Will There Be Blood? Incentives and Displacement Effects in Pro-Social Behavior*

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Abstract

We present evidence from nearly 14,000 American Red Cross blood drives and from a natural field experiment showing that economic incentives have a positive effect on blood donations without increasing the fraction of donors who are ineligible to donate. The effect increases with the incentive's economic value. However, a substantial proportion of the increase in donations is explained by donors leaving neighboring drives without incentives to attend drives with incentives; this displacement also increases with the economic value of the incentive. We conclude that extrinsic incentives stimulate pro-social behavior, but unless displacement effects are considered, the effect may be overestimated.

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1. Introduction

Volunteer, pro-social activities represent a substantial part of social life. In the US, for example, charitable giving totals over $260 billion, or around 1.9 percent of personal income (Andreoni, 2008), and the estimated value of volunteer time is over $240 billion (Independent Sector, 2006). The number of non-profit organizations registered with the IRS grew by about 60 percent between 1995 and 2005 (List, 2010). For many of these activities, however, supply is still below societal needs. Thus, understanding and improving the performance of pro-social activities are of great relevance for researchers and policymakers.

This is certainly the case with human blood. Blood transfusions are required in such critical situations as massive blood loss due to trauma, blood replacement during surgeries, the treatment of premature babies as well as for certain types of cancer and blood-related diseases. In recent years, the demand for blood has increased dramatically due to many reasons including an aging population and new medical and surgical procedures, such as organ transplants. Although many individuals are eligible to donate blood and numerous awareness campaigns promote its importance, only a small percentage of eligible individuals (under 10 percent) donate blood in the US and other developed countries, and even fewer do so in developing countries. As a consequence, blood supply shortages (as defined by the supply of blood being below what is necessary for three days) have become the norm rather than the exception (DiRado 2004; Hemobiotech 2008; Oakley 1996).[1] Thus, relative to society's needs, it appears that the individual benefits of donating blood fall short of the costs. This raises the question of whether "pure" altruism is sufficient to guarantee a sufficient, steady supply of blood.

Whether providing material incentives will stimulate blood supply, or any other pro-social activity, is largely an open question. Standard economic theory predicts that offering extrinsic incentives will increase the provision of pro-social activities by adding value to the "intrinsic" motivation that individuals have to perform these activities. However, alternative frameworks predict that offering rewards can backfire because they might crowd out the intrinsic motives to perform these activities (Bénabou and Tirole 2003, 2006; Deci 1975; Titmuss 1971). The empirical evidence is mixed; some findings suggest a reinforcing effect of incentives whereas others show that offering extrinsic incentives leads to a reduction in the performance of pro-social actions.[2]

In this paper, we provide robust evidence from both observational and field-experimental data that offering extrinsic material incentives increases blood donations. We use detailed data on a large sample

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[1] More than 16 million units of blood are collected annually in the United States (www.BloodBook.com). The American Red Cross and other organizations that collect blood aim to have, at any given point in time, blood necessary for three days of demand at each location and for each blood type, but this target is seldom met, especially for rare blood types (including 0 negative, which is the universal donor). Moreover, it is estimated that, worldwide, there is currently a shortage of about 22 million units of blood per year (HemoBiotech 2008).

[2] Among studies showing a crowding-out effect, see Deci (1975), Gneezy and Rustichini (2000), Frey and Oberholzer-Gee (1997), and Mellstrom and Johannesson (2008).

consisting of all blood drives conducted by the American Red Cross (ARC) in northern Ohio between May 2006 and October 2008 to study the effects of many different material incentives that the ARC offers to its donors. Our unit of observation is a blood drive, and our data include about 14,000 blood drive observations. With an average of 36 donors per drive, the data reflect about 500,000 blood donations. The data for each drive include the number of people who present to donate, the number of blood units collected, the number of people deferred from donating because they are ineligible, as well as information on the drive's date, the identity of the organization that hosted it, and its physical address. Crucial for the analysis, the data include information on whether an extrinsic reward was offered at each blood drive, the type of item offered (e.g., blankets, T-shirts, mugs, coupons, etc.), and the ARC cost to purchase the item. Thirty-seven percent of all drives offered an incentive, including items purchased by the ARC or given directly by the host of a drive.

Most drives were run many times at the same location, hosted by the same entity (e.g., a church, a civic organization, etc.). Moreover, 78 percent of all drives took place at host-locations in which the ARC at least once offered donors an incentive item and at least once did not offer any incentive. This within-host-location variability lets us compare outcomes between drives that do and do not offer incentives holding constant the location and host, thereby ensuring that the results are not driven by unobservable heterogeneity across different types of organizations or neighborhoods. Further, although the ARC does not assign incentives to drives in a purely random fashion, institutional details of ARC operations indicate that, once a set of observable drive-level characteristics are controlled for (e.g., the calendar date of the drives), the presence of incentives is non-systematic. This is because the ARC has a limited budget for incentives, and it attempts to apportion them across all hosts in a non-systematic way in order to treat all hosts fairly. We are able to confirm this by showing that the actual distribution of the value of incentives across hosts cannot be distinguished from a simulated, random distribution. Regression analyses with host-location fixed effects, therefore, allow us to identify the relationship between the presence of rewards and outcomes at a blood drive.

Our estimates show that the number of donors who attempt to donate and the number of units of blood collected significantly increase when incentives are offered. On average, offering incentives leads to between 5.0 and 6.7 extra donors presenting at a drive—an increase of 15-20 percent. We also find that offering incentives, which are given to all donors who present regardless of their eligibility, does not increase the fraction of donors being deferred; this indicates that the composition of the donor pool does not change when incentives are offered. The richness of the data allows us to perform a number of additional tests for the robustness of our findings. First, in addition to the results being robust to host-location fixed-effects specifications, we also find that the effect of incentives on donations is significantly larger when more donors are made aware that an incentive is being offered, and when no restrictions are placed on who may donate at a given drive. Second, using the cost of each incentive to the ARC as a proxy for the economic value of rewards to the donors (or for the ranking of values), we analyze whether items of different value have different effects on the outcomes of interest. If the social-image aspect of the items is the only motivation that increases donations, then we should not find a positive relationship between monetary value and donation response. However, we find a positive and significant relationship between the cost of the incentives and turnout and units collected (and, again, no effect on the percentage of deferred donors). Third, a potential confounder may be that drive hosts actively promote drives with or without incentives differently; thus, the incentive effect that we detect may be an information effect. However, this possibility is highly unlikely; the ARC informed us that hosts perform their activities (from offering a physical location to promoting the drive) in the same way regardless of the presence of incentives. On the two dimensions that we can observe and in which hosts may in principle influence drives, namely drive length and whether a drive is open to the general public, we do not find any difference associated with the presence of incentives. To probe this further, we created a proxy measure of host engagement in the blood donation process, as represented by whether the host ever added small promotions to a drive, and the results of regressions among the host organizations that are the least engaged yield essentially identical results to those for the full sample.

We also provide evidence from a natural field experiment that we ran at 72 ARC blood drives between September 2009 and August 2010 that corroborates the findings from the observational data. In the experiment, pairs of similar drives were selected and then randomly divided into control conditions (i.e., no incentives were offered) and treatment conditions (i.e., $5, $10, and $15 gift cards for a variety of stores were offered). Comparing outcomes between control and treatment drives while controlling for past outcomes at the same drives (a difference-in-differences analysis), turnout and units collected are higher under the treatment conditions and increasingly greater in correspondence with higher gift card value (and the results are statistically significant), with, again, no discernible impact on the share of deferred donors. The findings are qualitatively and quantitatively similar to those from the observational data, and importantly, any remaining identification issues are addressed in the experiment because the incentives were randomly assigned (by the researchers) and had no symbolic value but only economic value of different sizes.

Finally, we exploit the location and date information of each drive to analyze the impact that incentives have not only where they are offered but also at temporally and spatially neighboring drives to assess displacement and aggregate effects of incentives on donations. For instance, incentives may increase blood donations when offered at one location, but this could perhaps be (at least partially) due to donors switching the location and timing of their donations rather than an aggregate increase in donations. The opposite is also possible; incentives may crowd out blood donations at one location, but increase donations at other locations (presumably where incentives are not offered). Testing for the presence of these displacement effects will give a more comprehensive assessment of responses to incentives and also has major policy and organizational implications for the design of initiatives aimed at increasing aggregate pro-social behavior in a population. Although, in general, it might be difficult to define the full set of potential pro-social activities displaced by the introduction of incentives (for example, in the case of cash donations), there are only a few closely related pro-social activities to donating blood at a given drive other than donating blood at a different time or location. For this reason, examining the displacement effects for blood donations becomes particularly insightful for determining whether pro-social activities are in aggregate positively or negatively affected by the presence of material incentives.

We find that donors not only respond to the presence of incentives in a standard way by increasing supply at a given site but also shift their blood donation activity toward temporally and spatially neighboring drives that offer incentives, and shift away from drives that do not offer incentives. These displacement effects are largest if incentives are offered at close neighboring drives (specifically, within 2 miles), and even more so when the incentives offered at the neighboring drives are of higher monetary value. In an "average drive" scenario, about 45 percent of the additional donations at a drive that offers an incentive are a result of donors shifting their donation from neighboring drives. Thus, ignoring displacement effects can lead to a substantial overestimate of the total effect of incentives on pro-social behavior.

Our study advances the existing literature in a number of ways. First, the data and empirical setting allow for testing the impact of multiple incentives at multiple locations in a "natural" environment, as opposed to only examining one or two incentive items and locations in the previous literature.[3] Second, we combine the use of naturally occurring data from a large dataset (the largest, to our knowledge, for the study of blood donation) and from a large-scale natural field experiment. Third, and most crucially, the data allow us to test not only for "local" effects of incentives but also for the "total" effects by considering potential displacements. Substitution from lower- to higher-utility activities is a standard behavioral response, but the evidence on how it plays out in the context of pro-social behavior is scant. Gross (2005) suggests that many of those who donated money towards Tsunami relief in 2005 and 2006 substituted their donations away from other charities. Cairns and Slonim (2011) document that when a second collection is present at Catholic Mass, the amount collected for the first collection (which typically has a different destination) decreases significantly. On the other hand, Shang and Croson (2009) find no inter-temporal substitution in contributions to public radio. These studies, however, highlight the difficulty of examining substitution effects involving *monetary* contributions; it is possible that donors are substituting their charitable monetary donations away from other charitable causes and organizations not observed in these studies. Thus, with monetary donations, there could be many close substitutes.

The remainder of the paper is organized as follows. Section 2 offers institutional details on the blood

[3] For instance, Goette and Stutzer (2008) examine the effect of offering two items. They find that lottery tickets had a positive effect on blood donations whereas a free cholesterol test had no effect. Mellstrom and Johannesson (2008) offered cash to students to take a health test to determine whether they would be eligible to donate blood. They find mixed results depending on gender. Lacetera and Macis (2010a) find that offering a paid day off work increases blood donations significantly.

collection operations at the ARC and describes the data for this study. In Section 3, we describe the identification strategy for the analysis of the observational data and report the results on the "local" effects of incentives. Section 4 describes the design of the field experiment and reports our findings. Section 5 is dedicated to the analysis of the displacement effect and the "total" impact of material rewards for blood donations. In Section 6, we offer concluding remarks and discuss potential welfare effects that our estimates imply.

2. Institutional Context and Data

Our strategy to identify the effects of incentives on blood donation takes advantage of several institutional features of the blood-collection system run by the American Red Cross, Northern Ohio Blood Services Region. We first describe these institutional features in detail and then introduce the data for this study.

2.1 The American Red Cross in Northern Ohio

2.1.1 The Organization of Blood Drives

The ARC operates 36 regional blood centers within the US and Puerto Rico. The data for this study covers all (14,029) mobile blood drives organized by the Northern Ohio Blood Services Region from May 1, 2006 to October 8, 2008. Blood drives are run by the ARC at locations made available by host organizations on specific dates.

The ARC-Northern Ohio Region defines individuals who have attempted to donate blood within the past two years as "active" and those who have not been disqualified as "eligible." Donors can be disqualified for a variety of reasons that either endanger the donor or result in an unusable donation. Donors could be permanently disqualified for reasons such as HIV, or for many transitory reasons, such as anemia, low blood pressure or iron, and certain behaviors in the recent past (e.g., travel to certain locations) that increase the risks of blood problems. Donors are also ineligible to donate for 55 days after making a whole-blood donation.

The ARC follows several rules to determine whom to inform of upcoming blood drives. First, the ARC restricts whom they contact to only eligible donors. Second, donors are typically informed only about the drives that occur in the county where they live or donated before. In a few counties, ARC representatives send donors a postcard informing them of one specific drive occurring in the forthcoming calendar month, typically of a drive that will take place in the location where a donor has donated in the past. We call drives in these counties "postcard county drives." In all other counties (the majority), representatives send a flyer that informs donors of all drives open to the general public in the county that will occur in the next calendar month. We refer to drives occurring in these counties as "flyer county drives." Flyers are mailed out on the 23rd or 24th of the month, and postcards are mailed out on an ongoing basis as a drive approaches. Both flyers and postcards include information on the location of the drive(s), the date and the hours of operation, whether an incentive will be offered at the drive, and if an incentive is offered, what the incentive is (e.g., T-shirt, jacket, raffle ticket). Figure 1 provides an example of a flyer advertisement.

[Figure 1 about here]

Finally, a blood drive is either "open" or "closed." In open drives, anyone can present to donate. Closed drives are not advertised on the monthly flyers, and only members of a given organization (e.g., students or employees) are informed about these drives.

2.1.2 The Allocation of Incentives to Blood Drives

The ARC offers one of a variety of incentives at some blood drives. The most common items include T-shirts, jackets, coolers, blankets, coupons, and gifts cards from various merchants. Direct cash payments are prohibited under FDA regulation.[4] The ARC director who is responsible for recruitment is given a budget each year to purchase incentive items. These items are then allocated proportionally to district managers. Each district manager then decides how to allocate the different promotions across the drives in his or her district. There are three district managers in northern Ohio. Importantly, if a drive offers an item as an incentive, the item *must* be given to all presenting donors (i.e., those who show up) regardless of whether they donate or are deferred for any reason. This is done to avoid potential donors having any incentive to falsify information in order to be classified as eligible so they can obtain the item.

For the ARC operations, the host-location combination is the relevant unit of reference for the assignment of incentives. Some locations may attract more donors and some locations may have donors who are more responsive to an incentive (e.g., because some items may appeal to different demographic groups). Nevertheless, ARC managers stressed that they make a conscious attempt to offer incentives evenly across host-locations over time because of budget constraints and fairness considerations. Thus, the allocation of incentives across and within a given host is, to a large extent, non-systematic.

2.1.3 The Role of a Drive's Host

In principle, blood drive hosts have some flexibility in organizing drives. They can choose to make a drive open or closed, determine the location and number of hours of the drive, and select whom to inform (in addition to the county contact rules and donors who satisfy the ARC requirements). This opens the possibility that economic incentives might affect how hosts behave. For instance, hosts might contact more donors when an incentive is given at a drive. Thus, higher turnout in response to incentives could be explained by either changes in donor supply or changes in host behavior. From a public policy or ARC perspective, the total effect on donations is likely the most critical outcome, but from a research

[4] Cash payments can be used by organizations that collect blood or blood components for uses different from direct transfusion, such as for research (e.g., university labs) and drug manufacturing (e.g., plasma centers). Section 6 elaborates on how the effects we find in this paper might differ if incentives were cash payments, based on existing theories and evidence.

perspective, it is also critical to separate these alternative explanations to understand the effect of incentives on donor supply. However, although economic incentives may affect host behavior in addition to donor behavior, this alternative explanation seems unlikely. In practice and by convention, the aspects of a drive that the hosts might actually change are limited in many ways. First, the vast majority of hosts (93 percent) organize either all open or all closed drives. Second, once the length of a drive has been determined, which typically occurs well in advance of establishing whether an incentive will be offered, it is very rarely changed because doing so would imply considerable costs to the ARC (reallocating resources such as staff and equipment, coordinating with the hosts, communicating with the donors, etc.). Third, the vast majority of donors are contacted through standardized and centralized procedures; hosts and ARC representatives affect the number and types of donors contacted only very marginally (e.g., possibly through talking with friends and colleagues). Our econometric analyses and results from our randomized field experiment provide further support that donors rather than hosts are changing behavior.

2.2 The Data

The ARC conducted 14,029 blood drives in northern Ohio between May 2006 and October 2008.[5] For each drive, we know the date, time, and location (street address, town, and zip code); the number of donors presenting and deferred; the number of units of blood collected; and whether the drive was open or closed and in a flyer or postcard county. Table 1 presents descriptive statistics on these variables both for the full sample and after dropping the bottom and top 1 percent of the distribution of turnout, which leaves 13,707 drives.[6] On average, 30.4 units of blood were collected from 35.9 donors who presented, and 15 percent of donors who presented were deferred because they were classified as ineligible to donate.[7] Seventy-eight percent of drives were open and 80 percent were advertised using county-level monthly flyers. For each blood drive, we also gathered weather data for the day and location of each drive.

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[5] Northern Ohio covers 10,206 square miles and includes the metropolitan areas and suburbs of Cleveland, Youngstown and Akron. About 5.3 million people live in northern Ohio. The median income in 2008 was $48,120, the unemployment rate was 6.6 percent, and racial demographics comprised 82 percent Caucasians and 15 percent African Americans. For comparison, the median income in the US in the same year was $52,029, the unemployment rate was 5.8 percent, and the proportion of Caucasians and African Americans in the US population were 79.8 and 12.8 percent, respectively.

[6] Turnout varies from fewer than 10 to over 700 donors. In a handful of drives, the number of donors presenting was 0 due to extraordinary circumstances such as power interruptions. To ensure that our results are not driven by outliers, all of our analyses are limited to the sample that excludes the top and bottom 1 percent of the distribution of presenting donors. In what follows, we always refer to the sample obtained after dropping the outliers. Rain intensity is missing for 178 observations. Summary statistics for the sample limited to observations with complete information (N=13,529) are virtually identical to those presented here (see Appendix Table A1).

[7] A small percent of the 15% who we classify as deferred actually donated blood but the quantity supplied was insufficient. We classify these insufficient donations as deferred since the results are the same for the purpose of collecting blood.

[Table 1 about here]

The data also indicate whether an incentive was offered at each drive and, if so, what kind of incentive. Thirty-seven percent of all drives (36 percent when outliers are excluded) offered ARC or host incentives. The ARC began keeping track of the presence of incentive items on May 1, 2006, which explains the starting date for the data that we analyze in this study. Table 2 lists common items that the ARC offers. T-shirts are the most common item, given out in nearly 50 percent of all drives that offer incentives. Coupons are the second most common incentive and are offered in over 8 percent of the drives that provide incentives. Coolers, sweatshirts, and umbrellas are the next three most common items. Overall, there are 13 distinct items that the ARC offered to donors at more than 40 drives. In addition, hosts purchase and offer incentives at about one quarter of the drives with incentives. Unfortunately, precise information on the nature of the host-provided incentives is not available. However, ARC managers informed us that these incentives almost always have small economic value (e.g., a cup of coffee or raffle tickets with expected values of about a dollar). Some drives are also characterized by special attributes; for example, a drive may be run in honor of an individual or it may be particularly (but not exclusively) targeted to O-type donors.

[Table 2 about here]

Appendix Table A2 shows summary statistics on host types using the ARC's codification.[8] The most common host type, hosting 44 percent of all drives, was the general community, which includes drives at town halls and libraries. Manufacturing firms, hospitals, and high schools each hosted at least 7 percent of the drives. There is some variation across host types in average turnout, with 35 or more donors, on average, presenting at places such as high schools, colleges, the general community, or churches, and fewer than 30 donors presenting at nursing homes, professional services firms, retail stores, or government buildings. Also, there is some variation in the fraction of drives where incentives were offered, generally ranging from 23 percent (State) to 55 percent (high schools, Red Cross Chapters). Incentives were offered at elementary schools in only 2.6 percent of cases.

As shown in Table 3, there is variation among the 2,595 different individual hosts in terms of both the number of drives hosted and the presence of incentives. Whereas 815 hosts organized exactly one drive between May 2006 and October 2008, 1,780 others organized two or more drives at the same location. Table 3 shows that there is also a large variation *within* hosts who ran multiple drives regarding the presence of incentives at their drives. In particular, about 45 percent of hosts (constituting more than 77 percent of all drives and 10,616 drives in total) ran multiple drives in which at least one drive offered an incentive and at least one drive did not offer any incentive. This variation, together with the ability to control for a number of other factors, will be critical for our identification strategy.

[8] We only report host types in Appendix Table A2 with at least 100 drives to protect the privacy of specific host organizations that ran just a few drives and could be identifiable. However, all hosts are included in the regressions.

[Table 3 about here]

The present study departs from past empirical work by estimating the effects of incentives not only when and where they are offered, but also at neighboring drives that donors may be attracted to (or away from) that are temporally and geographically close. We used GIS software to compute the driving distance between the street addresses of all blood drives in our sample.[9] To determine neighboring drives for each of the drives in our data, we initially limited the travel distance between drives to be within 10 miles. Next, we limited the set of drives that were within 56 days prior to a drive's date because donors are not eligible to donate again if they donated less than 56 days prior to a drive. Finally, we limited neighboring drives going forward in time to include only drives that donors would have been made aware of by either the monthly flyers or postcards. For drives occurring prior to the 25th of the month, we limited neighboring drives going forward to only those that occur up to the end of that same month because donors would not yet have been made aware of drives occurring in the following month; and for drives occurring after the 25th of a given month, we extended neighboring drives to those occurring up to the end of the following month because donors would have been made aware of drives occurring in the following month.

Table 4 shows that, on average in our observation period, 6.5 neighboring drives occurred within two miles of every drive, 7.7 between two and four miles, and nearly 37 additional neighboring drives occurred between four and ten miles away. Further, the average number of neighboring drives that offer an incentive were 2.6, 3.1, and 14.6 that occurred within two miles, between two and four miles, and between four and ten miles, respectively.

[Table 4 about here]

3. The "Local" Effect of Incentives

In this section, we focus on the "direct" or "local" effects of incentives ignoring displacement effects. We first describe our empirical identification strategy and then present our main findings.

3.1 Empirical Model and Identification Strategy

To assess the impact of incentives at a specific drive, we estimate versions of the following model:

$$Y_{jt} = \alpha + \beta X_{jt} + \delta INCENTIVE_{jt} + \eta_j + \varepsilon_{jt} \qquad (1)$$

where j and t denote the drive's host-location and calendar date, respectively. We examine three

[9] Driving distances were calculated using standard GIS network-path algorithms for finding the shortest path through a network, following Dijkstra's (1959) shortest-path approach. Each road segment in the network was weighted by its Euclidean distance across space as the measure of "cost" in the shortest-path algorithm. All locations within a specified maximum distance (10 miles) were identified. When the GIS software could not find an exact geo-location, the address of the nearest US post office was used.

outcomes y_{jt}: the number of people presenting (turnout);[10] the units of blood collected; and the fraction of deferred people relative to those presenting. The variable $INCENTIVE_{jt}$ is an indicator of the presence of promotions at drive *jt*. Therefore, the parameter δ represents, ceteris paribus, the difference on the dependent variable (i.e., turnout, units collected, or fraction deferred) between drives with no incentives and drives with incentives.

The vector X_{jt} includes a drive's length in hours, weather conditions on the day of the drive (e.g., temperature dummies, rain, and snow on the ground), and dummies for year, month, day of the week, and ARC representative as well as dummies that indicate the presence of specific attributes for a drive. Weather conditions can exert significant influence on the outcome of blood drives. These should be temporary shocks to donations orthogonal to incentives; however, controlling for these factors improves the precision of the estimates. Including month dummies is important because the ARC operations have a seasonal dimension; district managers and drive representatives try to attract donors, for example, around the December holidays or in the summer months when donations are typically lower than other times of the year. We also control for ARC representatives because they may have, for instance, different social networks that they can use to affect turnout. Furthermore, we include specific dummies to control for any other attribute of a drive (e.g., if the drive is given in honor of someone, if it is a drive specifically addressed to O-type donors, etc.), and, limited to the specifications without host-location fixed effects, we add zip code dummies to capture any unobserved neighborhood characteristics.

Our main specification includes host-location fixed effects, η_i. We include these fixed effects because heterogeneity across hosts could explain some of the differences in outcomes across drives. In particular, hosts may have different features (e.g., social networks) that can affect donor turnout. Likewise, locations could vary systematically in terms of the number of potential donors and donor characteristics such as income, race and education. Host-location fixed effects will control for all of these types of heterogeneity. To the extent that different hosts' characteristics (e.g., intrinsic motivation of an organization's members or simply the size of a host's network) are connected with drives offering incentives, controlling for host fixed effects is vital to separate incentive effects from host effects. Controlling for host-location fixed effects, our estimate of the effect of incentives on outcomes is, thus, a difference-in-difference estimate; it measures the difference in outcomes when an incentive is present compared to when an incentive is not present within each host-location that ran drives with and without the presence of incentives. Thus, once the confounding factors described above have been controlled for, an analysis that identifies the effects of incentives on blood donation outcomes from *within host-location*

[10] If a donor leaves at any time after registering and going through the health check (but before donating), she will be classified as presenting. It is possible that a donor could show up and then not register for some reason (e.g., if there is a crowded waiting area). The ARC believes that donors who leave without signing in are rare because there is virtually never any delay to sign in. If donors who show up but who do not register cause a bias in our estimates, it may be in the direction of underestimating the effect of incentives on donors who present because incentives might have caused the longer lines or crowds.

will allow us to rule out alternative explanations that might otherwise account for the empirical patterns that we document. Finally, to account for heteroscedasticity as well as serial correlation within hosts, we estimate and report robust standard errors corrected for clustering at the host level.

In an attempt to further isolate the impact of incentives and determine the mechanisms behind any effect that they might have on any of the outcomes, we will also examine the differential impact of incentives at open drives, at all drives in flyer counties, and at open drives in flyer counties. If incentives attract more donors, this effect should be greater at open drives where more donors are permitted to donate, and greater when promoted in flyers where more donors are made aware that an incentive is being offered.

The next sub-section presents the results from our main specifications. We then assess whether variations in the economic value of the incentives affect donor responses, and, finally, we examine whether the effect of incentives on donor's behavior can be attributable, instead, to changes in the behavior of drive organizers.

3.2 Main Findings

Table 5a presents regressions on the number of donors who presented. The estimates shown in Column 1 without covariates compare simple mean differences between drives without incentives and drives with incentives. These comparisons indicate a statistically significant increase of 5 donors presenting when incentives are offered compared to when incentives are not offered. Compared to the mean number of 34 donors presenting across all drives, this estimated coefficient is substantial in magnitude.[11] Including the controls listed above does not substantively change the estimated effect of incentives (Column 2) nor does the inclusion of host fixed effects (Column 3).[12] The fact that the coefficient does not change much when we include host fixed effects is consistent with the ARC allocating incentives across hosts in a non-systematic manner. In Columns 4-6 we report the estimates from specifications where we add interaction terms between the presence of incentives and whether a drive is open and/or in a flyer county.[13] We confirm the expectation that incentives have a greater impact when anyone can present (in open rather

[11] A potentially confounding effect of incentives on donors presenting is that the presence of an incentive at a drive may be seen by potential donors as an indication that blood is in short supply, either in aggregate or locally, and this might make donors more willing to donate. However, donors receive information every month on all the drives taking place in their county, so donors typically see drives offering incentives every month. Therefore, the presence of a reward at one drive is unlikely to convey any information on the current demand for blood.

[12] The coefficients on the control variables are not reported here but are available upon request. Their signs are as expected. The length of a drive is associated with more donors presenting; rain, rain intensity, and snow all discourage donations (although these effects are not always statistically significant); and moderate temperatures are associated with more donations relative to either very cold or very warm weather.

[13] For the small fraction (7 percent) of hosts who ran both open and closed drives, we include specific fixed effects for the open and for the closed drives. This implies that the variable that indicates whether a drive is open cannot be estimated (i.e., drops out of the regression) because the host fixed effects are always nested within either open or closed drives. The same holds for the coefficients on the variable that indicates whether a drive is in a flyer or a postcard county, and for the zip code fixed effects.

than closed drives) and when more potential donors are made aware of the incentives (in flyer rather than postcard counties).[14]

Table 5b presents regressions that examine the effects of incentives on units of blood collected (Columns 1-4) and the share of donors deferred (Columns 5-8) using the specifications of Columns 3-6 of Table 5a. Column 1 shows that the effect of incentives on units collected is substantial; on average, compared to the mean number of 28.9 units collected across all drives, offering incentives increases units collected by 16 percent. Columns 2-4 show that incentives have larger effects at open (vs. closed) drives, in flyer (vs. postcard) counties, and, especially, in open drives run in flyer counties (vs. closed drives run in postcard counties).

Finally, Columns 5-8 of Table 5b show that offering incentives does not change the share of donors who are deferred. These results indicate that offering incentives does not disproportionately attract individuals who are ineligible to donate blood.

[Tables 5a and 5b about here]

3.3 Further Tests

3.3.1 Symbolic vs. Economic Value of Incentives

So far, the results indicate a strong, positive effect of incentives on turnout and units of blood collected with no disproportionate negative effect on the fraction of donors deferred. There are, however, potentially two broadly distinct sources of utility that people may get when obtaining the items. First, people may be attracted by the material (internal consumption) value of the item. Second, donors may be attracted by the symbolic and social content that they may derive from receiving the items. For instance, donors might be attracted by a T-shirt or a jacket with the ARC logo because wearing these articles signals donors' pro-social behavior and conveys donor status.

To disentangle the symbolic and social content values from the items' material values, Table 6 reports the results from the fixed effects regressions in Tables 5a and 5b that include the dummy variable for the main effect of the item and adds the cost (to the ARC) of each item and its square. If the symbolic value is the only reason that the items increase turnout and units collected (and the material cost and social value of the items are not strongly correlated), then the main effect of offering an incentive should remain significant and the cost of the items should not affect turnout or units collected. On the other hand, if

[14] The larger effect of incentives in flyer as compared to postcard drives is interesting in light of the ARC offering incentives at 36 percent of the drives because donors who are enticed by incentives will anticipate and potentially wait for an upcoming drive to offer an incentive. Thus, the difference between donations when incentives are offered and not offered could over-estimate the incentive effect to the extent that, if no incentives were *ever* offered, some donors would have donated without an incentive because they have no reason to wait for an upcoming drive to offer an incentive. This effect is not likely to be very large, however, since almost all drives are run at least 56 days apart to ensure that donors who donated the last time the drive was held will be eligible to donate again when the drive is next run. Thus, even if a donor anticipates an incentive being offered in the future, they will be eligible to donate at that future point even if they donate at the current drive without an incentive.

donors are attracted only by the material value, then the main effect of offering an incentive should have no effect whereas the cost of the items should be positively correlated with turnout or units collected. Finally, if donors are attracted by both the symbolic and material value of the items, then both the main effect and cost of the item should significantly affect turnout and units collected.

[Table 6 about here]

The results in Columns 1-3 show that incentives with higher value have a substantial and highly significant impact on turnout and units collected. A one-dollar increase in the cost of an incentive is associated with almost 2.5 extra donors presenting and 2.2 extra units collected but has no effect on the share of deferred donors. Moreover, once the costs of the items are added to the regressions, the coefficient estimate on the dummy variable indicating the presence of incentives becomes small and insignificant. These results strongly suggest that it is mostly the monetary cost of incentives that explains their effect rather than their symbolic value. Figure 2 shows the estimated effect of the cost of the items on turnout, units collected, and percentage of donors deferred using the estimates from Columns 1-3 in Table 6; the estimated effect is, essentially, linear in the range of values observed in the sample for both presenting donors and units collected. There is a slight concavity, and, although statistically significant, it is quantitatively negligible. Columns 4-6 confirm that the effect of the incentives is stronger in open drives that take place in counties where donors are informed through monthly flyers.[15]

[Figure 2 about here]

A potential alternative interpretation of the positive relationship between the item's costs and the increase in turnout and units collected is that the higher-cost items are offered less often and so higher-cost items are correlated with the scarcity and novelty of the item being offered. For instance, because jackets are offered less often than T-shirts, it is possible that donors will be more attracted to the jackets because they have fewer opportunities to obtain a jacket than a T-shirt. To examine this alternative explanation, we re-estimated the models presented in Table 6 and added to them either the frequency each item was offered (and its square) or the percentage of times that each item was offered (and its square) at each drive-location, and we report the results in Appendix Table A4. In either specification, we find no evidence that the items that were offered less frequently increased turnout or units collected, and the inclusion of these variables had no effect on any of the other estimates in the model.

Table 7 presents results from a similar analysis in which, instead of having the cost of all items as a continuous variable, we include a dummy variable for each item that is offered in at least 40 drives. The results are similar to those from Table 6 in that items of higher monetary value generally attract a larger

[15] The regressions presented in Table 6 include a dummy variable for the items for which information on cost was unavailable or incomplete (i.e., when a drive offered host-provided promos and/or "miscellaneous items"). Regressions on a sample that excludes drives where incentive cost information was missing or incomplete yield very similar results (see Appendix Table A3).

number of donors.[16] Moreover, note that T-shirts, which cost $2.95, attract 6.5 extra donors; sweatshirts, which cost $6.67, attract 13.2 additional donors; and jackets, which cost $9.50, attract almost 25 extra donors (these coefficients are also significantly different from each other at the 1 percent confidence level). Because these three items have nearly identical logos (in both shape and size), we can reasonably assume that they have extremely similar social-image value. Yet the impact on turnout and units collected increases with their economic costs, further suggesting that it is the item's cost rather than social image that explains the effect of incentives on donor behavior.[17]

[Table 7 about here]

In sum, the material value of the items rather than the social-image value appears to be driving the effect of incentives on turnout and units collected. This result might be less surprising than it first seems given the literature on social image (e.g., Bénabou and Tirole 2006). The social image that donors obtain would occur both at the blood drive itself, where gift items would not add any extra signal, and when donors display the branded ARC gift items subsequent to donating (e.g., wearing a Red Cross T-shirt or lying on the beach on a Red Cross beach blanket). In the latter case, donors would have to actively decide to display their items to receive any social-image value, and this decision may undermine the social-image value (Harbaugh and To 2008).

3.3.2 The Non-Systematic Assignment of Incentives to Host-Locations

Although the results in Tables 6 and 7 indicate that drives with higher valued incentives attract more donors, an alternative explanation is that the ARC representatives systematically allocate higher-value incentives to host pairs that the organization believes will attract the most additional donors. If this "targeting" occurs, then the relationship between higher-value incentives and greater turnout observed in Tables 6 and 7 may be not well identified. To investigate whether this targeting occurs, we note that, if ARC representatives provide specific hosts with higher (lower)-valued incentives, we would anticipate that the distribution of the values of incentives allocated across hosts would not appear random but would, instead, skew the distribution such that a higher proportion of hosts would receive both higher- and lower-value incentives than a random allocation of incentives across hosts. To test whether the actual distribution is different than a random allocation, we ran 1,000 Monte Carlo simulations to determine the distribution of a random allocation of incentives. In each simulation, we started with the entire set of incentives that the ARC allocated among hosts who ran at least one drive with and without incentives

[16] One exception is the 6-pack cooler, which is the second most expensive item at $9.37 and yet has only a moderate, albeit significant, effect on turnout, attracting 4.3 additional donors.

[17] Table 7 also shows that across all the incentives, two items (T-shirts and sweatshirts), indicate a significant decrease in deferrals, and two items (scarves and miscellaneous items) indicate a marginally significant increase in deferrals. Given the large number of specific incentives that we tested, we would anticipate that some of the incentives might have significant coefficients (positive or negative) by chance. We thus do not speculate that some items somehow have had a unique effect on deferrals but, rather, attribute these few significant effects to chance. Besides, the magnitude of these coefficients is always very small.

(because this within-host variation is what allows our regressions to identify the estimates when we include host fixed effects). Each simulation then randomly allocates these incentives to each host in the same proportion that we observe in the data (e.g., there were 99 hosts who ran exactly 2 drives).[18] We then ranked each host in the simulation from the lowest to highest mean value of incentive received. Finally, we take the mean value of incentives allocated for each rank over all simulations. The results of this simulation exercise are shown in Figure 3. The figure shows that the actual and simulated distributions lie nearly on top of each other. A Kolmogorov-Smirnov test of the actual and simulated distributions indicates no significant difference. These results suggest that the ARC representatives are not systematically targeting certain hosts with higher-value incentives, which is consistent with the ARC commitment to fairness towards individual hosts.

[Figure 3 about here]

3.3.3 The Role of a Drive's Host

A further alternative explanation is that hosts might actively promote drives with incentives differently from drives without incentives. For instance, an active host might contact more people when incentives are present, run an open rather than a closed drive, or run the drive for more hours. If this were the case, the incentive effect that we find may actually be an information effect. Fortunately, we can largely rule out these possibilities. First, ARC managers repeatedly told us that the activities performed by hosts, from offering a physical location to participating in promoting a drive, do not change according to the presence of promotions. Similarly, ARC representatives also follow identical, standardized procedures in promoting a drive, regardless of the specific drive host and the presence of incentives. Second, we directly check whether the presence of incentives has any effect on two dimensions we can observe and in which hosts might have some discretion, namely the length of a drive, and whether a drive is open to the general public. As shown in Appendix Table A5, we could not detect any significant difference, controlling for host and representative fixed effects, depending on whether incentives were or were not offered.

As a further way to check directly whether hosts might be more active when incentives are offered, we exclude from the analysis the subset of hosts (20.7 percent of the total number of hosts) who, at least once, used their own budget to purchase and offer an incentive to donors. We consider this behavior to serve as a proxy for the most "engaged" hosts. We re-ran our main regressions on the sub-samples of "engaged" and "not engaged" hosts (Appendix Table A6), and all of the main results in Tables 5-7 hold. Thus, we cannot find any evidence in the data that hosts are changing their behavior when incentives are

[18] More specifically, in each simulation, we first allocated to each host one drive with no incentive and one drive with a randomly chosen incentive; thus, every host in the simulation, like every host in the data that we used for identification, had at least one drive with and without an incentive. We then randomly assigned the remainder of the incentives with equal probability to all remaining host drives in the same proportion as found in the actual data.

offered.

4. Evidence from a Natural Field Experiment

In addition to the robustness checks, we ran a randomized natural field experiment in collaboration with the ARC in northern Ohio, to further ensure the robustness of our inferences. The experimental design is described below, followed by the report and discussion of the findings, which, as will be seen, confirm the results from the historical data analysis.

4.1 Experimental Design

We ran the field experiment in four waves: September 2009, December 2009, March 2010, and July-August 2011. In each wave, we randomly selected 18 drives from the set of drives that satisfied the following criteria that reflect the most typical drives. First, the drives had to be open and in a flyer county. Second, the drive locations had to have hosted at least three drives in the reference year. [19] Third, during the reference year, the mean turnout had to be within one standard deviation of the overall mean (mean: 35.9; one standard deviation: 20.2). Fourth, at most, 50 percent of the drives in the reference year could have offered an incentive. Fifth, no incentive was offered in the drive immediately prior to the intervention drive. Sixth, all drive locations in the experiment had to be at least five miles from each other.[20]

Among the sites that satisfied these requirements, we randomly selected nine pairs of drives for each of the four waves. Both drives that comprised each pair were held in the same county and in the same month but each pair was held in a different county. Finally, within each pair and in each wave, we randomly chose one location to be the treatment and the other location to be the control. That gave us 36 treatment and 36 control drive locations.

No items were offered at control drives. At treatment drives, the incentive item had a value of $5, $10, or $15. We randomly allocated the values across drive locations so that there were nine treatment drives with each value. All incentive items were gift cards from various merchants in the community (e.g., Wal-Mart, Target, BP, Buehler's, and Giant Eagle).[21] We let donors choose their gift card from multiple merchants to increase the liquidity of the reward. The three values will let us assess the slope of

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[19] The reference year goes from May 18, 2008 through May 18, 2009. The latter is the date when we received the list of drives that were scheduled for the following year from the ARC. Because the ARC allocates incentives to drives months in advance, it was important that we pre-selected our treatment and control drives as much in advance as possible to "lock in" those drives as well as to ensure that no incentives would be allocated at those sites in the drives immediately prior to our intervention drives.

[20] In the next section, we report that incentives at a given drive do not affect turnout at neighboring drives located more than two miles away; therefore, requiring that the drives be more than five miles apart minimizes the chance of any displacement effects across the experimental drives.

[21] As shown in Table 2, the ARC frequently offers gift cards or coupons. Therefore, these rewards should not be perceived as "unusual."

the donation supply curve. We chose the value of the cards to be within the range of (retail) values of the items offered by the ARC.[22]

A few final features of the experiment are central to the inferences that we will make. First, the gift cards include no reference to the ARC or blood donations; thus, we removed any symbolic or social value from the rewards. Second, the ARC guaranteed that identical (and standard) recruitment procedures were used for the drives with and without incentives. Third, at no point were donors informed that a study was being conducted, and, because gift cards had been offered at other drives, it is reasonable to assume that at no point were donors aware they were participating in a study and being "observed." Fourth, donors were informed of the offer of incentives through the normal monthly flyers or phone calls at 27 of the 36 treatment drives (7 per wave);[23] in the remaining 9 drives, the flyers did not provide any information informing donors of the incentives. We included these 9 "surprise" drives to test whether the main vehicle through which donors learned about the incentives was through the institutional channel of the monthly flyers as opposed to any informal channel such as "side-activities" by representatives or hosts. If we find similar incentive effects at the uninformed and informed treatment drives, then this would provide strong evidence that some unobserved factor is driving the change in donations other than donors responding to the incentives. Thus, the nine uninformed treatment drives are a further test of the causal mechanism.[24]

In Table 8, we report summary statistics of various characteristics of the treatment and control drive locations during the year prior to our intervention. Not surprisingly, given the random assignment, the treatment and control drives look similar along every dimension. None of the (small) differences between the 36 control drives and the 27 advertised treatment drives, between the 36 control and the 9 surprise treatment drives, and between the advertised and surprise treatment drives are statistically significant.

[Table 8 about here]

[22] The most expensive item used by the ARC had a cost of $9.50, but we assume a higher value to the donors based on higher retail prices. However, with gift cards, there is no difference between the cost and the retail price.

[23] More precisely, potential donors on the ARC contact list were informed of the upcoming treatment and control drives in the standard ways using the monthly flyers. In the 27 informed treatment drive locations, a random sample of about half of the potential donors on the ARC contact list received flyers indicating that gift cards would be offered as well as the amount of the gift cards whereas the other half of the potential donors on the contact list received nearly identical monthly flyers except their flyers excluded any information on the gift cards. As a consequence, note that any effect of the incentives on the "informed" drive might underestimate the effect that we would have had if all people on the contact lists had been informed.

[24] One might be concerned that flyer counties are not the ideal unit to define treatment and control conditions for the experiment because two (or more) drive locations might be geographically close together but in different counties. However, this is not a concern in our setting because the American Red Cross in northern Ohio contacts individuals based on all of the counties where they have donated in the past and not, for instance, the county where they live or work. Thus, if donors have donated in two (or more) counties in close proximity to each other, then they would be informed of the upcoming drives in these counties and we would observe all locations where they could choose to donate. On the other hand, if donors have only donated in one county although there are blood drives in close proximity but in a different county, they would not be informed of these neighboring drives.

4.2 Findings

Table 9 presents the simple means from our field experiment. We report outcomes (number of donors presenting, number of units collected, and share of presenting donors who were ineligible to donate) for control drives, "surprise treatment" drives, and "advertised treatment" drives. For each of these groups of drives, we report average outcomes measured in the pre-intervention period, which includes all of the drives that took place at each host-location during the reference year (May 18, 2008-May 18, 2009), and average outcomes on the date of our intervention.

[Table 9 about here]

In the control drives, on average, turnout fell by 0.4 individuals, and units collected rose by 0.3 during the intervention period compared to the previous year whereas the number of donors deferred fell by 2 percent. In the surprise treatment drives, turnout and units collected rose by 0.3 and 0.1, respectively whereas the number of donors deferred increased by less than half of a percentage point. In contrast to these relatively small changes, in the advertised treatment drives that offered $5, $10 or $15 gift cards, on average, turnout and units collected increased by 8.3 and 7.5, respectively whereas the fraction deferred decreased by 0.5 percent.[25] Compared to the change in the control drives, turnout and units collected increased relatively by 8.7 and 7.2 units, respectively. Panel B of Table 9 shows that the higher the advertised value of the gift card, the larger the effect on turnout and units collected; turnout increased, on average, by 5.1, 5.6, and 13.8 donors when the $5, $10, or $15 gift cards were advertised, respectively whereas units collected increased by 4.0, 4.4, and 13.6 units, respectively. Compared to the control condition, turnout increased, on average, by 5.5, 6.0, and 14.2 donors when the $5, $10, or $15 gift cards were advertised, respectively; units collected increased by 3.7, 4.1, and 13.3 units, respectively. No particular pattern emerges with respect to the share of donors deferred; the percentage of donors deferred fell 3 percent when the $15 card was advertised whereas it increased by 1 percent when either the $5 or $10 card was advertised.

To test the significance and robustness of these average effects, we estimate several versions of the following differences-in-differences (DD) specification:

$$Y_{jt} = \alpha + \beta EXP + \delta_1 EXP*TR\_ADVERTISED + \delta_2 EXP*TR\_SURPRISE + \lambda X_{jt} + \eta_j + \varepsilon_{jt}\,, \qquad (2)$$

where j denotes host-locations and t denotes time periods. There are 2 observation periods per drive: a pre-experiment observation ($EXP=0$) and an observation that corresponds to the date of the experiment intervention drive ($EXP=1$). The pre-experiment observations represent the average of each outcome (turnout, share deferred) across the drives that took place at each host location during the reference year (5/18/2008–5/18/2009). Let the dummy variable *TR_ADVERTISED* equal 1 for treatment sites where

[25] Note that we could only use 26 of the 27 advertised treatment drives in the analysis because, at one advertised treatment drive, unforeseen contingencies did not allow us to apply the experimental protocol.

donors were informed of the gift card by the monthly flyers and 0 otherwise and the dummy variable *TR_SURPRISE* equal 1 for treatment sites where donors were not informed of the gift card by the monthly flyers and 0 otherwise. Thus, the omitted category consists of the control drives. We do not estimate the main effect of *TR_ADVERTISED* and *TR_SURPRISE* because all of the models that we estimate include fixed effects for host-locations. The critical variables to identify the effect of incentives are the DD interaction estimates *EXP*TR_ADVERTISED and EXP*TR_SURPRISE.* The coefficient on *EXP*TR_ADVERTISED*, δ_1, indicates the difference in outcomes between sites where incentives were offered and donors were informed (i.e., the advertised drives) compared to drives where no incentives were offered (i.e., the control drives) at the intervention drives compared to the reference year. Thus, the coefficient estimate on EXP*TR_ADVERTISED* parallels the estimate on the main effect of incentives in the regressions reported in Tables 5a, 5b, and 6 of the historical analysis. The coefficient on *EXP*TR_SURPRISE*, δ_2, represents difference in outcomes between drives where incentives were offered but donors were not informed (i.e., the surprise drives) compared to drives where no incentives were offered (i.e., the control drives) at the intervention drives compared to the reference year. In addition to including host-location fixed effects, η_j, we add the control vector X_{jt}, which includes drive length and wave fixed effects. The outcome variable Y_{jt} is given, again, by the turnout (or the mean turnout in the reference year for the pre-experiment observations) and the donors deferred as a fraction of turnout. The standard errors are clustered at the host-location level; this is necessary, in particular, because of the way the two observations per host are constructed. In fact, the first observation is a yearly average whereas the second is just one drive, and this makes the errors heteroscedastic, and clustering at the host level corrects for this heteroscedasticity.

The estimates reported in Table 10 confirm the striking impact of incentives at the informed treatment drives. Column 1 shows that, when donors had been informed of the incentives, turnout increased by 9.9 units relative to locations in which no incentives had been offered during the intervention (coefficients on *EXP*TR_ADVERTISED*). This coefficient is similar to the differences-in-differences effect reported for the raw means in Table 9, and is statistically significant at the 1 percent level. Column 2 shows that these incentives did not induce a significant change in the fraction of donors being deferred. Columns 3 and 4 confirm and strengthen the result that the effect of the incentives on turnout increases with the monetary value of the incentive with no adverse consequences on the share of donors deferred. The results in Column 3 shows a monotonic relationship between the monetary size of the incentive and the estimated effect on turnout and units collected. The increase in turnout at the drives where informed donors received a $5 gift card compared to the averages in the reference year at the same locations, relative to the change in the control locations, was 5.2. The increase in turnout at the $10 drives was 8.2, and, at the $15 drives, the increase was 16.9. The relationship between the monetary value of the incentives and its effect on turnout, moreover, seems to be roughly linear, which is consistent with our findings from the historical data. The estimated effects for the $10 and $15 cards on turnout are all significant at the 5 percent level.

We also find significant differences between the $10 and $15 coefficients as well as between the $5 and $15 coefficients. However, although the DD coefficient estimate on the $10 treatment is more than 60 percent larger than the $5 DD estimate, this difference fails to attain conventional significance levels.

Columns 5 and 6 replace the DD treatment dummies with the monetary cost of the incentives in a linear fashion. The estimates here indicate that a $1 increase in the cost of the incentive at the informed drives leads to 1.05 extra donors presenting with, again, no significant effect on the share of donors deferred.

The coefficient estimates for the effect at the surprise reward locations on turnout, although positive, never comes close to reaching the level of significance. Thus, offering incentives without informing donors on the monthly flyers or through phone calls had no effect on turnout, which indicates that if there are any unobserved “side activities” among hosts and representatives, this behavior does not significantly affect donation behavior. Therefore, informing donors through the monthly flyers and telephone calls rather than just providing the incentives was critical for the positive significant effect that the incentives had on turnout and units collected. This strongly suggests that donors are changing their behavior in response to the advertised effects rather than possibly hosts changing their behaviors.

The evidence from the experiment strengthens our interpretation that (1) incentives increase donor turnout and units collected, (2) the positive responses are driven by the economic value of the incentives, (3) donors rather than hosts are changing their behavior in response to the presence of incentives, and (4) the incentives improve the performance of blood drives without the negative consequence of attracting disproportionately more donors who are ineligible to donate.

[Table 10 about here]

5. Assessing the Effect of Incentives on Neighboring Drives

One of the robust findings in our analyses thus far is the larger effect of incentives on turnout and units collected when drives are open rather than closed and when drives are advertised in flyer**s** rather than postcard counties. This is a first indication of the possible presence of displacement effects; the interaction parameters in Columns 4-6 of Table 5a, Columns 2-4 of Table 5b, and Columns 4-6 in Table 6 estimate the additional donors who are attracted to donate at drives that they would not otherwise be aware of (in the case of flyer rather than postcard information) or would not otherwise be aware of or able to donate at (in the case of open rather than closed drives). If donors are flexible regarding when and where they donate, then they may be influenced by incentives to change the date and location of their donations, in which case the above analysis could overestimate the overall effect of incentives; at least some of the increase may be explained by donors leaving one drive (that does not offer an incentive) and opting for another drive (that offers an incentive). To the extent that donors are changing the location of where they donate, there is no increase in overall donations.

Before turning to our general analysis of displacement effects, we briefly consider one potential avenue for displacement whereby donors may choose to push forward a donation due to an incentive, and then subsequently not donate at the following drive. This analysis is especially interesting with respect to examining whether there are inter-temporal crowding effects in which a donor's intrinsic utility to donate may be lowered by the presence of an incentive, resulting in a lower propensity to donate once the incentive has been removed. We repeat the regression analyses presented in Tables 5a, 5b, and 6, but add controls for whether an incentive was offered at the previous drive, the cost of the previous incentive, and the interaction effect for the presence of an incentive in the previous drive with the presence of an incentive at the current drive. Appendix Table A7 reports these results. The estimates indicate that there is no significant effect on turnout, units collected, or deferrals at a drive that follows a drive by the same host and in the same location offering an incentive; in other words, drive outcomes revert to the average levels for that host-location following the presence of incentives at a previous drive. This suggests that there are no long-term, intertemporal crowding effects once incentives were removed. It further suggests that there are no displacement effects over time isolated at the current location. However, displacement may occur across locations when there is less time between drives. We now turn to this more general examination that allows donors to switch when and where they donate across a broad set of drives rather than limited to only the one host-location displacement possibility.

5.1 Empirical Strategy

To analyze the impact of incentives offered at drives that neighbor a drive taking place at time *t* and host-location *j*, we estimate the following modification of model (1):

$$Y_{jt} = \alpha + \beta X_{jt} + \delta INCENTIVE_{jt} + \mu N_{jt} + \rho NI_{jt} + \eta_j + \varepsilon_{jt} \qquad (3)$$

where *Y, INCENTIVE, X* and η are defined in equation (1) above, N_{jt} is the number of neighboring drives of drive *jt*, and NI_{jt} indicates the number of the neighboring drives that offer incentives.

We adopt a series of strategies to isolate the effects of interest. First, if they occur, displacement effects should be more pronounced with drives that are closer in time and space. Thus we distinguish neighboring drives that occur within 2 miles from a focal drive, between 2 and 4 miles, and between 4 and 10 miles. Our construction of the set of relevant neighboring drives has been described in Section 2.2 above. Table 4 presents summary statistics on the number of neighboring drives at various distances and on the number of neighboring drives that offered incentives. For instance, on average, 2.6 drives within a 2-mile distance offered incentives across all drives.

Second, as discussed previously, potential donors are informed of the upcoming drives either through a flyer or a postcard, and possibly phone calls. More precisely, in flyer counties, donors are informed in advance of all of the *open* drives that have been planned for that month *in that county*, and, for each drive, the flyer indicates whether there is a promotion and, if so, what kind. In postcard counties, in contrast, donors are informed only about one drive (or a small number of drives if they receive more than one postcard), just a few days before the drive date. Thus, if displacement effects occur, they should be stronger where donors are informed in advance about a larger number of drives, and, of course, if these drives are open so they can attend.[26] Therefore, we perform separate analyses for closed drives, open drives, and open drives in flyer counties. Also, if changing the location of a donation is driven not only by the presence of a neighboring drive but also by the presence of incentives, then we should see a stronger decline in turnout at a given drive if there are incentives offered at neighboring drives. Thus, we calculate the impact of having any drives in the neighborhood of a focal drive as well as the effects of having neighboring drives with incentives; we look at all drives—closed drives, open drives, and open drives in flyer counties—separately. Finally, the results in Tables 6 and 7 suggest that drives are more attractive to donors in accordance with increasing value of the incentive that is being offered. Thus, we will also examine whether displacement effects are stronger when neighboring drives offer more expensive incentives.

For this analysis, we can only use observations with enough forward and backward temporal lags to have a complete record of all possible neighbors. To have a complete set of neighbor observations for every drive, we thus needed to remove drives from the analysis (as dependent variables) that occurred within the first 56 days and the last 30 days. This truncation of the data removes almost 7.5 percent of the observations. Regressions that have not been herein reported (available upon request) show that all of our previous results remain qualitatively (and, essentially, quantitatively) unchanged when repeated on this reduced dataset.

5.2 Findings

Table 11 reports the effect of potential substitute drives on presenting donors. All the regressions are versions of the full models that have been estimated in Table 6 with additions for neighboring drives. Column 1 adds the number of neighboring drives in three distance ranges: 0-2, 2-4, and 4-10 miles. The results indicate that the presence of one additional drive that is a potential alternative for a given drive reduces turnout significantly—by almost 0.2 donors on average—if it takes place within 0-2 miles. Additional drives taking place farther than 2 miles do not have a significant impact. Column 2 examines whether the number of neighboring drives that offer incentives affects turnout at a drive. The estimates suggest that, if one additional neighboring drive among the potential alternatives within 2 miles offers an incentive, the turnout will decline significantly—by nearly 0.25 donors. Drives that offer incentives but that are located farther away do not have any effect on turnout. Column 3 estimates the effects of a

[26] Because some donors may receive more than one postcard if they have donated at more than one location previously, they may have information on more than one drive. Therefore, some substitution may still occur in postcard counties, but, on average, it should be weaker than in flyer counties where all donors would be informed of all upcoming drives in the county.

change in the dollar value of the highest monetary value of incentives offered across potential substitute drives. We obtain negative, marginally significant coefficients that indicate that for every $1 increase in the highest monetary value incentives offered at potential substitute drives occurring within 0-2 and 2-4 miles, 0.1 fewer donors turnout; however, there is no effect for drives that are located 4-10 miles away. The results in Columns 1-3 reinforce the interpretation that donors are attracted to drives that offer incentives and more so when the incentives have higher value; however, the results also indicate that the spatial substitution is mostly limited to drives that are within 2 miles of each other.

Columns 4-6 repeat the analyses from Columns 1-3 and include estimates of the interaction of the variables of interest with the incentive dummy variable thereby indicating whether an incentive was given at the current drive. We include these interactions because we anticipate that donors will be less likely to switch away from a drive if the drive already offers an incentive. We do not find any significant effect for this interaction when examining the total number of potential neighboring drives (Column 4) or the number of potential neighbors that offer incentives (though, in this case, the direction of the estimate is as anticipated). However, Column 6 shows that the negative effect on turnout at the focus drive as a result of the neighboring drive that offers the costliest incentives within 0-2 miles (-0.21 fewer donors) occurs only for drives that do not offer incentives; this effect does not occur at all for drives that offer an incentive (the effect for these drives is a statistically insignificant +0.07=-0.21+0.28). This result indicates that donors are increasingly likely to switch away from drives without incentives than from drives that offer incentives as the value of the item that is being offered at a neighboring drive increases.

[Table 11 about here]

The results indicate that, for the most part, only drives located within 2 miles have significant effects on turnout at the current drive. Therefore, in what follows, we restrict the analysis to neighboring drives located within 2 miles. In Column 7, both the total number of neighboring drives and the number of neighboring drives that offer incentives are included. The coefficient estimate on the total number of potential neighboring drives within 0-2 miles decreases substantially (compared to Column 4) from -0.19 to -0.09 and is no longer significant whereas the coefficient estimate on the number of neighboring drives that offer incentives falls only slightly (compared to Column 5) from -0.29 to -0.25 and remains highly significant. Column 8 adds the highest monetary value of incentives offered at neighboring drives. The estimates in Column 8 show that (1) an increase in the number of neighboring drives, (2) an increase in the number of neighboring drives that offer incentives, and (3) an increase in the highest cost of an item offered at a neighboring drive all negatively affect turnout. Moreover, the interaction of the highest cost incentive offered at a neighboring drive and an incentive offered at the focal drive indicates that offering an incentive at the focal drive will significantly decrease the number of donors who substitute away from that drive towards the neighboring drive that offers incentives. Thus, the estimates in Table 11 support displacement effects in which offering an incentive at one location will reduce the number of donors who donate at neighboring drives (within 2 miles), and the displacement effects are stronger at drives that do not offer incentives.

Our estimates imply that displacement effects can be substantial because adding incentives can potentially affect many neighbors, and can be especially large if the incentive is the highest-value item that is being offered in the neighborhood. For instance, consider a simple case in which an item that costs $3.00 (the average and modal cost of the ARC incentive items in the sample) is added as an incentive to an existing drive in a neighborhood with four other drives within 0-2 miles driving distance (this case represents the average neighborhood conditions shown in the bottom-right panel of Table 4). To keep this example simple, further assume that none of the other drives in the neighborhood are offering an incentive. If we ignore displacement effects, the estimates in Column 1 of Table 6 indicate that an additional 6.24 donors ($3*2.47 – 3^2*0.13$) will turn out. However, the estimates in Column 8 of Table 11 indicate that turnout will also decrease by 0.69 (= 0.15 + 0.18 * $3) donors at each of the neighboring drives when none of the other drives are offering incentives. This implies that adding the incentive reduces turnout across all neighboring drives by a total of 2.76 (= 4*0.69) donors. Thus, about 45 percent (2.76/ 6.24) of the *extra* donors who turn out at the drive that is offering the incentive (when we ignored displacement effects) will comprise donors who would have donated otherwise at one of the neighboring drives. Thus, in this simple scenario, in a neighborhood with four other drives (none of which is offering incentives), for every "new" donor who shows up to donate when a $3 cost incentive is offered, 45 percent of the local increase is not due to new donors; rather, it is attributable to existing donors who have switched away from donating at other drives. Hence, ignoring these temporal and spatial displacement effects can result in substantially overestimating the total effect of incentives on donations.

Appendix Table A8 provides further evidence that donors are substituting across drives. The estimates in this table show that displacement effects are small and insignificant at closed drives, are generally much larger and significant at open drives, and are the largest at open drives in flyer counties. It is not surprising that the displacement effects are larger at open drives and open drives in flyer counties because more donors are aware of their options and able to substitute their donations towards the open drives. Similarly, the estimates indicate that an increase in the value of the highest cost incentive offered at a neighboring drive is smallest and insignificant at closed drives and is much larger and significant at open drives and open drives in flyer counties when the current drive does not offer an incentive. Thus, as anticipated, displacement effects are larger when more donors are able to substitute (at open drives) and when more donors are aware of more options to donate (in flyer counties). These results are consistent with standard economic reasoning in general but have not been documented in the context of pro-social behavior. Appendix Table A8 also presents regressions for the share of donors deferred. For deferrals, it is possible that drives that offer incentives could siphon donors who are more likely to be deferred because these donors have characteristics that might be more attracted to drives with incentives. However, we find no systematic evidence of this type of behavior occurring.

We pointed out above that, because there are only a few close substitutes to donating blood other than donating blood at a different time or location, examining displacement effects for blood donations is particularly useful for determining whether pro-social activities are, in aggregate, positively or negatively affected by the presence of material incentives. It is still possible that a few close substitutes exist. For instance, donors may substitute away from donating plasma to instead donate blood; in other words, our analysis, which only includes American Red Cross, Northern Ohio Blood Region blood donations as a possible substitute for donor's pro-social activities, may still overestimate the overall effect of material incentives on blood donations within the more general category of blood product donations. Whereas plasma donation has some differences from whole-blood donations (e.g., it takes longer and has more health restrictions), in one respect, it may be a close substitute because many plasma donors are compensated for their plasma donations (by other organizations). Broadening the category of possible substitutes even further, additional pro-social activities that may be a substitute for blood donations could be any number of other physical activities that require some effort and possibly some minor discomfort. Thus, we conjecture that the current analysis presents a potential lower bound on the size of the displacement effect, but we do not expect that the estimates presented in this paper are too far off the total displacement effects because we are able to estimate the effects of the closest substitutes and, also, because we cannot detect any displacement effects beyond 4 miles and more than 56 days.

6. Discussion and Conclusions

We have presented evidence that incentives offered at blood drives significantly increase the number of donors presenting and units of blood collected, and do not increase the proportion of deferrals. We also found that, when incentives are offered at a given drive, turnout is significantly reduced at (geographically and temporally) neighboring drives, especially when these drives do not offer incentives. This indicates that some donors switch the timing and location of their donations to take advantage of material incentives. Ignoring displacement effects could thus lead to a substantial over-estimate of the total effect of incentives depending on the presence of neighboring drives and whether they offer incentives.

The most important contributions of this study to the literature on the effects of extrinsic incentives on pro-social behavior are twofold. First, within the current paradigm of looking at the "local" effects of incentives, we provide field evidence from a large and representative population, and analyze the effects of many incentives used in the field. In this setting—and with specific reference to blood donations—we found that neither crowding out of motivations nor adverse selection appears to be consequences of the presence of incentives. Second, we expand beyond the existing approaches and explore the "total" effects of incentives, when donors can choose between different locations and times to donate. This extension is crucial because it shows that the positive, local effects of incentives are partially attenuated when we consider displacement effects.

Welfare analyses of incentives have to balance the gains in terms of additional units of blood collected with the costs of procuring the rewards. Using the analysis of the observational data (Table 11, column 8), we find that an incentive item of average cost ($3) leads to 6.12 additional donors presenting at a drive (=2.40*3-0.12*3^2). On average, therefore, 40.12 donors (=34+6.12) present at a drive with an incentive that costs $3, leading to a total cost of $120.40. The benefit of the incentive in terms of extra units of blood collected needs to take into account the displacement effect. Based on the calculations we presented in section 5.2 (i.e., in a scenario in which an incentive is assigned to an existing drive in a neighborhood with four other drives within 0-2 miles driving distance) the presence of a $3-cost incentive at a drive decreases the number of donors presenting at neighboring drives by 2.76 donors. This displacement effect, combined with the fact that 15 percent of donors presenting turn out to be, on average and irrespective of the presence of incentives, not eligible to donate, delivers a total of 2.86 extra units of blood collected (=[6.12-2.76]*0.85). Thus, the cost of the incentive item per unit of blood collected amounts to $42 (=$120.4/2.86). To this cost, one would then add the production, transportation and storage costs for the additional donors presenting and units collected such as labor and equipment costs, and the cost incurred to separate the different blood components. The reimbursement rates requested by different blood collection agencies and blood banks (a proxy for the collection costs) in the US are generally confidential information. As an upper bound on those costs, we use the Medicare hospital outpatient payment rate for a unit of whole blood for transfusion, which in 2010 was set at $206.25 (Centers for Medicare and Medicaid Services 2010). Taking these estimates, the rewards would be cost-effective provided that the full social value of one unit of whole blood is at least about $248.25. Estimating the social benefit from one unit of blood is a much more complicated exercise, however, and one that is beyond the scope of this paper. In fact, from one unit of blood collected, a full unit of red cells and several partial units of plasma, platelets, and cryoprecipitate can be derived, which can be used on multiple patients. To obtain an estimate of the social benefit one would need to estimate the expected impact of the transfusion of each blood component on the life expectancy of the patients multiplied by the value of those extra years of life. A lower bound estimate of the benefit could be given by the cash amount that is billed by hospitals when performing transfusions, which can reach about $1,000. Based on our calculations, the incentives used by the ARC to increase blood donations seem to be highly cost-effective, on average costing 4 percent or less of the social benefit.

One question that might be asked is whether the same effects found in this study would hold were the incentives offered in the form of direct cash. A definitive answer is difficult because the available theories and empirical evidence provide mixed results on the difference between cash and non-cash incentives. In the theoretical framework of Bénabou and Tirole (2006), any extrinsic incentive can potentially crowd out intrinsic motivation, regardless of whether they come in the form of cash or otherwise. Mellstrom and Johannesson (2008) find a negative response to cash incentives among their female (but not male) undergraduate student subjects for taking a compulsory health test to become a blood donor. Survey evidence presented in Lacetera and Macis (2010b) indicates that some donors might prefer cash-equivalent vouchers to cash for donating blood. However, other studies find that, whereas small, in-kind rewards motivate subjects more than small cash rewards, these differences vanish when the dollar value of the rewards is not minimal (Heyman and Ariely 2004); also, when asked to choose among in-kind and cash prizes, the vast majority of subjects choose cash (Kube et al. 2008). Our paper points to a high number of explicit, material incentives that enhance a form of altruism, and more so when their *economic* value is higher.

A number of future directions can be taken to complement the existing study. First, the availability of information at the individual level (both from historical and experimental data) would help to isolate the mechanisms through which economic incentives motivate blood donations. Interesting questions would be what individual demographics and past donation behavior are associated with more or less strong responses to the incentives; and whether "social" mechanisms are in place beyond individual processes with incentives setting in motion social or peer pressure mechanisms (e.g., individuals who are informed of the presence of incentives might tell friends or relatives thus inducing them to donate as well).

Second, information about the long-term behavior of donors would let researchers test whether being exposed to incentives once (or multiple times) modifies the "post-intervention" behavior.

An important third direction for future work is to examine other populations of potential donors. Our sample consists primarily of donors who have donated in an environment in which incentives have been offered in previous blood drives. One important population to study in future research is non-donors. Research could examine whether non-donors may be enticed to donate for the first time if offered incentives and, perhaps more importantly, whether being offered incentives to someone who donates for the first time would affect their future donations compared to donors donating for the first time without receiving an incentive. From a policy perspective, this population is important because less than 10 percent (and often well under 5 percent) of most eligible people in developed countries have ever made a blood donation. Another interesting population to study in future work would be donors who have never been offered an incentive for donating. Although this may not be too relevant from a policy perspective (because it would only be informative for the first time an incentive is offered), it could address some theoretical issues that we are not able to directly consider with the existing population. For instance, because about 40 percent of blood drives offer some form of an extrinsic material incentive, it is possible that potential donors who are affected by crowding have selected out. This is possible if crowding works through social-image and signalling (e.g., Bénabou and Tirole 2006) though not obvious since many people may be unaware of the prevalence of incentives if not already a (regular) donor. In contrast, the selection due to crowding is unlikely to the extent that donors' intrinsic utility is derived from motivations associated with warm glow or pure altruism (Andreoni 1989); if these are the prevalent motives for donating, donors can, for instance, donate at drives that do not offer incentives, donate at drives that offer incentives but the donors do not accept the gifts, accept the gifts but never display them publically, or, even if donors accept and use/display the gifts, donors may maintain sufficient intrinsic value.

In sum, we found that offering incentives at blood drives significantly and substantially increases donor turnout and blood units collected without negatively affecting the percentage of donors who are deferred. The effect is driven primarily by the economic value and not by the signalling value of the items. The positive effects of incentives are, however, partially attenuated by the displacement of donors from neighboring drives; ignoring these displacement effects would have led to an over-estimate of the effect of incentives. The displacement effects have largely been ignored in the literature on pro-social behavior (with the exceptions of the work cited previously), most likely due to lack of data but, nonetheless, should be considered in future work on examining and motivating pro-social behavior; for example, an arms race between potentially competing charities to attract donations could lead to positive results for individual non-profit organizations but to only small (or even negative) consequences for overall welfare.

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Table 1: Summary statistics

	Full sample			Dropping outliers		
	Mean	St.Dev.	Median	Mean	St.Dev.	Median
Number of donors presenting	37.0	26.9	31	35.9	20.2	31
Units of blood collected	31.3	23.0	26	30.4	17.3	26
Donors deferred (fraction of presenting)	0.15	0.09	0.14	0.15	0.09	0.14
Open drives	0.78	0.42	1.00	0.78	0.42	1.00
Drives in "flyer" counties	0.80	0.40	1.00	0.80	0.40	1.00
Open drives in "flyer" counties	0.61	0.49	1.00	0.62	0.49	1.00
Drive length (hours)	5.36	1.18	5.00	5.35	1.14	5.00
Incentives given (yes = 1)	0.37	0.48	0.00	0.36	0.48	0.00
Temperature (F)	55.19	17.98	59.00	55.16	18.00	59.00
Fraction <32F	0.14			0.14		
Rain	0.13	0.32	0.00	0.13	0.32	0.00
Rain intensity	0.03	0.08	0.00	0.03	0.08	0.00
Fraction days with rain	0.46			0.46		
Snow	0.23	0.96	0.00	0.23	0.96	0.00
Fraction days with snow	0.09			0.09		
Number of drives	14,029			13,707		

Notes: "Flyer" counties are counties where donors receive, every month, a flyer with information on all (open) drives that will take place in their county in that month. Donors in "non-flyer" or "postcard" counties, in contrast, receive only a postcard informing them of upcoming drives in the location(s) that the donors usually frequent. Rain measures inches of rain on the day of a drive; Rain intensity is measured as rain divided by hours of precipitation on the day of a drive; Snow measures the amount of snow (inches) in the 48 hours preceding a drive, and it is meant to capture the amount of snow on the ground on the day of the drive. The right panel removes drives in the top and bottom 1% of the distribution of donors presenting. Rain intensity is missing for 178 observations. Summary statistics for the sample limited to observations with complete information (N=13,529) are virtually identical to those presented here (see Appendix Table A1).

Table 2: Incentives at ARC Blood Drives

	At drives where incentives were offered %	At open drives %	At open drives in "flyer" counties %
T-Shirt	48.94	47.23	46.36
Coupon	8.55	9.30	9.88
Cedar Point ticket (raffle)	5.02	4.25	3.78
Cooler	3.01	3.23	3.23
Sweatshirt	2.49	2.91	3.02
Umbrella	2.35	2.50	2.27
Hat	1.67	1.87	1.87
6-Pack cooler	1.55	1.85	1.96
Blanket	1.16	1.31	1.33
Scarf	1.14	1.31	1.42
Mug	0.92	1.02	1.00
Music download card	0.88	0.90	0.48
Jacket	0.88	1.04	1.06
Miscellaneous items	3.07	3.16	3.05
Host-provided incentive	24.67	25.01	26.28
Number of drives	4,982	4,118	3,311

Table 3: Drive hosts and incentives

	Number of hosts	Percent of all hosts	Number of drives	Percent of all drives	Mean # of donors presenting
1. Hosts who ran exactly one drive	815	31.4	815	5.9	27.3
AND offered incentives	306	11.8	306	2.2	29.0
2. Hosts who ran at least two drives	1,780	68.6	12,892	94.1	36.4
AND never offered incentives	414	16.0	1,534	11.2	29.3
AND always offered incentives	211	8.1	742	5.4	35.4
AND sometimes offered incentives	1155	44.5	10,616	77.4	37.5
among these, JUST drives NOT offering incentives			6,682	48.7	35.7
among these, JUST drives offering incentives			3,934	28.7	40.5
All Drives	2,595	100%	13,707	100%	35.9

Table 4: Summary statistics on neighboring drives

	For each drive				For drives with incentives		
	Neighboring drives taking place within:				Neighboring drives taking place within:		
	0-2 miles	2-4 miles	4-10 miles		0-2 miles	2-4 miles	4-10 miles
mean	6.5	7.7	36.5	mean	6.8	7.9	36.9
st. dev.	8.0	9.0	34.6	st. dev.	7.8	9.1	34.3
	Neighboring drives **with incentives** taking place within:				Neighboring drives **without incentives** taking place within:		
	0-2 miles	2-4 miles	4-10 miles		0-2 miles	2-4 miles	4-10 miles
mean	2.6	3.1	14.5	mean	3.6	4.4	21.0
st. dev.	3.8	4.5	15.8	st. dev.	4.6	5.8	20.2

Notes: The unit of observation is a host-location/date. The number of neighboring drives for each focal drive was computed as follows. For a given drive X, neighboring drives are open drives that occurred in the same county as drive X between 56 days prior to drive X and (1) the end of the month in which drive X occurred, when drive X occurred on the 24th of the month or earlier, (2) the end of the following month when drive X occurred on the 25th of the month or later. Distance was measured in travel miles between street addresses, which were computed using standard GIS network-path algorithms for finding the shortest path through a network. All calculations were performed in GIS using the ESRI Streetmap 9.3 (2008). Further details are provided in section 2.2 in the text.

Table 5a: Local effects of incentives on the number of donors presenting at a drive

Dependent variable:	Donors presenting at a drive					
	(1)	(2)	(3)	(4)	(5)	(6)
Incentive dummy	5.03***	5.30***	5.41***	2.41***	3.98***	3.21***
	(0.56)	(0.39)	(0.32)	(0.51)	(0.57)	(0.40)
Incentive*Open Drive				3.73***		
				(0.63)		
Incentive*(Drive in "Flyer" County)					1.79***	
					(0.67)	
Incentive*(Open Drive in "Flyer" County)						3.52***
						(0.60)
Controls	No	Yes	Yes	Yes	Yes	Yes
Host-location Fixed Effects	No	No	Yes	Yes	Yes	Yes
Observations	13,707	13,529	13,529	13,529	13,529	13,529
R-squared	0.01	0.52	0.20	0.21	0.20	0.21
N. of host-locations			2,582	2,582	2,582	2,582
Mean of the dependent variable when no incentives offered:	34.0					

Notes: The dependent variable is the number of donors presenting at a drive. Controls include the length of the drive (in hours), weather conditions on the day of the drive (amount of rain in inches and its square, rain intensity [measured as rain per hour of precipitation] and its square, amount of snow fallen in the 48 hours before a drive and its square, and temperature dummy variables [0-36, 36-53, 53-68, 68-75, 75+]), and sets of fixed effects for year, month, week-of-the-month, day-of-the-week, ARC representatives, representative-specific week-of-the-month effects, special attributes of the drive, and, in the OLS specification of column (2), zip code fixed effects. The number of observations drops from 13,707 in column (1) to 13,529 in the remaining columns due to missing observations for rain intensity. Robust standard errors corrected for clustering at the host-location level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5b: Local effects of incentives on the number of units of blood collected and the share of donors deferred

Dependent variable:	Units of blood collected				Share of donors deferred			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Incentive dummy	4.71***	2.01***	3.51***	2.80***	-0.001	0.003	-0.000	0.001
	(0.28)	(0.45)	(0.52)	(0.37)	(0.002)	(0.004)	(0.004)	(0.003)
Incentive*Open Drive		3.35***				-0.005		
		(0.55)				(0.004)		
Incentive*(Drive in "Flyer" County)			1.50**				-0.001	
			(0.60)				(0.004)	
Incentive*(Open Drive in "Flyer" County)				3.04***				-0.003
				(0.53)				(0.003)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Host-location Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,529	13,529	13,529	13,529	13,529	13,529	13,529	13,529
R-squared	0.18	0.19	0.18	0.19	0.04	0.04	0.04	0.04
N. of host-locations	2,582	2,582	2,582	2,582	2,582	2,582	2,582	2,582
Mean of the dependent variable when no incentives offered:	28.9				0.15			

Notes: The dependent variables are the number of units of blood collected at a drive (columns [1] through [4], and the donors deferred as a fraction of donors presenting (columns [5] through [8]). Controls include the length of the drive (in hours), weather conditions on the day of the drive (amount of rain in inches and its square, rain intensity [measured as rain per hour of precipitation] and its square, amount of snow fallen in the 48 hours before a drive and its square, and temperature dummy variables [0-36, 36-53, 53-68, 68-75, 75+]), and sets of fixed effects for: year, month, week-of-the-month, day-of-the-week, ARC representatives, representative-specific week-of-the-month effects, special attributes of the drive. Robust standard errors corrected for clustering at the host-location level are reported in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 6: Effects of incentive costs regressions

Dependent variable:	Donors presenting	Units collected	Share deferred	Donors presenting	Units collected	Share deferred
	(1)	(2)	(3)	(4)	(5)	(6)
Incentive dummy	0.02	-0.13	0.005	0.46	0.27	0.004
	(0.92)	(0.82)	(0.006)	(0.92)	(0.82)	(0.006)
Cost of incentive to the ARC ($)	2.47***	2.23***	-0.003	1.29**	1.15**	-0.000
	(0.44)	(0.39)	(0.003)	(0.51)	(0.45)	(0.003)
Cost of incentive squared	-0.13***	-0.12***	0.000	-0.07	-0.06	-0.000
	(0.04)	(0.04)	(0.000)	(0.06)	(0.06)	(0.000)
Cost*(Open Drive in "Flyer" County)				1.61***	1.45***	-0.003
				(0.33)	(0.30)	(0.002)
Cost squared*(Open Drive in "Flyer" County)				-0.08	-0.08	0.001*
				(0.06)	(0.06)	(0.000)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Host-location Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,529	13,529	13,529	13,529	13,529	13,529
R-squared	0.22	0.20	0.04	0.22	0.20	0.04
N. of host-locations	2,582	2,582	2,582	2,582	2,582	2,582

Notes: Controls include the length of the drive (in hours), weather conditions on the day of the drive (amount of rain in inches and its square, rain intensity [measured as rain per hour of precipitation] and its square, amount of snow fallen in the 48 hours before a drive and its square, and temperature dummy variables [0-36, 36-53, 53-68, 68-75, 75+]), and sets of fixed effects for: year, month, week-of-the-month, day-of-the-week, ARC representatives, representative-specific week-of-the-month effects, special attributes of the drive. The cost to the ARC of each specific promo is shown in Table 7. The regressions include a dummy variable for the items for which information on cost was unavailable or incomplete (i.e., when a drive offered host-provided promos and/or "miscellaneous items"). Regressions on a sample that excludes drives where incentive cost information was missing or incomplete yield very similar results (see Appendix Table A3). Robust standard errors corrected for clustering at the host-location level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Effects of specific incentive items

Sample:			All Drives		Open Drives in "flyer" Counties	
Dependent variable:			Donors presenting	Share deferred	Donors presenting	Share deferred
	# Drives offered at	ARC cost	(1)	(2)	(3)	(4)
T-shirt	2,519	$2.95	6.48***	-0.004**	7.85***	-0.007***
			(0.37)	(0.002)	(0.48)	(0.003)
Coupon	431	$3.64	6.09***	0.001	7.76***	0.004
			(0.68)	(0.004)	(0.84)	(0.005)
Cedar point ticket (raffle)	258	$1.00 (a)	2.13**	0.005	3.93*	0.007
			(1.03)	(0.007)	(2.07)	(0.012)
Cooler	154	$1.78	2.61***	0.003	3.98***	0.002
			(0.94)	(0.009)	(1.28)	(0.011)
Sweatshirt	125	$6.67	13.23***	-0.021**	16.24***	-0.011
			(1.29)	(0.009)	(1.39)	(0.010)
Umbrella	122	$4.58	5.55***	0.002	7.51***	-0.001
			(1.00)	(0.007)	(1.31)	(0.010)
Hat	88	$1.94	3.57***	-0.015	4.19***	-0.008
			(1.22)	(0.010)	(1.56)	(0.012)
6-pack cooler	78	$9.37	4.33***	0.003	7.44***	-0.002
			(1.48)	(0.010)	(1.65)	(0.011)
Blanket	59	$6.33	14.37***	-0.016	16.83***	-0.008
			(1.76)	(0.012)	(1.96)	(0.012)
Scarf	59	$2.50	9.05***	0.024*	10.78***	0.024*
			(1.69)	(0.014)	(1.93)	(0.013)
Mug	49	$1.42	9.56***	0.007	11.05***	-0.006
			(1.60)	(0.010)	(2.71)	(0.018)
Music download card	48	$1.50	5.21**	0.006	7.85**	-0.011
			(2.42)	(0.018)	(3.09)	(0.019)
Jacket	44	$9.50	24.80***	-0.02	27.02***	-0.012
			(2.26)	(0.013)	(2.80)	(0.015)
Miscellaneous items	165	(b)	4.48***	0.013*	4.99***	0.016*
			(1.17)	(0.007)	(1.48)	(0.009)
Host-provided incentive	1,287	(c)	2.08***	0.002	2.20***	-0.001
			(0.55)	(0.004)	(0.69)	(0.004)
p-value of:	H0: T-shirt=Sweather		0.000		0.000	
	H0: Sweather=Jacket		0.000		0.001	
	H0: T-shirt=Jacket		0.000		0.000	
Observations			13,529	13,529	8,340	8,340
R-squared			0.23	0.04	0.27	0.05

Notes: A dummy variable for each incentive item is included in the regressions. The cost to the ARC of each item is presented in the table, but it does not enter the regressions. (a): The expected value of a Cedar Point ticket incentive item was computed as follows: $15*2/(34+2)≅$1. (b) and (c): The cost of host-provided promos and that of "miscellaneous items" is unknown. As explained in the text, host-provided promos are typically lottery tickets and other items of small value. All results are from fixed-effects regressions for which the fixed effects are defined at the level of the host-location. Controls include the length of the drive (in hours), weather conditions on the day of the drive (amount of rain in inches and its square, rain intensity [measured as rain per hour of precipitation] and its square, amount of snow fallen in the 48 hours before a drive and its square, and temperature dummy variables [0-36, 36-53, 53-68, 68-75, 75+]), and sets of fixed effects for: year, month, week-of-the-month, day-of-the-week, ARC representatives, representative-specific week-of-the-month effects, special attributes of the drive. Robust standard errors corrected for clustering at the host-location level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Pre-treatment characteristics of the field experiment sites

	Control Sites (N=36)			
	Mean	Std. Dev.	Min	Max
Number of drives in reference year	5.56	1.38	3.00	9.00
Fraction of drives with incentives	0.21	0.19	0.00	0.67
Average drive length (hours)	5.22	0.76	4.00	6.30
Average number of donors presenting	30.68	10.20	14.33	51.17
Average number of units of blood collected	26.69	8.94	12.67	46.00
Donors deferred as a share of presenting	0.13	0.04	0.00	0.19
	Advertised treatment sites (N=27)			
	Mean	Std. Dev.	Min	Max
Number of drives in reference year	5.70	1.30	2.00	8.00
Fraction of drives with incentives	0.24	0.18	0.00	0.50
Average drive length (hours)	5.29	0.62	4.00	6.00
Average number of donors presenting	32.05	9.63	16.00	58.88
Average number of units of blood collected	28.07	8.34	14.25	50.63
Donors deferred as a share of presenting	0.12	0.03	0.05	0.18
	Surprise (non-advertised) treatment sites (N=9)			
	Mean	Std. Dev.	Min	Max
Number of drives in reference year	6.00	0.71	5.00	7.00
Fraction of drives with incentives	0.25	0.19	0.00	0.60
Average drive length (hours)	4.98	0.77	4.00	6.00
Average number of donors presenting	27.38	7.97	17.50	40.60
Average number of units of blood collected	23.79	7.59	14.50	35.6
Donors deferred as a share of presenting	0.14	0.04	0.08	0.19

Notes: The table presents characteristics of the 72 experimental drive locations measured in the reference year (i.e., from 5/18/2008 through 5/18/2009).

Table 9: Differences-in-differences results from the field experiment

	Pre-intervention	Intervention	Difference	Diff-in-Diff
Panel A: Averages				
Control drives				
	Pre-intervention	Intervention	Difference	
Donors presenting	30.68	30.28	-0.40	
Units collected	26.69	27.00	0.31	
Share deferred	0.129	0.106	-0.024	
N. Obs.	36	36		
Surprise (non-advertised) treatment drives				
	Pre-intervention	Intervention	Difference	**Diff-in-Diff**
Donors presenting	27.38	27.67	0.29	**0.69**
Units collected	23.79	23.89	0.10	**-0.21**
Share deferred	0.136	0.139	0.004	**0.027**
N. Obs.	9	9		
Advertised treatment drives (all)				
	Pre-intervention	Intervention	Difference	**Diff-in-Diff**
Donors presenting	31.83	40.12	8.28	**8.68**
Units collected	27.83	35.31	7.48	**7.17**
Share deferred	0.123	0.118	-0.005	**0.019**
N. Obs.	26	26		
Panel B: By $ value of the treatment				
$5 advertised treatment drives				
	Pre-intervention	Intervention	Difference	**Diff-in-Diff**
Donors presenting	31.13	36.22	5.09	**5.49**
Units collected	27.29	31.33	4.04	**3.73**
Share deferred	0.118	0.124	0.006	**0.029**
N. Obs.	9	9		
$10 advertised treatment drives				
	Pre-intervention	Intervention	Difference	**Diff-in-Diff**
Donors presenting	31.51	37.13	5.62	**6.02**
Units collected	27.57	32.00	4.43	**4.12**
Share deferred	0.121	0.133	0.013	**0.036**
N. Obs.	8	8		
$15 advertised treatment drives				
	Pre-intervention	Intervention	Difference	**Diff-in-Diff**
Donors presenting	32.83	46.67	13.84	**14.24**
Units collected	28.60	42.22	13.63	**13.32**
Share deferred	0.129	0.098	-0.031	**-0.008**
N. Obs.	9	9		

Notes: The pre-intervention observations consist of averages across all of the drives that took place at each host-location during the reference year (5/18/2008–5/18/2009).

Table 10: Differences-in-differences results from the field experiment: Robustness to regression analysis

Dependent variable:	Donors presenting	Share deferred	Donors presenting	Share deferred	Donors presenting	Share deferred
	(1)	(2)	(3)	(4)	(5)	(6)
EXP	-0.12	-0.022*	-0.06	-0.022*	-0.23	-0.013
	(1.09)	(0.011)	(1.13)	(0.011)	(1.02)	(0.010)
EXP*TR_ADVERTISED	9.91***	0.024				
	(2.12)	(0.018)				
EXP*TR_SURPRISE	1.08	0.029	1.16	0.029		
	(1.77)	(0.029)	(1.75)	(0.030)		
EXP*$5 TR_ADVERTISED			5.16**	0.028		
			(2.15)	(0.022)		
EXP*$10 TR_ADVERTISED			8.23**	0.043		
			(3.38)	(0.032)		
EXP*$15 TR_ADVERTISED			16.86***	0.000		
			(3.17)	(0.023)		
EXP*TR_ADVERTISED*$VALUE					1.05***	0.001
					(0.18)	(0.002)
EXP*TR_SURPRISE*$VALUE					0.14	0.000
					(0.15)	(0.003)
p-value of:						
H0: EXP*TR_ADVERTISED						
= EXP*TR_SURPRISE	0.000	0.864				
H0: $5 DD = $10 DD			0.405	0.670		
H0: $10 DD = $15 DD			0.059	0.243		
H0: $5 DD = $15 DD			0.002	0.317		
Observations	142	142	142	142	142	142
R-squared	0.38	0.08	0.48	0.11	0.48	0.06
N. of host-location-wave clusters	71	71	71	71	71	71
Mean of dependent variable before the intervention:	30.7	0.13	30.7	0.13	30.7	0.13

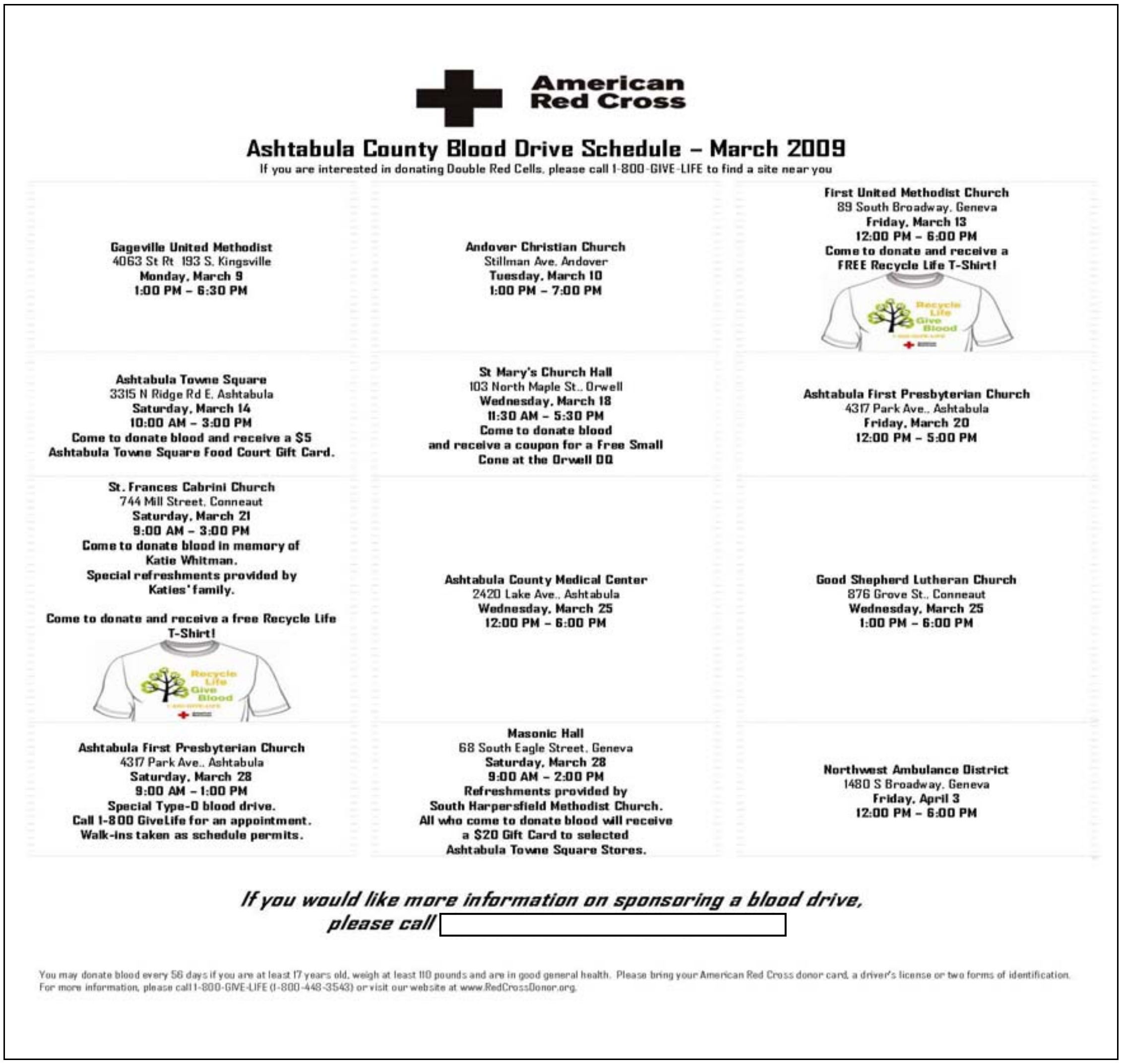
Notes: The table reports coefficients from fixed-effects regressions, where the fixed effects are defined at the level of the host-location-wave. There are two observation periods per drive, a pre-experiment observation (EXP=0), and an observation corresponding to the experiment drive (EXP=1). The pre-experiment observations consist of averages across all of the drives that took place at each host-location during the reference year (5/18/2008–5/18/2009). The dummy variable TR_ADVERTISED equals 1 for treatment sites where donors were informed on the monthly flyers about the gift card and 0 for control drives and drives where incentives were offered but no donors were informed. The dummy variable TR_SURPRISE equals 1 for treatment sites where donors had not been informed by the monthly flyers about the gift card. The coefficients on the interactions EXP*TR_ADVERTISED and EXP*TR_SURPRISE, therefore, are the difference-in-differences estimators. The regressions control for drive length. Robust standard errors corrected for clustering at the host-location-wave level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Displacement effects on number of donors presenting

Dependent variable:	Donors presenting							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Incentive dummy	0.01	0.27	0.04	0.78	0.40	-0.54	0.28	-0.25
	(0.96)	(0.96)	(0.96)	(1.01)	(1.00)	(1.04)	(0.99)	(0.99)
Cost of incentive ($)	2.53***	2.45***	2.52***	2.46***	2.44***	2.50***	2.45***	2.40***
	(0.46)	(0.46)	(0.46)	(0.46)	(0.46)	(0.46)	(0.46)	(0.46)
Cost of incentive squared	-0.13***	-0.13***	-0.13***	-0.13***	-0.12***	-0.13***	-0.13***	-0.12***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Number of neighboring drives overall								
taking place within 0-2 miles	-0.19***			-0.19***			-0.09	-0.10*
	(0.06)			(0.06)			(0.06)	(0.06)
x Incentive dummy				-0.01			-0.04	-0.05
				(0.04)			(0.06)	(0.06)
taking place within 2-4 miles	-0.06			-0.05				
	(0.05)			(0.05)				
x Incentive dummy				-0.03				
				(0.04)				
taking place within 4-10 miles	0.01			0.02				
	(0.02)			(0.02)				
x Incentive dummy				-0.01				
				(0.01)				
Number of neighboring drives with incentives								
taking place within 0-2 miles		-0.24***			-0.29***		-0.25***	-0.15**
		(0.06)			(0.07)		(0.07)	(0.07)
x Incentive dummy					0.07		0.08	-0.04
					(0.07)		(0.11)	(0.11)
taking place within 2-4 miles		-0.003			-0.002			
		(0.04)			(0.05)			
x Incentive dummy					-0.003			
					(0.07)			
taking place within 4-10 miles		-0.002			0.01			
		(0.02)			(0.02)			
x Incentive dummy					-0.02			
					(0.02)			
Highest cost ($) of incentive offered at								
neighboring drives, at drives:								
taking place within 0-2 miles			-0.10*			-0.21***		-0.18***
			(0.05)			(0.06)		(0.06)
x Incentive dummy						0.28***		0.35***
						(0.09)		(0.09)
taking place within 2-4 miles			-0.10*			-0.09*		
			(0.05)			(0.05)		
x Incentive dummy						-0.01		
						(0.09)		
taking place within 4-10 miles			-0.02			-0.01		
			(0.04)			(0.05)		
x Incentive dummy						-0.03		
						(0.08)		
Observations	12,254	12,254	12,254	12,254	12,254	12,254	12,254	12,254
R-squared	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
N. of host-locations	2,469	2,469	2,469	2,469	2,469	2,469	2,469	2,469

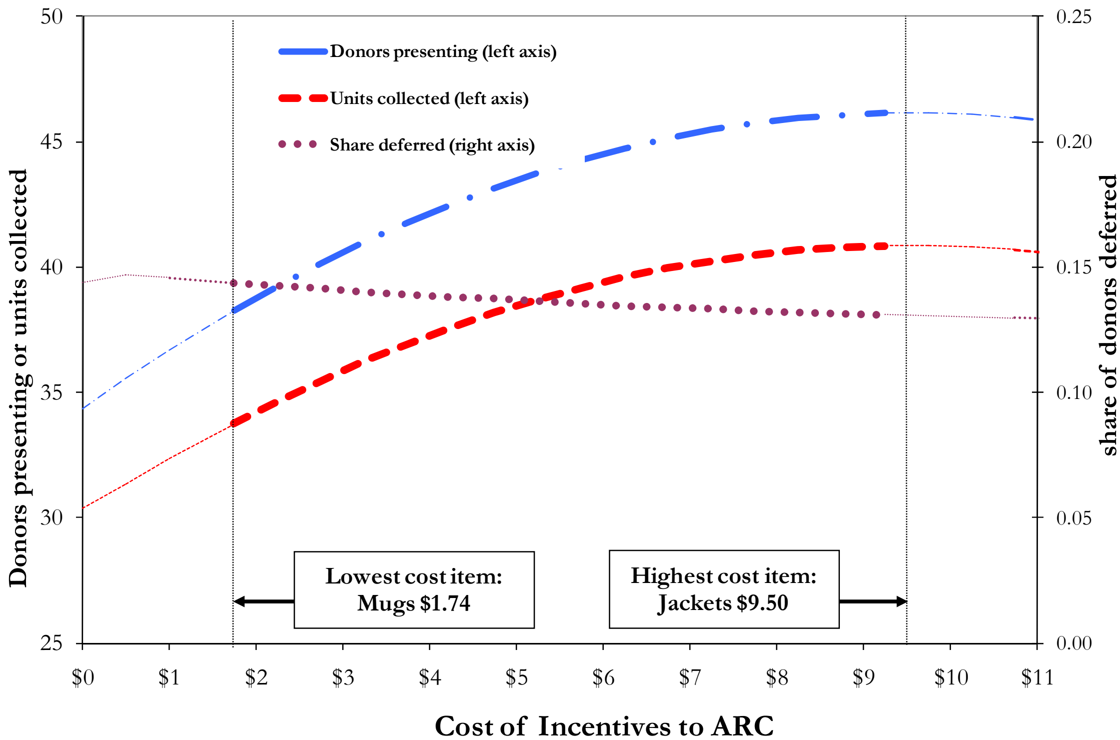
Notes: The number of observations in these regressions differs from the previous tables because here we exclude the drives that occurred in the first 56 days and those that occurred in the last 30 days of the sample period (although these drives were excluded from the sample used to run the regressions, these were not excluded for the computation of the number of substitute drives). The number of neighboring drives was computed as described in the notes to Table 4 and in the text. All results are from fixed-effects regressions for which the fixed effects are defined at the level of the host-location. Controls include the length of the drive (in hours), weather conditions on the day of the drive (amount of rain in inches and its square, rain intensity [measured as rain per hour of precipitation] and its square, amount of snow fallen in the 48 hours before a drive and its square, and temperature dummy variables [0-36, 36-53, 53-68, 68-75, 75+]), and sets of fixed effects for: year, month, week-of-the-month, day-of-the-week, ARC representatives, representative-specific week-of-the-month effects, special attributes of the drive. Robust standard errors corrected for clustering at the host-location level are reported in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 1: Example of ARC flyer



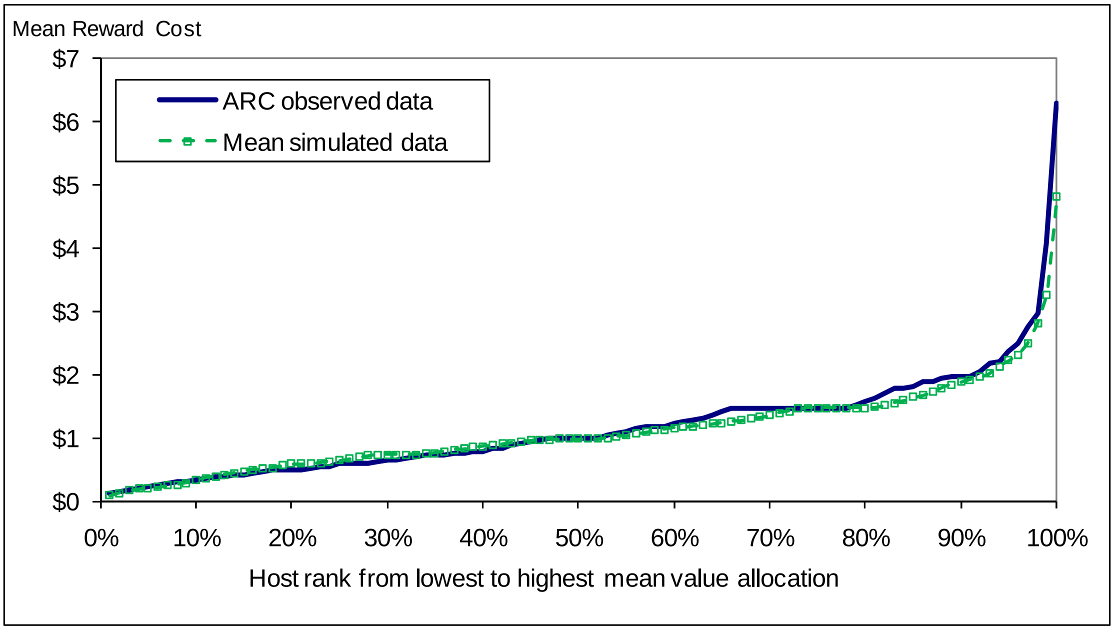
Notes: The name and phone number of the ARC representative have been blanked for confidentiality reasons.

Figure 2: Estimated effects of incentive costs



Notes: Predicted values obtained using the results from Table 6, Columns 1-3. The baseline is open drives of average length (5.35 hours) taking place in flyer counties on the third Wednesday of April, on days with no rain, no snow, and with temperatures between 53F-68F.

Figure 3: Simulated Random Assignment of Incentives to Host-Locations



Notes: The figure shows the mean values from the simulations (described in detail in Section 3.3.2 in the text) and the mean values for each host-location at each rank in the actual data. The horizontal axis shows the rank from lowest to highest mean value incentive allocated to host-locations. The vertical axis shows the mean value of the incentives that were offered at each host-location rank. See Section 3.3.2 for details.