and Leone 1988, Larkin 2014, Oyer 1998).[3] An incentive may also impact people other than those who are directly targeted if those targeted motivate others to also act. The effects may also occur after the incentives are removed.[4] For example, people can adjust the timing of volunteering and motivational crowding out may reduce future supply. Finally, the effects might vary for different types of individuals. Previous work (Lacetera et al. 2012) considered a subset of the questions above (a, b, and e), studying primarily incentives historically offered by the ARC (e.g., T-shirts and mugs) with *drive-level* data.[5]

The results show a positive, short-term, local individual response of the supply of blood to reward offers, increasing with the rewards' value. The probability of donating increased from 0.53% without any incentive to 0.77%, 0.99%, and 1.33% for $5, $10, and $15 gift card offers, respectively. We go beyond this finding to consider four additional results. First, we find evidence of *spatial displacement*; on average, 31% of the increase in the propensity to donate at the intervention drives is explained by a reduction in the probability to donate at some other ARC drive. Moreover, displacement increases with the value of the incentive and is nearly 45% for the highest-valued reward ($15).

Second, there is *heterogeneity* in the local and displacement effects. The rewards increased the likelihood to donate at the intervention drives from 13.2% to 20.9% and from 0.08% to 0.22% for subjects who had and had not, respectively, donated at those sites in the past. The effects are larger for subjects who are older, donated more often, or donated more recently. These findings are consistent with a standard incentive effect in that individuals who have donated in the past at a given location are more likely to have lower costs of donating there again. This also holds true for individuals with lower cost of time and donation discomfort such as older and more experienced subjects. Experienced donors may also be more likely to have a stronger reputation for being prosocial and thus less concerned with rewards undermining their self-image, social image, or intrinsic motivations (Exley 2013). In contrast to past evidence, there are no gender differences in responses.

Third, we find significant *spillovers*. Informing individuals of rewards through official ARC channels led others who were not officially informed of the rewards (including active, lapsed, and new donors) to be more likely to donate. For every 100 subjects who were informed of the rewards, an additional 3.9 new and lapsed donors donated. These results indicate that the local average effect of reward offers on donations underestimates the total effect due to the significant spillovers, overestimates the total effect due to spatial displacement, and misses substantial heterogeneity.

Fourth, we show no net overall long-term effects beyond the intervention period. Comparing donations (likelihood or amount) after our intervention for *all* subjects who were and were not offered rewards, there are no differences. This finding indicates that the donations induced by the incentives at the intervention drives were genuine extra donations and that the incentive did not cause any overall intertemporal displacement. However, we find that among subjects who donated during the intervention, those who had been informed of the incentive offer shifted the timing of future donations (compared with donations prior to the intervention) in a manner consistent with pushing forward the timing of their next donation after the intervention; those informed of the rewards and donating during the intervention were on average 12 percentage points less likely to donate within 12 weeks after the intervention than those not offered a reward and donating during the intervention. Over a longer time horizon, however, we find no differences in donations after the intervention. Thus, there was a shift in the timing of donations after the intervention among donors who donated during the intervention. Methodologically, this analysis also shows that observing a sufficiently long-term horizon can avoid drawing potentially incorrect inferences about the effect of incentives on prosocial behavior.

We also calculate the cost per extra unit collected to be between $22 and $55, which is arguably well below the value of having one additional blood unit available.

[3] Cairns and Slonim (2011) show that appeals for monetary donations to one cause reduce donations to a related cause. Shang and Croson (2008) found that fundraising at one time had no effect on donations for the same cause at a later date.

[4] Offering incentives temporarily was found to affect longer-term behavior in the case of physical exercise (Charness and Gneezy 2009, Royer et al. 2012); Meer (2013) and Rosen and Sims (2011) study habit formation in charitable giving.

[5] Lacetera et al. (2012) also provided drive-level analysis of only short-term local effects from the experimental treatments reported here. Another related study is by Goette and Stutzer (2011), who estimate the effects of a free cholesterol test offer and a lottery ticket offer on blood donations. The analysis is limited to contemporaneous effects and does not include spatial or intertemporal substitution or spillovers. Mellstrom and Johannesson (2008) examine the effect of a cash incentive on Swedish students to take a health test to determine their eligibility to be blood donors.

Section 2 provides information on the ARC Northern Ohio Blood Service Unit. Section 3 describes the experimental design and the data. We report and discuss our findings in §4, and in §5 we conclude by discussing the implications of our findings and directions for future research.

2. The Blood Service Operations of the American Red Cross

The ARC's Northern Ohio Blood Service Unit is an important part of the ARC's overall operations; its primary goals are to increase blood donations to serve the local hospitals, provide backup units to other units in need, and address short-term emergencies.[6] The ARC runs more than 7,000 blood drives in Northern Ohio each year. Each drive has a host partner (e.g., a church or hospital) that provides space at a location and date. The ARC provides the blood collection equipment and staff (including a drive representative). Several thousand individuals are typically informed about each drive. In most counties, the ARC mails a flyer on the 23rd or 24th of each month with information on all of the drives in the county for the following month. The flyers indicate each drive's location, date, and time as well as whether an incentive is offered and the type of incentive. The ARC or the hosts provide the incentives; the most common items are T-shirts (about 50% of all drives with rewards), coupons and gift cards (about 10%), followed by jackets, coolers, and blankets. Rewards are given when donors present (i.e., show up) rather than for making an actual blood donation. The ARC mails county flyers to everyone who has previously donated in that county who is active and eligible. An active donor is someone who has donated at least once over the past two years. An eligible donor is someone who is not currently disqualified from donating. Donors can be disqualified if donating may endanger them or if their donation would be unusable.[7]

3. Research Design, Data, and Descriptive Statistics

3.1. Structure of the Experiment and Data

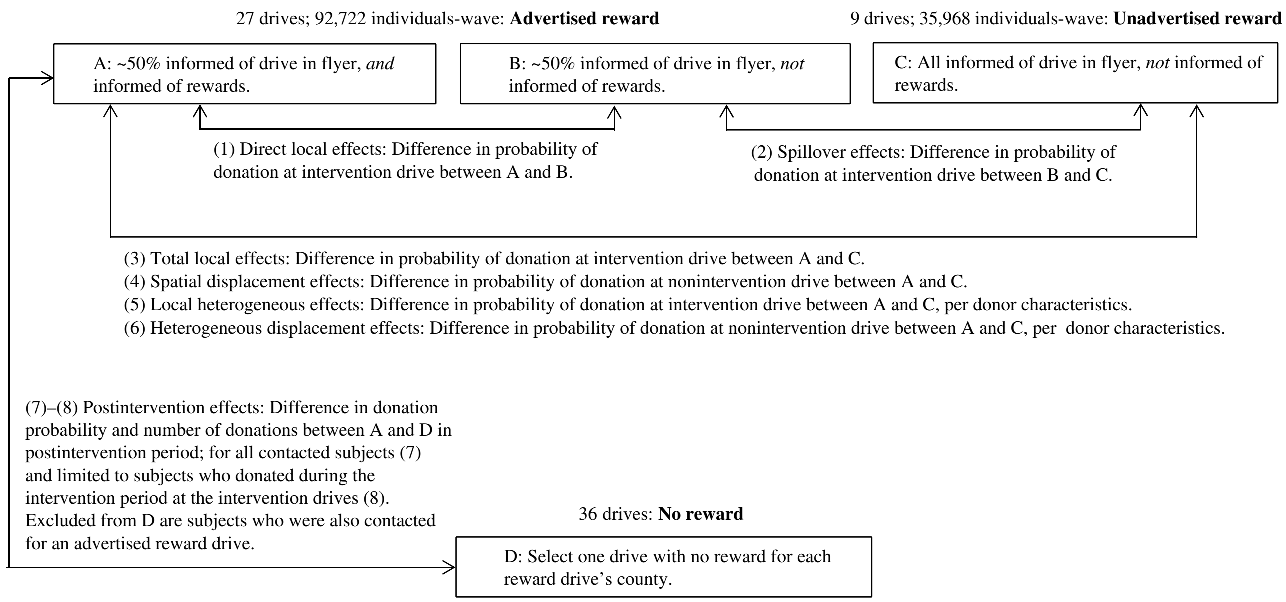
The experiment was run over four periods (September 2009, December 2009, March 2010, and July–August 2010) to collect more independent observations and control for seasonal effects. We randomly chose 72 drives (18 in each of the periods) from a large set of "standard" drives in terms of historical turnout, openness to the public, and frequency. We only included drives that had no other incentive offer during the intervention period or on the date of the drive immediately prior to the intervention. For the drives and counties in the experiment, 98,278 subjects were contacted through the ARC's standard procedures. For all subjects, we observe gender, age, blood type, and every donation from four years before until at least nine months after the intervention. At the individual level, we observe whether someone donated, but we do not have information on anyone who presented but was not eligible to donate. We thus cannot assess whether rewards affected deferral rates at the individual level. However, Lacetera et al. (2012), using ARC drive-level observational and experimental data (that includes the number of donors presenting and the number presenting who successfully donated) show that deferral rates are not affected by the presence of rewards. Iajya et al. (2013) also find no effects of similar gift card incentives on eligibility or safety of collected blood in Argentina. We also observe the location of every donation and the total number of lifetime donations. This information lets us distinguish between subjects who have and have not donated in the past at each intervention site. This is important because people who have previously donated at a drive are more likely to live closer to it, know how to get to it, and be familiar with ARC staff and hosts. They are therefore likely to have lower costs to attend these drives and be more likely to donate at sites that they have donated at previously. About 50% of subjects were contacted in exactly one intervention period, 30% in two periods, and 20% in three or four periods. Thus, there were 176,327 subject-wave observations. We limit the sample to those who were eligible to donate at the intervention drives, giving us 79,680 subjects and 128,690 total contacts to analyze.[8] We also observe every person who donated at any of the intervention drives who was and was not formally contacted by the ARC including new and lapsed donors who are eligible but have not donated for some time. The following subsections present the experimental design, and Figure 1 graphically shows the four main treatments (A–D) and which treatments are being compared for all the results reported in §4. Additional details, including an example of a typical flyer, are in the online appendix (available at http://ssrn.com/abstract=2314008).

[6] The ARC operates 36 regional blood centers within the United States and Puerto Rico. In 2010, about 4.1 million people lived in Northern Ohio, median income was about $47,000 (overall U.S.: $50,221), the unemployment rate was 9.9% (U.S.: 9.6%), and there were 83% Caucasians and 11.4% African Americans (U.S.: 72.4% and 12.6%).

[7] Examples for disqualification include individuals with anemia, low blood pressure, low iron, or recent behaviors that increase the risk of potential problems with their blood. Donors are also not permitted to donate for 56 days after making a whole blood donation.

[8] When a flyer is mailed, the ARC requires the recipient to be eligible for at least one of the advertised drives. A donor may thus be ineligible for an intervention drive on a flyer if the drive is before he becomes eligible to donate later in the month.

Figure 1 Experimental Design



Notes. This flowchart reports details of the structure of the experiment. The connecting arrows indicate the pairs of experimental groups that were used for each test, and the numbering of the effects tested (1 through 8), reported under each related arrow, mirrors how results are reported in §4. Further details on the design are in the online appendix.

3.1.1. Drive-Level Randomization and Incentives. In each intervention wave, the 18 drives were divided into nine pairs such that the drives within a pair were held in the same county and advertised on the same flyer and each pair was in a different county and advertised on different flyers. Within each pair, we randomly assigned one drive to have a reward (*reward drives*) and the other to have no reward (*no reward drives*) so we have 36 reward and 36 no reward drives. The reward and no reward drives were not only similar in meeting the standard drive criteria but also had the same population of potential donors who were contacted because the drives in a pair were advertised on the same county flyer. Because no incentive was offered at the no reward drives, from the perspective of potential donors and the hosts, these drives functioned identically to any other ARC drive that did not offer a reward.

At the reward drives, presenting donors (regardless of their eligibility to donate) received gift cards for \$5, \$10, or \$15. We randomly allocated the three dollar values equally across the 36 reward drives in the four periods. Having three dollar values lets us estimate the shape of the supply curve and whether subjects respond to the economic value (donate more with higher values) or to receiving a gift (donate the same amount regardless of value). Because the ARC sometimes offers gift cards and the \$5-to-\$15 values are in the normal range that the ARC offers, the cards were unlikely to be perceived as unusual. An unusual gift or value may signal that there is a greater need for blood or that the ARC is running an experiment and this might affect the interpretation of the results (Levitt and List 2007, List 2008).[9] We also observe whether donors accepted or refused the gift cards and how much they used them. If the cards were not accepted or used, that would suggest that the dollar values are not a good proxy for the value to the donor.[10]

3.1.2. Individual-Level Within-Drive Randomization. We randomized the 36 reward drives into two conditions: 27 "advertised reward" drives (conditions A and B in Figure 1) and nine "unadvertised reward" drives (condition C in Figure 1) balanced evenly over the four intervention periods (with seven advertised reward drives in each of the first three periods). In the advertised reward drives, a random sample of approximately half of the subjects per drive was informed that a reward would be given, the types of gift cards offered, and the dollar amount

[9] More generally, it may be argued that the presence of rewards is perceived as a signal of scarcity and subjects would react to this rather than to the rewards per se. However, the sbjects receive information about a set of drives in the flyers with only some offering rewards. Thus, it is unlikely that they derive any information on scarcity from a single drive on the flyer.

[10] Although several past studies examining rewards for activities with intrinsic motivation have offered cash, we did not offer cash for two main reasons in addition to the benefits of using gift cards. First, the Food and Drug Administration prohibits blood collected from donors paid in cash from being labeled as coming from volunteer donors. Second, because the ARC does not provide cash rewards, a cash offer would be perceived as unusual, making the interpretation of the results more difficult. In §5 we discuss how the effects of rewards on behavior and crowding may differ between gift cards and cash.

(condition A). We eventually used only 26 of the 27 advertised treatment drives in the analysis because unforeseen contingencies at one location did not allow the host to apply our protocol. In the nine unadvertised reward drives (two in each of the first three periods), no subject was informed in advance of the incentive. Regardless of the treatment, all donors who presented were given the cards at all 36 reward drives.

The ARC guaranteed that standard procedures were used for all drives in the experiment. Because subjects were not informed that a study was conducted and the ARC offers gift cards or other items of similar value, it is also reasonable to assume that subjects were not aware of participating in a study or being observed. Thus, our design is a natural field experiment (Harrison and List 2004). The only change to the ARC's operations was the random assignment of rewards to drives and who was informed about them; no other aspect (e.g., personnel, location, supplies, or communications) changed. Because about 40% of ARC drives offer a promotional item, and most flyers show at least one drive with a promotion, the reward offers should not be perceived as unusual. Finally, subjects could always choose to donate when and where no items were offered, so we can observe whether subjects spatially or temporally change behavior.

3.2. Assessing the Impact of the Rewards

The experimental design and data allow us to test multiple channels through which incentives might affect subject behavior and blood donation. These tests are described below.

Short-Term Local Effects. The only difference in the design between the uninformed-of-reward and the informed-of-reward subjects at the advertised reward drives is whether they received a flyer indicating or not indicating the reward offer. Thus, we compare the donation behavior of these two groups to assess the effect of reward offers at the intervention drives.

Spillovers. Some individuals may learn about the rewards from the informed subjects through word-of-mouth or other social networking activities. Because no subject receiving flyers for the unadvertised reward drives was informed of the rewards, the donation behavior of this group offers a benchmark for the donations of the uninformed subjects at the advertised drives (for a similar design in a different context, see Duflo and Saez 2003).[11] If these spillovers occur, comparing donations between the informed and uninformed subjects at the advertised reward drives underestimates the effect of rewards. We also measure spillovers by comparing the number of new and lapsed donors who present at the advertised reward drives with those who present at no reward drives.[12]

Spatial Substitution. Observing donations at *all* ARC drives in Northern Ohio lets us test for displacement generated by the incentive offers; subjects may be attracted to a drive offering a reward and away from another drive where they otherwise would have donated. This does not constitute a genuine new donation. We explore this effect to estimate the overall, immediate impact of the rewards.

Heterogeneous Responses. The data provide proxies for both intrinsic motivation and costs to donate. Having donated previously at a given location likely reveals lower costs of donating at that site than at a different one (e.g., in terms of travel time). A past donation at a site can also lower the cost of donating there again to the extent that it lowers logistical costs and uncertainty (e.g., finding the location). Given these lower costs, we expect stronger absolute responses to incentive offers for those who previously donated at the advertised reward drives. For those who have not donated at a drive previously, the reward will need to be larger to overcome the higher cost of donating at the new location.[13] Furthermore, the total number, frequency, and recency of past donations as well as type O negative blood type provide plausible proxies for intrinsic motivation. We assume that more donations and donating more recently are indicators of higher intrinsic utility to donate. Whether donors with greater intrinsic motivation should be more or less responsive to incentives is ambiguous. On one hand, more intrinsically motivated individuals might be likely to donate irrespective of the presence of incentives and therefore be unaffected or even negatively affected by rewards if the rewards crowd out the intrinsic motivation. On the other hand, a stronger reputation for volunteering (associated with having donated more often and more recently) may lessen the severity of the negative image effects (Exley 2013). Type O negative individuals (universal donors) might also have higher intrinsic motivation given the greater potential usage

[11] It is also possible that officially informed subjects might learn that a uniformed subject did not receive a reward offer. This could potentially introduce uncertainty with the informed subject regarding whether a reward would be given and thus lower the subject's expected value of the reward. In this case, we would underestimate the effect of the incentive offer.

[12] Although we did not anticipate informal communications between ARC personnel or drive hosts and contacted donors as were requested to follow our protocols, we also test for this possibility by comparing donations at unadvertised reward drives and no reward drives. Details are reported in the online appendix.

[13] Another proxy for donation costs is age; older individuals may have higher costs because of their health status and mobility. However, older age may also correlate with lower opportunity cost of time if, for example, they are retired.

Table 1 Characteristics of the Experimental Sites Before and During the Intervention

	All ARC Northern Ohio sites		No reward sites		Advertised reward sites		Unadvertised reward sites	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Preintervention								
No. of drives in reference year	2.63	(2.35)	5.56	(1.38)	5.70	(1.30)	6.00	(0.71)
Fraction of drives with incentives	0.42	(0.36)	0.21	(0.19)	0.24	(0.18)	0.25	(0.19)
Average drive length (hours)	5.27	(1.11)	5.22	(0.76)	5.29	(0.62)	4.98	(0.77)
Average no. of donors presenting	29.92	(21.31)	30.68	(10.20)	32.05	(9.63)	27.38	(7.97)
Average no. of units of blood collected	25.61	(17.93)	26.69	(8.94)	28.07	(8.34)	23.79	(7.59)
Donors deferred as a share of presenting	0.14	(0.08)	0.13	(0.04)	0.12	(0.03)	0.14	(0.04)
At intervention drive								
Drive length			5.18	(0.90)	5.08	(0.78)	4.89	(0.78)
No. of drives in flyer					15.35	(6.42)	13.67	(4.95)
No. of drives with ARC rewards in flyer					8.50	(5.16)	6.89	(2.52)
N	1,427		36		26		9	

Note. This table presents characteristics about the 1,472 ARC blood drive sites in Northern Ohio and the 71 experimental drive sites measured in the reference year before the first intervention wave and on the intervention date.

of their blood (Wildman and Hollingsworth 2009). Finally, although we do not have a specific prior, we test for differential responses between men and women given that past studies found gender differences in the response to incentives.

Long-Term Effects. We consider two types of postintervention effects. First, like spatial displacement, subjects may shift the timing of a donation that they would have made otherwise to obtain the rewards. Although this type of response would result in no effect on overall donations, it could help alleviate seasonal shortages. Second, if being offered rewards permanently reduces intrinsic motivations, then postintervention decreases in donations will be longer-lasting and negatively affect total supply.

3.3. Descriptive Statistics and Design Checks

Table 1 shows statistics on the characteristics of the experimental sites selected and not selected for the study for the year prior to and during our intervention. Given the random assignment, the three conditions (no reward, advertised rewards, and unadvertised rewards) have similar characteristics. Most of the characteristics are also nearly identical for the selected and nonselected locations (e.g., similar turnout and blood units collected). However, because of our selection criteria (see the online appendix for details), in the prior year the selected sites hosted more drives (we required at least three) but fewer drives with incentives (we required at most 50% and none in the drive prior to the intervention) than the sites not selected.

The randomization was successful also at the individual level (Table 2). Subjects were nearly identical across the treatments overall and conditional on having previously donated at an intervention site or not. Identifying subjects based on whether they have or have not previously donated at a specific location naturally leads to substantial heterogeneity because individuals who donate at more locations will be more likely to have donated at a given location and the subject characteristics reflect this heterogeneity.[14] Subjects with a past donation history at the sites on average had donated at three different locations, whereas subjects without a past donation history at the sites had donated on average at about two different locations. Those with past history at an intervention site also had made more total donations, donated more frequently in the past two years, and donated more recently. They were also older than those who had not donated at the intervention sites. This heterogeneity highlights the importance of separately analyzing subjects with and without past donation experience at the intervention sites. We henceforth refer to subjects with and without at least one past donation at the intervention sites simply as subjects with and without history (4,745 and 123,945 observations, respectively).

We make three final points to further verify the validity of the design. First, a survey was conducted at the reward drives to assess whether the information on the rewards was communicated as designed. Presenting donors were asked whether they knew about the presence of gift cards before coming to the blood drive and, if so, how they learned about

[14] To illustrate this point, consider two intervention drives, X and Y, and two types of people, A and B, each comprising half of the population. Type A people have donated at both locations and half of type B people have only donated at X and the other half only at Y. Although there would be an equal number of types A and B overall, all type A's and half of the type B's have past history at an intervention drive whereas no type A's and half of type B's have never donated at an intervention drive. Thus, the subjects who have donated at more locations (A's) will make up more of the population among those who have past history (they make up two-thirds of this population) than among those who have never donated at an intervention site.

Table 2 Subjects Contacted for the Intervention Drives—Individual Characteristics

	All subjects contacted			Subjects with previous donation experience at the intervention site			Subjects without previous donation experience at the intervention site		
	Advertised reward			Advertised reward			Advertised reward		
	Informed of reward	Not informed of reward	Unadvertised reward	Informed of reward	Not informed of reward	Unadvertised reward	Informed of reward	Not informed of reward	Unadvertised reward
Ethnicity									
Caucasian	0.929	0.931	0.937	0.973	0.978	0.980	0.928	0.929	0.936
African American	0.023	0.023	0.020	0.004	0.005	0.001	0.024	0.023	0.021
Other	0.047	0.046	0.043	0.023	0.016	0.019	0.048	0.048	0.043
Female	0.522	0.524	0.507	0.492	0.502	0.478	0.523	0.525	0.508
O negative blood type	0.089	0.089	0.088	0.112	0.100	0.107	0.088	0.089	0.087
Age									
16–25	0.311	0.312	0.301	0.128	0.136	0.141	0.318	0.319	0.307
26–50	0.383	0.383	0.379	0.363	0.353	0.319	0.383	0.384	0.381
51+	0.307	0.305	0.320	0.509	0.511	0.540	0.298	0.297	0.312
N. of previous donations									
1–4	0.525	0.527	0.531	0.217	0.229	0.228	0.538	0.539	0.542
5–9	0.163	0.164	0.156	0.189	0.186	0.168	0.162	0.163	0.155
10–14	0.079	0.079	0.078	0.125	0.105	0.098	0.077	0.078	0.077
15+	0.232	0.229	0.235	0.469	0.480	0.505	0.223	0.220	0.226
Donations/year in the past two years									
Average	1.206	1.196	1.122	1.967	1.942	2.036	1.175	1.167	1.090
At most 1	0.679	0.683	0.724	0.397	0.405	0.373	0.691	0.693	0.736
Between 1 and 1.5	0.117	0.118	0.095	0.148	0.140	0.138	0.116	0.117	0.093
More than 1.5	0.204	0.199	0.182	0.455	0.455	0.490	0.194	0.190	0.171
Time of last donation prior to intervention									
Within 6 months	0.380	0.376	0.378	0.573	0.574	0.588	0.372	0.368	0.371
Between 6 and 12 months	0.279	0.277	0.276	0.202	0.191	0.197	0.282	0.280	0.279
More than 12 months	0.341	0.347	0.345	0.225	0.236	0.215	0.346	0.351	0.350
Number of sites where donated in the past									
Average	1.990	1.980	1.763	3.083	2.945	3.068	1.950	1.942	1.717
One site only	0.551	0.553	0.639	0.295	0.335	0.292	0.561	0.561	0.651
Two sites	0.211	0.214	0.182	0.219	0.212	0.229	0.211	0.214	0.180
Three or more sites	0.238	0.234	0.179	0.487	0.453	0.479	0.228	0.225	0.169
N	46,434	46,288	35,968	1,806	1,710	1,229	44,628	44,578	34,739

Note. This table presents characteristics for the total 128,690 individual-wave subjects contacted for an intervention drive, divided by experimental condition and previous donation experience at the intervention sites.

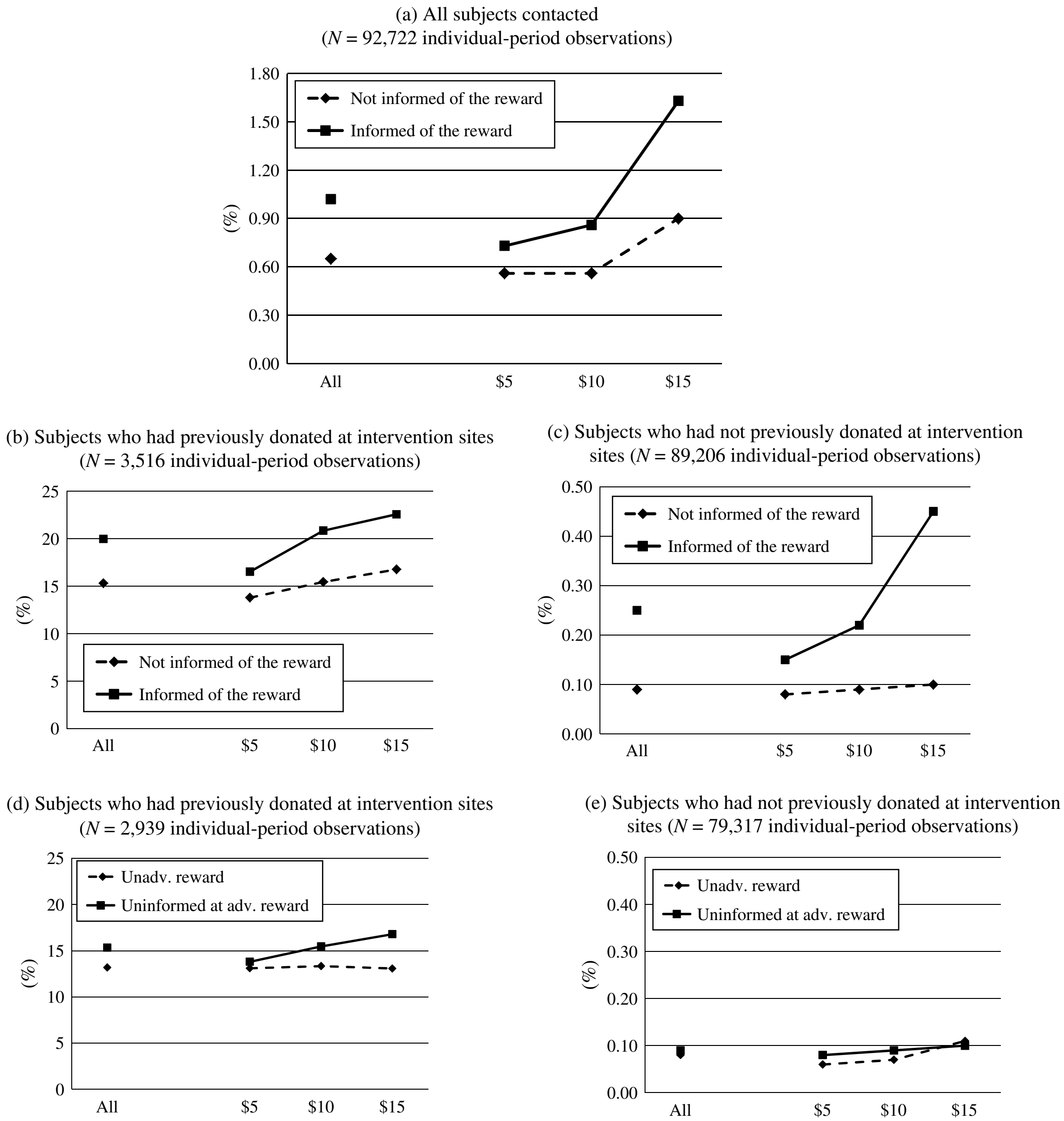
them. The response rate was 94% and we collected 640 surveys. Among those who were sent flyers with the reward information, 52% (147/282) indicated knowing about them primarily through the flyers.[15] In contrast, only 4% (6/149) of the respondents at the unadvertised reward drives reported knowing about the rewards. Thus, the official communication of rewards was effective and the lack of awareness of subjects at the unadvertised drives is consistent with ARC representatives and hosts not telling anyone about the rewards.

Second, to further investigate if the same standard recruitment procedures were used for the drives with and without rewards, we compared donations at no reward drives with donations at unadvertised reward drives where ARC representatives were aware of the incentives but no subjects were informed. Table A2 in the online appendix shows no significant difference in donation rates at the unadvertised and no reward drives. This result indicates that there is no significant unofficial information regarding rewards being communicated from the ARC representatives and drive hosts to subjects.

Third, we examined whether gift cards were actually taken and used. We find that 98% of the cards offered were taken and more than 90% of the sum of all the cards' value was spent within the first four weeks after being given out with no differences in either the take-up or usage rates across the conditions.

[15] There could be many reasons why only 52% of informed respondents indicated knowing about the rewards. For instance, they may have not noticed, forgotten, or not wanted to admit knowing about them. In our analysis, we adopt the standard conservative approach of estimating "intent to treat" effects. This implies that our results may underestimate the effect of incentives to the extent that donors did not even notice the reward offer.

Figure 2 **Share of Subjects Who Donated at the Advertised Reward Drives**



Notes. Panels (a)–(c) show the percentage of subjects contacted for an advertised reward drive who donated blood at that drive who were not informed of the reward (dashed lines and diamond markers) and who were informed of the reward (continuous lines and square markers). The overall donations are shown on the left side. The right side shows the donations broken into the specific reward dollar values. In panels (d) and (e), the dashed lines and diamond markers represent the percentage of subjects informed of an unadvertised reward drive who donated at that drive. The continuous lines and square markers represent the percentage of subjects informed of an advertised reward drives, but not informed by the ARC of the reward offer, who donated at that drive.

Thus, we are confident that the subjects perceived the rewards as having economic value.[16]

4. Results

We first report on all short-term impacts of the rewards and then assess the long-term effects. We conclude by quantifying the overall costs and benefits of the intervention.

[16] There was almost immediate use of the gift cards, thus little variation in when they were used; we do not observe what subjects purchased with gift cards, so there was not much more that we could learn beyond that the cards were used.

Result 1 (Direct Effects). Subjects informed of rewards are more likely to donate than subjects contacted for the same drives but not informed of the rewards, with the effect increasing in the value of the reward.

4.1. Short-Term Responses

4.1.1. Effect of Incentives at the Advertised Reward Drives. Figures 2(a)–2(c) show the average donation rates at the advertised reward drives for all subjects and separately for subjects with and without history. Donation rates are higher when subjects

Table 3 Effect of Incentives at the Advertised Reward Drives

Dependent variable:	1 if donated at intervention drive, 0 otherwise								
Sample:	Subjects contacted for an advertised reward drive								
	All			Previous history at site			No previous history at site		
Mean of dependent variable (for uninformed subjects):	0.65%			15.32%			0.09%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Informed of reward	0.33***			5.50***			0.16***		
	(0.06)			(1.18)			(0.03)		
Informed of $5 *reward*		0.11	0.15*		3.66**	3.72**		0.055*	0.062*
		(0.07)	(0.08)		(1.61)	(1.89)		(0.032)	(0.036)
Informed of $10 *reward*		0.33***	0.31***		5.52***	7.02***		0.135***	0.142***
		(0.08)	(0.09)		(1.90)	(2.26)		(0.041)	(0.045)
Informed of $15 *reward*		0.66***	0.61***		7.19***	5.52***		0.356***	0.341***
		(0.11)	(0.13)		(1.66)	(2.01)		(0.064)	(0.067)
p-value of:									
$10 *informed* ≥ $5 *informed*		0.01	0.08		0.20	0.13		0.05	0.08
$15 *informed* ≥ $10 *informed*		0.01	0.03		0.23	0.69		0.00	0.01
$15 *informed* ≥ $5 *informed*		0.00	0.00		0.04	0.26		0.00	0.00
Intervention wave fixed effects	x	x		x	x		x	x	
Site fixed effects			x			x			x
Observations	92,722	92,722	92,722	3,516	3,516	3,516	89,206	89,206	89,206
R-squared	0.143	0.144	0.146	0.157	0.158	0.168	0.002	0.002	0.003

Notes. The estimates are from linear probability models. All regressions include controls for gender (dummy for female), age (dummies for 18–25, 25–49, and 50+), a dummy for the type O negative blood type, total donations to date (dummies for 1–4, 5–9, 10–14, and 15+ donations), average annual donation frequency in the past two years (dummies for at most 1, between 1 and 1.5, and 1.5+), number of distinct sites where donated in the past (dummies for 1, 2, and 3+), and most recent donation (more than 12 months earlier, within the last 6 to 12 months, or within the last 6 months). For all categorical dummies, the first category is omitted from the regressions. Standard errors clustered by individual are reported in parentheses. The estimated coefficients were multiplied by 100 and thus represent percentage-point changes.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

were informed of a reward, especially the $15 reward. Patterns are similar for subjects with and without past history (Figures 2(b) and 2(c), respectively), and the donation rates are much higher for subjects with past history.

Table 3 reports estimates of versions of the following model:

$$DONATED_{ijt} = a + \beta T_{ijt} + \gamma X_{ijt} + \eta_j + \mu_t + \varepsilon_{ijt}. \quad (1)$$

$DONATED_{ijt}$ is equal to 1 if subject i donated at intervention drive j on date t (one of the intervention periods) and 0 otherwise. The treatment dummy T_{ijt} is an indicator for whether subject i was informed of a reward as opposed to not being informed when contacted about a given drive; thus, the coefficient β indicates the difference in donation probability at the same drive between these two groups. We estimate both the average effect across the three dollar values and the effect for each different value. The controls in vector X_{ijt} include dummy variables for gender and O negative blood type as well as categorical variables for age, total donations to date, average annual donation frequency in the past two years, number of distinct sites where donated in the past, and most recent donation (see Table 3 for details). The terms η_j and μ_t represent drive-level and intervention-period fixed effects, respectively. We use linear probability models because they allow us to conveniently include drive-level and other fixed effects without running into incidental-parameter problems (Angrist and Pischke 2009) and they provide a more direct interpretation of the marginal effects especially on interaction terms (Ai and Norton 2003).[17] Standard errors are clustered by individual because about half of the subjects were contacted in more than one period.[18]

The regressions estimate a higher donation likelihood by informed-of-reward subjects (column (1)) that is increasing with the dollar value of the reward (columns (2) and (3)). Given the heterogeneity between subjects with and without history, we always

[17] Table A3 in the online appendix reports marginal effects from Logit estimates of our main models. For individuals without history, we use a rare events model to account for the rare occurrence of donations at our drives (King and Zeng 2001, 2002). The results from these alternative specifications are similar to those from linear probability models.

[18] For this and the subsequent regressions tables in the article, we report only the main estimates of interest; full sets of estimates are reported in the online appendix.

estimate results over all subjects and separately for subjects with and without history. For subjects with history (columns (4) and (5); baseline donation rate of 15.3%), offering rewards increased the donations by 5.5 percentage points for informed subjects. The increase in donations to \$5, \$10, and \$15 offers is estimated to be 3.66, 5.52, and 7.19 percentage points higher, respectively, than donations by the uninformed subjects—a 24%, 36%, and 47% relative increase, respectively.

Column (6) shows results with drive fixed effects. The estimated effects are closer across the three dollar amounts. However, this does not necessarily imply that the effect of the reward offer on donations is more similar (or nonmonotonic). In particular, if knowledge about the reward offer was passed from informed to uninformed subjects and if this donor-to-donor spillover was more prevalent for higher reward values, then uninformed subjects would also show a higher donation response to higher reward offers. Figure 2(b) shows this pattern. This higher donation rate among the uninformed with higher reward offers thus compresses the difference in the fixed-effects estimates between informed and uninformed donors. We explore the significance of this spillover effect more formally below.

For subjects with no history at the advertised drives, the estimated effects are significant and large. Being informed of a reward led to an average 0.16 percentage-point increase in the likelihood to donate, compared with a 0.09 percentage-point base rate for the uninformed subjects. The response to the \$15 offer was particularly large because it increased the likelihood to donate by about 0.36 percentage points, or approximately 400% over the uninformed subject's base rate (columns (7)–(9)).[19]

Result 2 (Spillovers). Informing individuals of rewards led others who were not officially informed to be more likely to donate.

Figures 2(d) and 2(e) show the donation rates among uninformed subjects with and without history, respectively, at the advertised and unadvertised reward drives. Donations increased with the reward value among the uninformed subjects with history at the advertised reward drives (Figure 2(d)) whereas there is no equivalent increase for subjects at the unadvertised drives (Figure 2(e)). This suggests that some of the uninformed subjects at the advertised reward drives may have been influenced by informed subjects. The survey evidence mentioned in §3 is consistent with this potential spillover; significantly more of the uninformed-of-reward donors at the advertised reward drives reported knowing about the reward (14%; 29/209) than the uninformed-of-reward donors at the unadvertised drives (4%; 6/149) (p of difference < 0.01).

We identify spillover effects in two ways. First, we compare the behavior of the officially uninformed subjects at the advertised and unadvertised drives. Differences in donations may be attributed to informed donors affecting uninformed subjects behavior because only the presence of informed subjects systematically differs (ARC representatives and hosts were aware of the rewards in both sets of drives). We estimate the nearly identical model (1) specification above, except that now (a) the treatment dummy T_{ijt} equals 1 if a subject was contacted for an advertised reward drive but was uninformed about the reward and 0 if the subject was contacted for an unadvertised reward drive, and (b) because it compares behavior across-drives, the standard errors are corrected for potential within-drive correlation (Donald and Lang 2007, Moulton 1990) and we cluster at both the individual and drive level (using the procedure developed in Cameron et al. 2011).[20]

The estimates are in Table 4. Uninformed subjects were significantly more likely to donate at the advertised than unadvertised drives, driven by the \$15 reward (columns (1) and (2)). This difference is entirely driven by subjects with history (columns (3)–(6)), with the uninformed at advertised reward drives being 2.3 percentage points more likely to donate than were those at the unadvertised drives ($p < 0.10$). This average increase is driven primarily by the \$15 reward, which raised the donation rate by almost 3.6 percentage points ($p < 0.05$). For subjects with no history, no substantial effects were detected. The fact that the effect is limited to subjects with history at a drive is further indication of a spillover; the subjects who had donated before at the same site are more likely to share social ties because, for example, they are more likely to live in the same neighborhood, work together, and donate together.

For the second spillover test, we examine the 328 individuals who donated at the intervention sites

[19] In Table A9a in the online appendix, we also report results with individual fixed effects. The results on the full sample and the subsample of subjects without history are similar to those presented in the text. The results on the subsample with history are noisy because only 20 of the 3,493 subjects were contacted in more than one intervention period. We report these latter results for completeness, but they should be cautiously interpreted with this small-sample caveat in mind.

[20] Although the clusters (35) are more than the number (30) suggested by Cameron et al. in Tables A6 and A8 of the online appendix, we report results of regressions with p values obtained by two-way clustering (by donor and drive) and bootstrapping along the drive dimension using the procedure in Cameron et al. (2008). The estimated standard errors are larger, but the key point estimates from Table 4 are significant at the 10% level and from Table 6 at the 5% and 1% levels.

Table 4 Spillover Effects; Uninformed at Advertised Reward Drives vs. Uninformed at Unadvertised Reward Drives

Dependent variable:	1 if donated at intervention drive, 0 otherwise					
Sample:	Uninformed subjects (either at unadvertised or advertised reward drives)					
	All		Previous history at site		No previous history at site	
Mean of dependent variable (for uninformed subjects at unadvertised drives):	0.53%		13.18%		0.08%	
	(1)	(2)	(3)	(4)	(5)	(6)
Uninformed at advertised reward drives	0.16 (0.08)**		2.26 (1.36)*		0.000 (0.024)	
Uninformed at \$5 *advertised reward drives*		0.11 (0.11)		2.45 (2.11)		−0.008 (0.023)
Uninformed at \$10 *advertised reward drives*		0.16 (0.11)		0.31 (1.87)		0.000 (0.036)
Uninformed at \$15 *advertised reward drives*		0.24 (0.12)**		3.57 (1.75)**		0.013 (0.034)
p-value of:						
\$10 *adv. rew.* ≥ \$5 *adv. rew.*		0.35		0.19		0.40
\$15 *adv. rew.* ≥ \$10 *adv. rew.*		0.28		0.06		0.31
\$15 *adv. rew.* ≥ \$5 *adv. rew.*		0.19		0.33		0.20
Observations	82,259	82,259	2,939	2,939	79,320	79,320
Adjusted *R*-squared	0.127	0.127	0.154	0.155	0.001	0.001

Notes. The estimates are from linear probability models. All regressions include the same controls as those described in Table 3. Intervention-period fixed effects are included in all specifications. Two-way (donor and drive) clustered standard errors (Cameron et al. 2011) are reported in parentheses. The estimated coefficients were multiplied by 100 and thus represent percentage-point changes.

$^{*}p < 0.1$; $^{**}p < 0.05$.

but were not contacted through any formal ARC channel about the presence of these drives (in other words, these are not subjects and they received no flyers during the study period). Table 5 shows that among these individuals 108 were first-time donors and the remaining 220 had donated at some point in the past (lapsed donors). If there were no spillovers, we would expect the donations of these individuals to be distributed across the drives proportionally to the number of drives for each condition—thus 36.7% (26/71) at advertised reward drives, 50.6% (36/71) at no reward drives and 12.7% (9/71) at unadvertised reward drives. Instead, we observe a shift in the actual distribution of these donors toward advertised reward drives; 46.3%, 43.5%, and 47.7% of overall, first-time, and lapsed donors, respectively, donated at the advertised drives and the differences from the theoretical 36.7% level are statistically significant.

Table 5 Distribution of Noncontacted Donors at Intervention Drives

	No reward drives	Unadvertised reward drives	Advertised reward drives
No. of drives	36	9	26
Share of total no. of drives (%)	50.7	12.7	36.6
	All noncontacted donors		
No. of noncontacted donors	148	28	152
Share of total no. of noncontacted donors (%)	45.1	8.5	46.3
Difference			+**9.7%**
Binomial test *p*-value			0.01
	First-time donors		
No. of noncontacted donors	56	5	47
Share of total no. of noncontacted donors (%)	51.9	4.6	43.5
Difference			+**6.9%**
Binomial test *p*-value			0.07
	Non-first-time donors		
No. of noncontacted donors	92	23	105
Share of total no. of noncontacted donors (%)	41.8	10.5	47.7
Difference			+**11.1%**
Binomial test *p*-value			0.01

These proportions translate to the average number of noncontacted donors per drive being higher at the advertised reward drives (5.8) than at the no reward and unadvertised reward drives (3.9). Thus, 1.9 extra noncontacted individuals donated per advertised reward drive when the ARC officially communicated the reward to only half the subjects. Given that on average each drive generated 26.8 units of blood during the preintervention period (Table 1), 7.1% (1.9/26.8) more donations per drive were due to spillovers. If we assume that these new and lapsed donors were primarily attracted by the informed-of-reward subjects with history, then the 1,283 informed-of-reward subjects with history over the 26 drives attracted on average 1.9 extra donors per drive, or 3.9 new and lapsed donors for every 100 subjects informed of the reward ($3.9 = [26 * 1.9] * [100/1,283]$). The value of attracting new and lapsed donors to make a donation may be greater to the organization than the donation itself to the extent that they become active and repeat donors.

Two mechanisms may explain these results. First, informed-of-reward subjects may actively motivate their relatives, friends, neighbors, and coworkers, e.g., through announcing their activities and the rewards (Kessler 2013). Second, more passive peer or neighborhood effects may occur when more people are seen donating, e.g., other individuals, even if not aware of the rewards, may decide to donate in order to conform (Brock and Durlauf 2001). Separating these social mechanisms is an important avenue for future research.

Result 3 (Total Direct Effects). The overall positive effect of the reward offers at the treatment sites is greater than the effect on the individuals formally informed of rewards.

The spillovers between subjects informed and uninformed of rewards indicates that the difference in donations between these subjects underestimates the total direct effect of offering rewards. To determine the total direct effect, we compare the donations of subjects who were informed of rewards at the advertised drives with all the subjects invited to the unadvertised reward drives. We again estimate model (1) above, but now we compare subjects informed of the rewards ($T_{ijt} = 1$) with subjects contacted for the unadvertised reward drives ($T_{ijt} = 0$) and again cluster standard errors by individual and drive. The results are in Table 6. Subjects with and without history were more likely to donate if informed of the rewards. Overall, the likelihood to donate was about 7.7 percentage points higher for subjects with history (a relative increase of over 50% from the baseline of 13.2%) and 0.14 percentage points higher for those without history (175% higher than the baseline of 0.08%). The effects increased with the value of the reward. The $5, $10, and $15 rewards increased the likelihood of donating by 5.7, 7.4 and 9.5 percentage points, respectively, for subjects with history (all $p < 0.01$) and by 0.03 ($p = 0.43$), 0.11 ($p = 0.14$), and 0.34 ($p < 0.01$) percentage points for those with no history.[21]

4.1.2. Testing for Spatial Displacement. We now estimate the effect of our intervention on donations at ARC drives other than the intervention drives included on the flyer (i.e., in the same county as the intervention drive) and at drives that took place elsewhere in Northern Ohio during the intervention month. We assume that any unobserved donations at other locations outside of the ARC's operations are unlikely to affect displacement estimates in any meaningful way because other blood banks played a minor role in Northern Ohio (under 15% of the total units collected) and donors are unlikely to donate with multiple blood collection organizations.[22] We also estimate the reward offer effects at *all* ARC drives (including the intervention drives) during the intervention months to determine the overall short-term effects.

We compare subjects informed of the rewards at the advertised drives with subjects at the unadvertised reward drives. Versions of model (1) are estimated using the binary outcomes "donated somewhere else in the county," "donated somewhere else in Northern Ohio outside the county," and "donated anywhere in Northern Ohio." Because the likelihood to donate somewhere else may depend on the number and features of the alternative options, the regressions control for the number of other drives included on the flyer when the intervention drive was advertised[23]

[21] Table A9b in the online appendix reports results with individual fixed effects. Again, the results on the full sample and on the subsample of subjects without history are similar to those presented here, whereas the results on the subsample with history are noisy because of only a very small number of subjects (24 of 3,006) contacted in more than one period.

[22] It is also possible that displacement occurs outside Northern Ohio, but this is likely to reflect subjects moving rather than being an effect of the rewards. Substitution may also occur with plasma or platelet donations; however, these components represent only a small share of donations. Finally, subjects could substitute some other form of prosocial behavior in response to a blood donation reward offer, but this also is unlikely to affect the estimates given the unobvious relationship between blood donations and other prosocial activities. An analysis of displacement to all possibly relevant activities is beyond the scope of this paper, but studying displacement in the blood donation context may be as ideal a context as possible because there are no close substitutes for blood donations (as opposed to, e.g., cash donations).

[23] We could control for either the number of drives offering incentives or the total number of drives on a flyer, but we could not add both because the correlation between them was nearly 0.8. The results do not change meaningfully with either control; because there is a better fit with the number of drives offering rewards, we present these estimates.

Table 6 Total Direct Effect of the Incentives

Dependent variable:	1 if donated at intervention drive, 0 otherwise					
Sample:	Uninformed subjects (either at unadvertised or advertised reward drives)					
	All		Previous history at site		No previous history at site	
Mean of dependent variable (for uninformed subjects at unadvertised drives):	0.53%		13.19%		0.08%	
	(1)	(2)	(3)	(4)	(5)	(6)
Informed of reward	0.47***		7.67		0.142***	
	(0.10)		(1.47)***		(0.042)	
Informed of \$5 *reward*		0.24**		5.73***		0.033
		(0.10)		(1.66)		(0.041)
Informed of \$10 *reward*		0.46***		7.40***		0.111
		(0.12)		(2.02)		(0.074)
Informed of \$15 *reward*		0.80***		9.54***		0.344***
		(0.23)		(2.14)		(0.102)
p-value of:						
\$10 *informed* ≥ \$5 *informed*		0.04		0.23		0.18
\$15 *informed* ≥ \$10 *informed*		0.08		0.21		0.04
\$15 *informed* ≥ \$5 *informed*		0.01		0.06		0.00
Observations	82,399	82,399	3,035	3,035	79,364	79,364
Adjusted R-squared	0.137	0.137	0.158	0.159	0.003	0.003

Notes. The estimates are from linear probability models. All regressions include the controls described for Table 3 above. Intervention-period fixed effects are included in all specifications. Two-way (donor and drive) clustered standard errors are reported in parentheses. The estimated coefficients were multiplied by 100 and thus represent percentage-point changes.

$^{**}p < 0.05$; $^{***}p < 0.01$.

and whether a blood drive where the subject had donated in the past (other than the intervention drive) offered a reward during the intervention month. The coefficient of interest in these regressions is again the one on T_{ijt} ($=1$ if subject i was informed of the reward at the advertised drive and $=0$ if contacted for an unadvertised reward drive).

Result 4 (Spatial Displacement). The increase in donations at the intervention drives due to rewards is partially explained by displacement of donations away from non-intervention drives.

Table 7 presents the results from 16 separate regressions.[24] Columns (1) and (5) show the estimates on "donated at the intervention drive" from Table 7 with the added control variables. Row 1 shows the estimates from regressions aggregating across the three reward values and Rows 2–4 show the estimates with dummies for each reward value. Thus, each column shows results from two regressions, one in row 1 and one in rows 2–4. Columns (1) and (5) show that the extra control variables increase the estimated effect of reward offers on donations by 0.23 and 0.02 percentage points for subjects with and without history (compared with those presented in Table 6), but they do not change the qualitative interpretation of any of the results described above.

For subjects with history, being informed of the rewards increased the donation rate at an intervention drive by 7.9 percentage points, but it decreased the donation rate at other sites within the same county by 2.45 percentage points ($p < 0.10$) and had no effect at drives outside the county. The within-county displacement explains roughly 31% (2.45/7.9) of the increase at the intervention drives. The displacement effect was especially large for the \$15 reward ($p < 0.01$), explaining nearly 45% (4.5/10.1) of the higher donation rates at the intervention drives. The overall effect of the \$15 incentive, net of any displacement effect reported in column (4), is 6 percentage points. A consequence of the larger spatial displacement at the \$15 drives is that, in contrast to the local effect, the net increase in donation rates that includes displacement effects no longer differs between the \$10 and \$15 offers. For

[24] Among subjects with a past history (Table A10-a in the online appendix), the number of drives at which the ARC offered some reward was positively correlated with the likelihood that the donor gave blood at some drive other than the intervention drive and the variable capturing whether some ARC-provided reward was offered at a drive at which the donor had given blood in the past (excluding the intervention site) was positively correlated with the likelihood that the donor gave blood at some drive in the county other than the intervention drive and negatively correlated with the likelihood of donating at the intervention drive. For donors without history (Table A10-b), a reward offer at drives where they had given in the past was positively correlated with the likelihood that they donated somewhere other than the intervention site.

Table 7 Local, Displacement, and Total Effects

Sample:	Subjects informed of reward at advertised or uninformed at unadvertised drives							
	Previous history at intervention site				No previous history at intervention site			
Dependent variable:	Donated at intervention drive	Donated at other drives in county	Donated at other drives outside county	Donated anywhere	Donated at intervention drive	Donated at other drives in county	Donated at other drives outside county	Donated anywhere
Mean of dependent variable (for uninformed subjects):	13.19%	8.88%	2.69%	24.74%	0.08%	5.79%	3.53%	9.40%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All	7.90***	−2.45*	0.50	5.96***	0.16***	0.47	−0.59	0.05
	(1.51)	(1.48)	(0.82)	(1.52)	(0.05)	(0.59)	(0.55)	(0.35)
$5 *advertised reward*	6.31***	−2.19	0.49	4.62**	0.06	0.35	−0.83	−0.43
	(1.66)	(1.66)	(0.92)	(2.12)	(0.05)	(0.64)	(0.63)	(0.42)
$10 *advertised reward*	6.86***	−0.17	0.57	7.26***	0.12*	0.55	−0.41	0.26
	(2.13)	(1.80)	(0.86)	(1.97)	(0.07)	(0.70)	(0.54)	(0.37)
$15 *advertised reward*	10.06***	−4.50***	0.44	6.00**	0.36***	0.51	−0.58	0.29
	(2.02)	(1.47)	(1.07)	(2.33)	(0.10)	(0.63)	(0.71)	(0.44)
p-value of:								
$10 *adv. rew.* ≥ $5 *adv. rew.*	0.41	0.11	0.44	0.15	0.23	0.36	0.17	0.32
$15 *adv. rew.* ≥ $10 *adv. rew.*	0.11	0.00	0.45	0.32	0.03	0.48	0.37	0.38
$15 *adv. rew.* ≥ $5 *adv. rew.*	0.05	0.05	0.49	0.31	0.00	0.35	0.30	0.16
Observations	3,034	3,034	3,034	3,034	79,329	79,329	79,329	79,329

Notes. The dependent variable is indicated at the top of each column, and the specifications are the same as those in Table 6 with the addition of control variables for the number of alternative drives with material rewards offered in the county and for a dummy variable equal to 1 if a material reward was offered in the intervention month at some drive where the donor had given blood in the past. Two-way (donor and drive) clustered standard errors (Cameron et al. 2011) are reported in parentheses. The estimated coefficients were multiplied by 100 and thus represent percentage-point changes.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

subjects without history, there is no evidence of displacement.[25]

4.1.3. Heterogeneous Effects. We now add interaction terms for each subject characteristic with T_{ijt}, comparing subjects informed of rewards for the advertised reward drives with subjects informed of rewards for the unadvertised reward drives. Each interaction is estimated separately so that the heterogeneous effects for each characteristic are evaluated at the mean value of the other characteristics. We first present estimates for the heterogeneous effects at the intervention drives (Table 8, panel (a)), then for the heterogeneous effects at all other drives in the county (Table 8, panel (b)), and again separately for subjects with and without history at the intervention drives.[26]

Result 5 (Heterogeneous Effects at Intervention Drives). Primarily for subject without previous history at the intervention drives, the responses to the incentive offers at the intervention drives were greater for individuals who are older, donated more often, or donated more recently.

We find no gender or blood type differences in the response to rewards. For subjects with history, we find only a minimal amount of heterogeneity; there is a stronger response among subjects who donated more often (more than once per year) and more recently (within the past 6 months). The results indicate much more heterogeneity among subjects without past history. There is a stronger response among older subjects, subjects with more total donations, subjects who donated with higher frequency in the past two years, subjects who had donated at more locations, and subjects who made their last donation within six months prior to the intervention. One explanation for the stronger response among subjects who were older,

[25] The higher displacement among subjects with history is consistent with the evidence in Table 2 that subjects without history donated at fewer locations in the past (1.9) and were more likely to have only donated at one location (55%) than were donors with history (3% and 29%, respectively). Thus, donors with history have a history of more flexibility in the locations where they donate and should be more prone to displacement effects. Because the overwhelming majority (over 99%) of these donations occurred at locations other than the intervention drives, there is greater noise (unrelated to the experimental conditions) in these estimates. Thus, although the effect of the $15 reward is now 0.29 percentage points, it is not significant because the standard errors increased substantially.

[26] Table 8, panels (a) and (b), reports only the estimated coefficients for the main incentive term (aggregating across the three reward values) and the interactions. Table A11 in the online appendix presents estimates aggregating across subjects with and without history.

Table 8 Heterogeneous Effects

(a) Heterogeneous effects at the intervention drives

Dependent variable:	1 if donated at intervention drive, 0 otherwise													
Sample:	Subjects informed of reward at advertised reward drives or uninformed at unadvertised reward drives													
	Previous history at intervention site							No previous history at intervention site						
Informed of reward	8.86***	5.73**	8.02***	8.26***	7.28**	3.52*	2.67	0.17***	0.04	0.16***	0.53***	0.06	0.06*	0.02
	(2.14)	(2.41)	(1.62)	(2.53)	(3.46)	(2.11)	(2.28)	(0.06)	(0.04)	(0.05)	(0.15)	(0.04)	(0.03)	(0.03)
Female ∗ *Informed of reward*	−1.97							−0.02						
	(2.32)							(0.05)						
Age 26–50 ∗ *Informed of reward*		0.79							0.14**					
		(3.10)							(0.06)					
Age 50+ ∗ *Informed of reward*		3.64							0.22***					
		(3.02)							(0.08)					
O negative ∗ *Informed of reward*			−1.06							−0.05				
			(4.10)							(0.11)				
5–9 *past donations* ∗ *Informed of reward*				−1.92							0.13*			
				(3.47)							(0.08)			
10–14 *past donations* ∗ *Informed of reward*				−4.47							0.17**			
				(3.49)							(0.08)			
15+ *past donations* ∗ *Informed of reward*				0.97							0.27**			
				(3.33)							(0.11)			
Two sites ∗ *Informed of reward*					−0.56							0.12		
					(4.89)							(0.08)		
Three or more sites ∗ *Informed of reward*					1.61							0.49***		
					(4.42)							(0.15)		
Between 1 *and* 1.5 *donations/year* ∗ *Informed of reward*						9.26***							0.24***	
						(3.59)							(0.09)	
More than 1.5 *donations/year* ∗ *Informed of reward*						6.61**							0.43***	
						(3.09)							(0.13)	
Last donation within past 6 *months* ∗ *Informed of reward*							8.57**							0.32***
							(3.78)							(0.09)
Last donation between 6 *and* 12 *months* ∗ *Informed of reward*							0.98							0.07
							(2.44)							(0.05)
Observations	3,034	3,034	3,034	3,034	3,034	3,034	3,034	79,326	79,326	79,326	79,326	79,326	79,326	79,326
Adjusted R-squared	0.160	0.160	0.160	0.160	0.160	0.162	0.163	0.003	0.003	0.003	0.003	0.003	0.003	0.003

more experienced, and donated more recently is that they may be less concerned with rewards undermining their self-image, social image, or intrinsic motivations (Exley 2013). Because these effects primarily occur for subjects with no history at the intervention drives, the results may also reflect greater mobility and to the extent that older, more experienced subjects may be retired or have a lower time valuation. As for the result that those who donated more frequently and more recently were more responsive to the reward offer, their intrinsic motives might also be less affected by receiving a reward. Finally, the greater response among subjects who gave blood at more locations is likely due to lower mobility cost and hence more likely to be induced by a reward to donate at a new location.

Result 6 (Heterogeneous Displacement Effects). Displacement effects among subjects with previous history were stronger for older subjects and for subjects who had donated at more sites and more often.

There is also some heterogeneity in the donations at other locations. Consistent with our finding that displacement occurred only among subjects with history, we only find significant heterogeneity in this group. Stronger displacement effects occurred for the oldest subjects and those who had donated at more than two sites or at least 10 times previously. These results affirm our view that subjects with lower mobility costs (i.e., older and donated at multiple sites) are more likely to spatially alter their donations toward drives offering incentives.

4.2. Long-Term Impact of the Rewards

To test the effects of the incentive offers after the intervention period, we compare subjects who were informed of the rewards at the advertised reward drives with those who were contacted for a no reward

Table 8 (Continued)

(b) Heterogeneous effects in spatial displacement														
Dependent variable:	1 if donated at another drive in the county, 0 otherwise													
Sample:	Subjects informed of reward at advertised reward drives or uninformed at unadvertised reward drives													
	Previous history at intervention site							No previous history at intervention site						
Informed of reward	−1.91	0.12	−2.34	−0.29	0.70	−1.19	−2.05**	0.41	0.44	0.49	0.07	0.32	0.10	0.37
	(1.57)	(1.33)	(1.63)	(0.98)	(1.08)	(0.74)	(0.92)	(0.66)	(0.30)	(0.59)	(1.41)	(0.31)	(0.31)	(0.38)
Female ∗ Informed of reward	−1.09							0.12						
	(1.87)							(0.37)						
Age 26–50 ∗ *Informed of reward*		−0.79							0.31					
		(2.07)							(0.43)					
Age 50+ ∗ *Informed of reward*		−4.38**							−0.27					
		(2.17)							(1.13)					
O negative ∗ Informed of reward			−1.00							−0.18				
			(3.39)							(0.56)				
5–9 *past donations ∗ Informed of reward*				−0.70							0.00			
				(1.88)							(0.52)			
10–14 *past donations ∗ Informed of reward*				−5.02*							0.30			
				(2.70)							(1.01)			
15+ *past donations ∗ Informed of reward*				−3.09							0.59			
				(2.55)							(1.23)			
Two sites ∗ Informed of reward					−1.85							0.53		
					(1.95)							(0.64)		
Three or more sites ∗ Informed of reward					−5.83**							−0.37		
					(2.96)							(1.31)		
Between 1 *and* 1.5 *donations/year ∗ Informed of reward*						−0.85							0.47	
						(2.53)							(0.56)	
More than 1.5 *donations/year ∗ Informed of reward*						−2.42							1.84	
						(2.61)							(1.96)	
Last donation within past 6 months ∗ Informed of reward							−0.25							0.48
							(2.58)							(1.00)
Last donation between 6 *and* 12 *months ∗ Informed of reward*							−1.31							−0.25
							(1.89)							(0.51)
Observations	3,034	3,034	3,034	3,034	3,034	3,034	3,034	79,326	79,326	79,326	79,326	79,326	79,326	79,326
Adjusted *R*-squared	0.079	0.080	0.078	0.079	0.081	0.079	0.079	0.093	0.093	0.093	0.093	0.093	0.093	0.093

Notes. The estimates are from linear probability models. All regressions include the same controls as those described in Table 3 as well as intervention wave fixed effects. This table reports only the main effect of the reward treatment and those of interaction terms. Two-way (donor and drive) clustered standard errors (Cameron et al. 2011) are reported in parentheses. The estimated coefficients were multiplied by 100 and thus represent percentage-point changes.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

drive and who were not contacted for any advertised reward drive and were thus unaware of the intervention reward offers. We proceed with two analyses. We first consider *all contacted subjects*. We then focus on the subjects who *presented to donate* at an intervention drive. We limit the time window to nine months after the intervention because that allows us to use data from all four periods and because a longer time horizon would include noisier data (e.g., increased likelihood of subjects moving outside the region).

Result 7 (Long-Term Effects for All Subjects). Among all contacted subjects, incentive offers had no long-term (i.e., postintervention) effects.

On the full sample of contacted subjects (i.e., the intent to treat), we compare (a) subjects who were invited to advertised reward drives and were sent flyers indicating the reward offer with (b) subjects who were contacted for a no reward drive and were not contacted for any advertised reward drive. These groups are within our experimental design and thus ex ante statistically equivalent (see Table A13 in the online appendix).[27] We estimate versions of model (3) where the outcome is either (i) whether a subject

[27] In addition to the subjects invited to advertised reward drives who were informed of the incentives and the subjects invited to unadvertised reward drives, the sample here also includes subjects invited to no reward drives only (as described in the online appendix, this occurred in nine out of 36 county waves). Also, for the purpose of determining the effect of being informed of the reward on postintervention donations, we no longer require the subjects to be eligible to donate at the intervention drive (as we

Table 9 Long-Term Effects; Informed of the Reward vs. Invited to No Reward Drives

(a) Dependent variable equals 1 if the subject donated anywhere within 12, 26, or 39 weeks after intervention

Dependent variable:	Donated in the *N* weeks after intervention											
	12 weeks		26 weeks		39 weeks		12 weeks		26 weeks		39 weeks	
Sample:	Previous history at site						No previous history at site					
Mean of dependent variable (no-adv. reward donors):	26.6%		45.4%		54.0%		14.3%		29.2%		35.5%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Informed of reward	−0.43		−0.40		−1.44		0.66		0.64		0.70	
	(1.26)		(1.49)		(1.32)		(0.58)		(0.67)		(0.59)	
Informed of $5 *reward*		0.08		0.21		−0.90		0.52		0.34		0.51
		(1.83)		(1.71)		(1.48)		(0.85)		(0.84)		(0.73)
Informed of $10 *reward*		−0.59		−0.12		−0.82		0.87		1.13		1.08
		(2.18)		(1.87)		(1.75)		(0.67)		(0.89)		(0.80)
Informed of $15 *reward*		−0.84		−1.26		−2.53		0.58		0.44		0.51
		(1.39)		(1.91)		(1.80)		(0.50)		(0.64)		(0.64)
Observations	6,738	6,738	6,738	6,738	6,738	6,738	100,962	100,962	100,962	100,962	100,962	100,962
Adjusted R-squared	0.175	0.175	0.287	0.286	0.304	0.304	0.162	0.162	0.256	0.256	0.279	0.279

(b) Dependent variable equals the number of donations made within 26 or 39 weeks after intervention

Dependent variable:	Number of donations in the *N* weeks after intervention											
	12 weeks		26 weeks		39 weeks		12 weeks		26 weeks		39 weeks	
Sample:	Previous history at site						No previous history at site					
Mean of dependent variable (no-adv. reward donors):	0.27		0.71		1.09		0.14		0.41		0.61	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
POST ∗ *Informed of reward*	−0.01		−0.00		−0.05		0.01		0.01		0.01	
	(0.01)		(0.02)		(0.03)		(0.01)		(0.01)		(0.01)	
POST ∗ *Informed of* $5 *reward*		0.00		0.01		−0.02		0.01		−0.00		0.01
		(0.02)		(0.03)		(0.04)		(0.01)		(0.01)		(0.01)
POST ∗ *Informed of* $10 *reward*		−0.01		−0.01		−0.06		0.01		0.02		0.01
		(0.02)		(0.03)		(0.05)		(0.01)		(0.01)		(0.02)
POST ∗ *Informed of* $15 *reward*		−0.01		−0.01		−0.06		0.01		0.01		0.01
		(0.01)		(0.03)		(0.04)		(0.00)		(0.01)		(0.01)
Observations	6,738	6,738	6,738	6,738	6,738	6,738	100,962	100,962	100,962	100,962	100,962	100,962
Adjusted R-squared	0.176	0.176	0.304	0.304	0.344	0.343	0.161	0.161	0.295	0.295	0.345	0.345

Notes. The sample includes observations for subjects who were informed of rewards at the advertised reward drives and for subjects who were contacted for no reward drives and were not contacted for any advertised reward drive. The estimates are from linear probability models. All regressions include the controls described in Table 3 as well as the number of drives offered in the donor's county in the X-week period after the intervention and the number of such drives with rewards. Intervention-period fixed effects are included in all specifications. Standard errors (reported in parentheses) are clustered by county wave. In panel (a), the estimated coefficients were multiplied by 100 and thus represent percentage-point changes.

donated anywhere within N weeks after the intervention date, with $N = 12$, 26, or 39, or (ii) the number of donations made in the same period.[28] Table 9 shows the results. For subjects both with and without history at the intervention drives, the incentive offer did not meaningfully affect postintervention donations. The estimates are small relative to the baseline donation rates, and none is statistically significant.[29]

needed to do in the short-term analyses). To address the potential effects of the subset of subjects who received a reward unexpectedly because they donated at an unadvertised reward drive, we repeated this analysis after removing these donors ($N = 108$) from the sample. Their inclusion or exclusion does not change the results.

[28] Because the ARC requires at least 56 days have to passed between two donations, the 12-week period gives donors four weeks (i.e., approximately one month) to donate postintervention, thus reflecting an immediate response. We refer to weeks because most drives at each location occur on the same day of the week and most individuals donate at the same location over time. The results are not sensitive to choosing different time periods (e.g., 11 or 13 weeks as the first cutoff or 25 or 27 weeks for the second cutoff), and 39 weeks is the longest time we have for the fourth wave of our data.

[29] Table A14 in the online appendix reports these effects using the difference in difference specification in model (2) described below. The results are again qualitatively similar.

Result 8 (Long Term for Donating Subjects). *Among subjects who donated during the intervention, those who had been informed of the incentive offer shifted the timing but not the overall propensity or amount of future donations.*

Although the preceding analysis indicates that the incentive offer had no overall effect on postintervention donations, we are also interested in knowing whether the subsample of subjects who were informed, donated, and received a reward at an intervention drive changed their donation patterns after the intervention. We thus compare the following groups: (c) subjects who donated at an advertised reward drive and were informed in advance of the reward through the ARC's formal channels (these subjects were most likely to have known in advance of the reward offer and received the reward when they donated) and (d) subjects who donated at a no reward drive and were contacted for that drive but were not contacted for any advertised reward drive (these subjects were unaware of the intervention reward being offered and did not receive any reward when they donated). Of course, the informed subjects who donated at the advertised reward drives are not a random sample; they differ from those who donated at the no reward drives on the characteristics that significantly differed in the heterogeneity interaction terms documented in Table 8 and also, potentially, on other unobservable traits. Nonetheless, this is a critical comparison to isolate and focus on whether the higher donations that occurred among the subjects informed of the rewards were genuine new donations or were instead becasue of a shift in the timing of their donations or intertemporal displacement. To address selection issues, we use a fixed-effect specification in a difference-in-differences framework, comparing donations in the N weeks preceding and following an intervention:

$$\begin{aligned} Y_{it} = \alpha &+ \delta_1 \, Postintervention \\ &+ \delta_2 \, Postintervention * T_i + \lambda X_{it} \\ &+ \eta_i + \varepsilon_{it}, \end{aligned} \tag{2}$$

where Y_{it} is the outcome for subject i in period t (i.e., the time period pre- or postintervention, excluding any donation that occurred on the intervention date). The regressions include individual fixed effects (η_i), and the standard errors are clustered at the individual level. *Postintervention* is a dummy for the postintervention period, thus the coefficient on it measures the change in donations for the no reward control group after compared with before the intervention. As in model (1), T_i is a dummy to indicate the treatment condition for subject i (equal to 1 if in the informed condition (c) and to 0 if in the no reward condition (d)). Because we estimate individual fixed-effects models and each subject was only in one treatment condition, the regressions omit the main effect for the variable T_i. The key parameter estimate, δ_2, measures the change in donation likelihood (or number of donations) from the pre- to post-intervention period for the two groups. There are no subject-specific controls in these regressions because we include subject fixed effects. However, we now control for pre- and postintervention drive-level factors that will vary across subjects and conditions and that we anticipate will affect donations that include the number of drives run in the reference period at sites where the subject gave blood in the past and the number of these drives that offered material rewards.

For subjects with history, panel (a) of Table 10 shows a decrease in donations 12 weeks after compared with before the intervention drive donation for those who donated at the advertised versus no reward drives. The decline was 12.3 percentage points ($p < 0.05$) from a baseline rate of 47%. This negative effect increased with the value of the reward and was especially strong for the $15 reward. This can be explained because, although subjects are more likely to incur the same rescheduling costs regardless of the dollar value of the rewards, the benefits of rescheduling are greater the higher the reward value. However, there were no significant systematic effects for longer periods of time. Panel (b) of Table 10 indicates that, for both subjects with and without history, there was essentially no significant change in the number of donations in the 26 and 39 weeks after compared with before the intervention for subjects who donated at the advertised versus at the no reward drives.[30]

These findings are consistent with the additional donations during the intervention being extra donations rather than intertemporal displacement, and subjects with history (i.e., lower costs) adjusting the timing of donations to obtain the rewards rather than rewards causing a reduction in overall donations or a permanent negative effect on motivation. First, because there is no difference in the likelihood of donating (or in the total number of donations) in the 26 and 39 week pre- versus postanalyses, the total number of donations before and after the intervention is unchanged and thus the extra donations during the intervention period are genuine additional donations. Second, because the negative effect disappears in the 26 and 39 week medium-long term, the 12-week short-term decrease is unlikely to reflect a change in

[30] In panel (b) of Table 10 we limited to the 26- and 39-week periods because a subject who donated at an intervention drive would only be eligible to donate at most once within the 12 weeks pre- and postintervention periods.

Table 10 Long-Term Effects; Informed of Reward and Donated at Advertised Reward Site vs. Donated at No Reward Site

(a) Dependent variable equals 1 if the subject donated anywhere within 12, 26, or 39 weeks before or after intervention

Dependent variable:	Donated in the *N* weeks before/after intervention											
	12 weeks		26 weeks		39 weeks		12 weeks		26 weeks		39 weeks	
Sample:	Previous history at site						No previous history at site					
Mean of dependent variable (no reward donors, before interv.):	46.60%		86.04%		92.23%		15.56%		60.00%		75.56%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Postintervention	3.86	3.85	−7.09***	−7.08***	−6.09***	−6.08***	3.17	3.16	−6.73	−6.74	−14.73	−14.45
	(3.53)	(3.53)	(2.65)	(2.65)	(2.29)	(2.29)	(6.65)	(6.68)	(8.64)	(8.67)	(8.92)	(8.94)
Postintervention ∗ *Donated_informed of reward*	−12.32**		−1.55		−1.93		0.03		0.92		4.62	
	(4.91)		(3.79)		(3.29)		(8.59)		(10.17)		(10.11)	
Postintervention ∗ *Donated_informed of* $5 *reward*		−5.10		0.02		0.22		6.23		7.14		5.83
		(7.00)		(5.51)		(4.76)		(14.67)		(13.62)		(13.39)
Postintervention ∗ *Donated_informed of* $10 *reward*		−10.87		−0.88		−0.51		−8.08		16.31		17.31
		(7.15)		(5.97)		(5.11)		(9.66)		(13.71)		(12.33)
Postintervention ∗ *Donated_informed of* $15 *reward*		−18.34***		−3.10		−4.43		2.53		−11.33		−4.61
		(6.42)		(4.82)		(4.18)		(11.11)		(11.35)		(11.47)
p-value of:												
$10 *informed* − $5 *informed*		0.50		0.90		0.90		0.34		0.54		0.39
$15 *informed* − $10 *informed*		0.36		0.74		0.49		0.36		0.03		0.05
$15 *informed* − $5 *informed*		0.10		0.62		0.39		0.82		0.15		0.40
Observations	1,348	1,348	1,348	1,348	1,348	1,348	322	322	322	322	322	322
No. of donors	653	653	653	653	653	653	161	161	161	161	161	161
R-squared	0.021	0.026	0.035	0.036	0.043	0.044	0.049	0.056	0.013	0.046	0.058	0.078

(b) Dependent variable equals the number of donations made within 26 or 39 weeks before or after intervention

Dependent variable:	Number of donations in the *N* weeks before/after intervention							
	26 weeks		39 weeks		26 weeks		39 weeks	
Sample:	Previous history at site				No previous history at site			
Mean of dependent variable (no reward donors, before interv.):	1.53		2.09		0.76		1.20	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Postintervention	−0.16***	−0.16***	−0.12*	−0.12*	−0.02	−0.02	−0.03	−0.03
	(0.06)	(0.06)	(0.07)	(0.07)	(0.12)	(0.12)	(0.17)	(0.17)
Postintervention ∗ *Donated_informed of reward*	0.05		−0.02		0.07		−0.10	
	(0.08)		(0.10)		(0.14)		(0.20)	
Postintervention ∗ *Donated_informed of* $5 *reward*		0.21*		0.08		0.14		−0.08
		(0.12)		(0.13)		(0.21)		(0.30)
Postintervention ∗ *Donated_informed of* $10 *reward*		−0.12		−0.06		0.23		−0.03
		(0.12)		(0.15)		(0.19)		(0.25)
Postintervention ∗ *Donated_informed of* $15 *reward*		0.06		−0.06		−0.06		−0.16
		(0.11)		(0.13)		(0.17)		(0.24)
p-value of:								
$10 *informed* − $5 *informed*		0.03		0.43		0.70		0.88
$15 *informed* − $10 *informed*		0.19		0.98		0.15		0.61
$15 *informed* − $5 *informed*		0.27		0.36		0.32		0.79
Observations	1,348	1,348	1,348	1,348	322	322	322	322
No. of donors	653	653	653	653	161	161	161	161
R-squared	0.028	0.035	0.029	0.030	0.008	0.025	0.023	0.025

Notes. The sample includes all subjects who either (1) donated at the no reward drives (and were not informed of any advertised reward drive) or (2) donated at the advertised reward drives and were informed of the reward. Each subject has two observations: one for the preintervention period and one for the postintervention period. *Postintervention* is a dummy variable equal to 1 for the postintervention observation and 0 for the preintervention observation. The variable *Donated_informed of reward* is equal to 1 if the subject was in group (2). Individual fixed effects are included in all the regressions. Controls include the number of drives offered in the donor's county in the X-week period before and after the intervention and the number of such drives with rewards. Standard errors clustered by individual are reported in parentheses. In panel (a), the estimated coefficients were multiplied by 100 and thus represent percentage-point changes.

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

motivation. These findings also have clear implications for policy. Economic rewards can be used to not only generate new donations but can also temporarily shift the timing of the donations.

4.3. Cost-Effectiveness

We first quantify the cost per each extra unit of blood collected when a reward was offered. Because we find no evidence that advertising rewards significantly affected the number of donations after the intervention, we only include blood collected during the intervention periods. Table 11 reports the results using the information in Table 7, column (1) (estimated coefficient for "donated at intervention drive" for the number of rewards given out) and column (4) (estimated coefficient for "donated anywhere in Northern Ohio" for the overall number of extra units collected). We only consider estimates with $p < 0.05$ and assign a value of 0 to the others. Thus, we focus on the effects of offering rewards to subjects with history at the intervention sites. Column (1) in Table 7 shows that 13.2% of contacted subjects with history donated when uninformed of the rewards. This result is reported in the first row of Table 11 and assumes 100 individuals are contacted. The third row in Table 11 reports the additional units of blood collected when the reward was offered (column (4) in Table 7). Because the ARC has to give the reward to all donors presenting, regardless of whether they donated, we convert the estimates on units collected to donors presenting to determine the number of the rewards that have to be provided.

Table 11 Cost Calculations

	Past history at sites		
All values are per 100 individuals contacted	$5	$10	$15
1. Units collected—baseline when no incentives offered[a]	13.19	13.19	13.19
2. Donors presenting—baseline when no incentives offered[b]	15.16	15.16	15.16
3. Extra units collected when incentives offered[c]	4.62	7.26	6.00
4. Extra donors presenting when incentives offered[a, b]	5.31	8.34	6.89
5. Total no. of donors presenting when incentives offered	20.46	23.50	22.05
6. Cost of providing incentives[d] ($)	102.3	235.0	330.7
7. Cost per extra unit collected[e] ($)	22.1	32.4	55.1

Note. In this table we show the cost calculations elaborated in §4.3.
[a]From Table 7, column (1).
[b]Donors presenting = units collected ∗ 1.149 (donors deferred are 13% of donors presenting, irrespective of the presence of incentives).
[c]From Table 7, column (4).
[d]$ value of the incentives ∗ total no. of donors presenting at drives with incentives.
[e]Total cost of providing incentives/no. of extra units collected when incentives provided.

Lacetera et al. (2012) found that at ARC drives the blood units collected were 13% less than the number of presenting donors due to deferrals, regardless of the presence or cost of the reward. Table 11 thus shows the donors presenting to be the units collected times 1.149 ($= 1.00/0.87$). Rows 2, 4, and 5 show the estimated number of donors who presented when no incentives were offered, the extra donors presenting when incentives were offered, and the total number of donors presenting when incentives were offered. We do not include the extra donations by lapsed and new donors due to spillover effects because the small numbers of advertised reward drives for each dollar value make it difficult to separate these effects. Inclusion of these effects would lower the estimated cost of incentives to attract each additional donation by about 25%. Moreover, to the extent that new and lapsed donors become regular donors, the estimated costs would be even lower. Row 6 indicates the total cost of the rewards per 100 contacted individuals (i.e., the product of donors presenting and dollar value of the gift cards), and row 7 reports the additional cost per extra unit of blood collected. The $5 and $10 rewards were the most cost-effective, costing only $22 and $32 per extra unit of blood collected, respectively, while it cost $55 per extra unit for the $15 reward. This higher cost was due to the $15 reward being more expensive and the result that it triggered a substantial displacement from other drives.[31] Had we only examined the local effects, and ignored the displacement effects, we would have estimated the cost per extra unit of blood for the $5, $10, and $15 offers to be $18, $34, and $40, respectively, suggesting a bigger gap between the $5 and $10 offers and a much smaller gap between the $10 and $15 offers.

Estimating the benefit from collecting one extra unit of blood is difficult. One approach is to estimate a lower bound based on the amount that is paid for each unit of blood. The Medicare hospital outpatient payment rate for a unit of whole blood for transfusion was set in 2010 at $206.25 (Centers for Medicare and Medicaid Services 2010). This suggests that the $5, $10, and $15 rewards for people with history are all highly cost-effective. Another approach is to calculate the value of the potential uses of the additional blood collected. For example, about seven units of blood are needed for brain surgery, hip replacement, and cancer treatment on average per patient per week

[31] We do not consider mailing costs because they are incurred regardless of the presence of rewards. We are also ignoring the marginal costs of the ARC operations to collect each additional unit. We assume that these are relatively small given the scale of the ARC's operations and low variable costs for equipment and storage. We are also not including the 2% of the cards that presenting donors did not take, which would slightly further reduce the cost per unit of blood collected.

as well as for certain organ transplants (Canadian Blood Services 2011). To fully capture the benefits, we would need to determine the expected impact of these procedures on the life expectancy and quality of the patients multiplied by the dollar value of those extra years of life to the recipient and to society.[32] There may be a potentially large variation in these expected benefits, but it is reasonable that the benefits will far outweigh the extra costs we have estimated.[33]

5. Conclusion: Implications and Directions for Future Research

This study shows that offering economic rewards positively affected the propensity of subjects to donate blood, and the effect was larger for higher-valued incentives. In addition, the incentives caused a spillover effect in which donations were higher among individuals who had not been officially informed of the rewards when other people received flyers officially informing them of the reward offers. The rewards also led to spatial displacement and short-term shifts in the timing of donations, but they did not lead to long-term effects.

The results have implications for organizations interested in enhancing the supply of blood and other products and services the availability of which relies on a vast and diverse set of primarily volunteer suppliers as well as for policy makers. Because many of these activities originate in the civil society (e.g., within firms, associations, and churches), it is important to consider the social mechanisms that are put in motion by economic incentives. Furthermore, because donors may substitute among prosocial activities, one needs to assess whether and how the presence of rewards prompts substitution to quantify the net effect. With reference to our findings, spatial substitution indicates that part of the expenditures for the rewards displaces donations that would have occurred anyway and ignoring this substitution would lead to over-estimates of the effects. On the other hand, the intertemporal, short-term shift in the timing of donations that we observe could be used to enhance efficiency in blood collection or any other prosocial activity for which demand varies over time. Incentives may be an effective way of reallocating donations toward periods of greater shortage. Finally, organizations involved in managing these activities and products (such as blood) can also benefit from identifying which subgroups of the population are more or less responsive to rewards.

Our evidence also has insights for theory. First, and perhaps most importantly, to our knowledge, theoretical work examining the effects of incentives on charitable behavior has not considered contexts in which donors have the option to choose the timing and location of donations in order to donate when rewards are offered or donate when no rewards are offered. This flexibility, however, may be critical to understanding the effects of an incentive offer. Most contexts, like the one studied here, do not force donors to accept rewards for donating. Second, reputation may also critically affect the impact of an incentive offer on donations. As Exley (2013) shows, reputation may be the missing link to reconcile conflicting findings on the effects of incentives on prosocial behavior. Donors' motivations among those who have donated often may not be adversely affected by a small reward.

A third contribution of this study is methodological. Unlike previous research mostly based on hypothetical surveys or framed/artefactual experiments, our study together with other recent ones, is based on field evidence of actual donation behavior. Especially for prosocial activities or more generally activities for which individuals are expected to be intrinsically motivated (in charitable organizations as well as in companies), it is particularly important to rely on large samples, actual behavior, and ideally natural field experimental methods to obtain findings that may otherwise be affected by social desirability biases and social or self-image concerns (Lacetera et al. 2013).

There are several avenues for further research. First, because subjects studied in this paper had donated at least once in the past, future work can examine whether incentives can also induce nondonors to donate, potentially repeatedly. People who have never donated are, ceteris paribus, presumably less intrinsically motivated than existing donors. However, our results hold across all levels of past experience, including subjects who had donated the least, indicating that even those who had previously donated the least increased their donations in response to the reward offer.

Second, we assessed the effect of incentives in an environment where donors are sometimes exposed to rewards. This has the advantage that subjects are less likely to interpret the rewards as unusual and possibly to react to the unusual aspect rather than to the economic value of the incentives per se, which would otherwise make the interpretation of

[32] Note that one unit of blood collected provides a full unit of red cells and several partial units of plasma, platelets, and cryoprecipitate. Up to three of these four products can be derived from one unit and used on multiple patients.

[33] From the ARC's perspective, an alternative assessment involves considering alternative methods to increase donations and determine whether reward offers are the cheapest method. We are not aware of the full possibility set, but this could include changing who is contacted (e.g., the definition of active and eligible donors), telemarketing, and advertising procedures.

any results problematic. An interesting question is whether incentives would have similar effects if they were offered where none had been previously offered, even if most people at some point in their lives would most likely have been offered a reward for volunteer work in other contexts. Another question is how donations would respond if incentives were offered at every drive. In this case, we would not anticipate spatial or temporal substitution given that rewards are always offered. However, in the context that we examined with incentives only sometimes being offered, incentives can be used specifically to take advantage of spatial and temporal substitution to address short-term shortages. The current environment thus makes the spatial and temporal displacement relevant and perhaps as important if not more so than studying incentives without the possibility for displacement effects.

Third, studying a context where donors are persistently exposed to reward offers is appropriate for understanding if a policy of permanent reward offers could sustain the positive effects detected here. For instance, it is possible that reward offers could have negative effects the first time individuals are exposed to them but could have positive effects in the long run as individuals get used to receiving rewards, or individuals could habituate to the presence of incentives and so donation levels could revert to levels without reward offers.

Fourth, in addition to monetary value, the effect of reward offers and the extent to which crowding out may occur might also depend on the fungibility, nature, framing, and perceived purpose of the rewards. Subjects in the current study were offered gift cards that could be used at a variety of merchants, making them extremely fungible and their monetary value essentially identical to their face (cash) value. Although these gift cards and cash have equal monetary value, they could nonetheless have distinct effects. For example, gift cards may be perceived as a token of appreciation (or reciprocity) for volunteering whereas cash may be perceived as payment; thus, cash could potentially lead to crowding-out effects. Several studies (hypothetical surveys and laboratory experiments) have studied cash offers for volunteer and other activities with intrinsic motivations. Gneezy and Rustichini (2000) show that small cash offers have negative effects if the cash value is large enough the effect turns positive, and Heyman and Ariely (2004) show that cash rewards may be more effective than equivalent in-kind rewards if the amount is not very small. Kube et al. (2012) also found that cash had a smaller effect than an in-kind incentive, but when subjects could choose among in-kind and cash rewards in a separate treatment, most chose cash. Although more theoretical and empirical research is needed to better understand how the nature and perception of rewards affect blood donor behavior, the evidence presented here along with several other recent studies (see Lacetera et al. 2013 for a review) demonstrate that noncash economic rewards are an effective policy tool to increase donations and deal with at least temporary shortages.

Last, we focused on incentives with a financial value in this paper, but other motivators could be used to induce more blood donations.[34] These include social recognition, reducing waiting times, rewarding hosts, or ARC representatives, increasing the saliency of the benefits to the recipients of the donations, reducing the social distance between donors and recipients, or encouraging donors to actively focus on the donation decision. It would be interesting to assess how these policies compare with economic incentives.

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[34] For instance, Stutzer et al. (2011) find that active-decision reflection increases donations among individuals who have not thought about the importance of blood donations. See also Ashraf et al. (2013) and Lacetera and Macis (2010) on the impact of social-image incentives.

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