

Redesigning the Market for Volunteers: A Donor Registry*

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ABSTRACT: This paper addresses volunteer labor markets where the lack of price signals, non-pecuniary motivations to supply labor, and limited fungibility of supply lead to market failure. To address the causes of the market failure, we conduct a field experiment with volunteer whole blood donors where we introduce a market-clearing mechanism (henceforth: the Registry). Our *intention-to-treat* estimates suggest that subjects invited to the Registry, regardless of joining, are 66% more responsive to critical shortage appeals than control subjects. While the registry increases supply during a critical shortage episode, it does not increase supply when there is no shortage; thus the Registry significantly improves coordination between volunteer donors and collection centers, thereby improving market outcomes. We find evidence that the Registry's effectiveness stems from crowding-in volunteers with purely altruistic motives and volunteers with a preference for commitment.

KEYWORDS: Voluntary labor, coordination, market failure, altruism, commitment, ask avoidance, market design.

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1 Introduction

Markets are the primary institution in which economies organize and allocate goods and services among individuals. The power and appeal of market institutions is that under certain assumptions, market equilibria are also socially optimal. However, in markets that lack a price signal, it can be difficult to achieve equilibrium. This difficulty is exacerbated in markets that rely on volunteers to supply goods and services when the volunteers are primarily motivated by unobservable preferences that are difficult for markets to react to, such as altruism, warm glow and status seeking. In such cases, these markets may not only result in shortages, but can also experience excess supply. For example, Bertina Ceccarelli of United Way in New York remarked “that sometimes its almost more work to find something for a volunteer to do than to just turn them away.”¹

In this paper, we consider the market for whole blood, which relies on altruistically motivated volunteers and is characterized by both periods of excess demand and excess supply, resulting in a direct loss of nearly \$1.1 billion USD annually. The lack of price signals and the altruistic motivations of blood donors makes it difficult for collection centers and donors to coordinate to meet demand.² The challenges in the whole blood market are more similar to the challenges facing other volunteer labor markets, rather than those found in charitable giving or organ markets, since blood, unlike money, is not fungible and blood markets, unlike organ markets, are “thick” and the supply is generic (i.e., it is only differentiated by a small number of blood types).³

The main problem in the whole blood market is one of coordination of supply to meet demand. Demand for whole blood is temporally stable with the vast majority of donated blood used for treating cancer and blood diseases, while only 2% is used for trauma, which may fluctuate over time. However, supply fluctuates, resulting in periods of excess supply and periods of excess demand. The fluctuation in supply is best illustrated through the pattern of solicitations issued by the Australian Red Cross Blood Service (henceforth: Blood

¹See <http://www.nytimes.com/2009/03/16/nyregion/16volunteers.html>. Further, Volunteerhub, a popular volunteer management software, has several articles aimed at helping non-profits deal with the problem of volunteer over-supply.

²Exceptions include the use of “blood barometers” in many Scandinavian countries, where blood collection agencies post the current level of supply for each blood type on agency web sites to communicate the current need to interested donors.

³Clearinghouse mechanisms have proven to effectively increase thickness in many “thin” markets, such as the market for kidneys or bone marrow (Roth et al., 2004, 2007) by bringing together a larger number of “buyers” and “sellers” to facilitate a transaction. Roth (2008) provides a thorough outline and examples of providing thickness and overcoming congestion in various markets. Registries (or clearinghouses) have also been used to reduce congestion as markets become thick, for example, in entry-level labor markets (Roth, 1984; Roth and Peranson, 1999) and school choice (Abdulkadiroglu and Sönmez, 2003; Abdulkadiroglu et al., 2005, 2009).

Service) throughout the year. In August and September (winter months in Australia), the Blood Service increases the number of blood donation solicitations by 200-300% relative to other months (see Figure S1). This costly surge in solicitations is due to a lower supply, rather than an increase in demand. Moreover, due to the short shelf-life of whole blood, approximately 21-42 days, blood collected during periods of excess supply cannot be cost-effectively stored to cover periods of excess demand.⁴ To address the coordination problem, we designed the Registry. The Registry collects information on individual preferences for making a blood donation (henceforth, donation always refers to a blood donation) so that a central organizer is able to coordinate potential donors' actions based on information on their preferences, instead of donors acting on their own. In this way, we create a more responsive supply to address the temporal imbalances.⁵

In partnership with the Blood Service, we conduct a field experiment that implements a mechanism, the Registry, to improve market coordination.⁶ We randomly assigned 15,388 long-lapsed donors (donors who have donated before, but have not made a donation in at least the past 24 months) to a treatment within the experiment, which unfolded over 14 months and two rounds (described in Section 2). In Round 1, we randomly assigned some subjects to be invited to join the Registry (henceforth: the Registry Conditions). Subjects assigned to the Registry Conditions were truthfully told that the Blood Service was creating a donor Registry where Registry members would only be asked to donate when there was a need for their blood type and that the Blood Service would only contact Registry members once or twice per year.⁷ By contrast, subjects in the Donation Only and Control conditions were never informed of the existence of the Registry. Round 2 calls began three to five months later (when anticipated winter shortages occurred) and subjects were randomly assigned to receive a Standard Shortage Appeal or a Critical Shortage Appeal, which occurs when there is less than a few weeks of blood supply remaining. The two rounds allow us to answer the following four questions:

⁴Additionally, blood donors are required to wait 8-12 weeks between whole blood donations to allow the body to regenerate red blood cells and can only give a fixed amount during a donation. Thus, collection centers cannot continually cultivate the most willing donors during shortages.

⁵Alternative approaches, such as offering or increasing extrinsic incentives (Goette and Stutzer, 2008; Lacetera et al., 2012, 2013, 2014), informing prospective donors of shortages (Bruhin et al., 2015; Sun et al., 2016), reducing time costs (Craig et al., 2016) or providing unconditional gifts (Garbarino et al., 2013) may increase supply, but they are not designed to encourage supply-side flexibility. Conversely, the Registry is effective because it targets supply increases only when there is excess market demand conditional on the normal supply, thereby improving market efficiency.

⁶Slonim et al. (2014) provides an early and brief discussion of the Registry on pages 191-193. Slonim and Wang (2017) tested three variations of registry designs against current market setups for volunteers in a controlled lab experiment and found significant improvements in market efficiency in all the Registry Conditions.

⁷Since the completion of the Registry study period, the Blood Service has continued to use the Registry.

- (1) How to populate the Registry?
- (2) Does implementing a Registry improve the timing of blood supply (i.e., the intention to treat effect)?
- (3) Is the Registry cost-effective?
- (4) To which type of donor preferences does the Registry appeal?

We find that the introduction of the Registry significantly improves the coordination of supply. Based on our *intention-to-treat* analyses, subjects who received a Registry invitation, regardless of joining the Registry, are significantly more responsive to donation solicitations than subjects who do not receive an invitation. For instance, they are 66% more likely to donate within three weeks of receiving a solicitation. Further, we find that the Registry invitation serves as an effective selection or screening mechanism—Registry members are 100% more responsive to critical shortages than individuals who were not invited to the Registry as well as individuals who opted out of joining the Registry. Further, soliciting Registry members during a shortage reduces solicitation costs by 50% and results in a lower probability of both excess supply and excess demand.⁸

Beyond our main intention-to-treat analyses, we also find that the Registry additionally serves as an effective selection (i.e., screening) mechanism. In particular, we also explore the channels through which the Registry may serve as an effective screening mechanism. The invitation to join the Registry was designed to appeal to individuals who might be the most likely to be marginal donors: (1) individuals with purely altruistic motives, rather than only warm glow motives (Becker, 1974; Andreoni, 1989); and (2) individuals who are in need of a commitment device. We briefly discuss how the Registry might be working through each of these behavioral channels in Section 4 and provide the formal development in Supplementary Material B.⁹

⁸The structure of the Registry invitation and donation solicitation follows a “foot-in-the-door” approach Freedman and Fraser (1966), whereby individuals who first comply with a smaller request (e.g., join the Registry) are more likely to comply with a later, larger, request (e.g., make a donation). However, the literature in psychology is mixed as to the effectiveness of the “foot-in-the-door” technique (see Beaman et al. (1983); Dillard (1991) for reviews) and that its effectiveness is quite heterogeneous (Cialdini et al., 1995).

⁹The Supplementary Material can be found here Supplemental Materials.

2 Experimental Design, Hypotheses and Data

In partnership with the Australian Red Cross Blood Service, we introduced a Registry throughout Australia using a large-scale field experiment that unfolded over two rounds. We drew the sample for our experiment from the population of long-lapsed donors. Long-lapsed donors are donors who have given at least one successful whole blood donation, but have not donated in at least the past 24 months.¹⁰ Before presenting the details, we initially provide a high level overview of the experiment and our main hypotheses (Section 2.1) and then present the more precise details and data used (Section 2.2).

2.1 Overview of Design & Hypotheses

The motivation for our experimental design was to determine (1) how to populate the Registry; (2) whether implementing a Registry improves the coordination of the blood supply and (3) if so, to understand the motivations of the donors who are crowded back into donation activities through the Registry.

To answer these questions we designed a two-round experiment that consisted of call agents from the Blood Service contacting long-lapsed donors by telephone. In Round 1, which occurred between April and June 2012, our objective was to populate the Registry. To do this we conducted a 2×2 between subjects design, where the two treatments are a randomly assigned Registry invitation and a randomly assigned Donation solicitation. This design results in four treatment groups: Registry Invitation Only, Donation Solicitation Only, Registry Invitation & Donation Solicitation and No Registry Solicitation & No Donation Invitation (henceforth: Registry Only, Donation Only, Registry + Donation, and Control, respectively). The Round 1 design allows us to understand how to populate the Registry by comparing whether individuals were more or less likely to join the Registry when the invitation was or was not coupled with a donation solicitation.

When subjects were invited to join the Registry in Round 1, they were told that if they joined the Registry they would only be called when there was a current need for their blood

¹⁰We also restricted our sample to donors whose last donation occurred within the past 4 years in order to increase the likelihood of reaching these donors. Our concern was that donors who last donated more than 4 years ago may be more likely to have changed their contact details and thus be harder to reach. Long-lapsed donors have two major advantages as a population to study. First, they are likely to be the “marginal” donors; donors who have donated more recently are more likely to donate regardless of treatment conditions, and people who have never donated before may be more likely to be unresponsive to any manipulation. Second, once a donor has been designated as long lapsed, the Blood Service ceases to have any form of normal marketing communications with these donors; thus, we can minimize the likelihood that these donors are having any other form of (unobserved) solicitations that might interfere or add noise to the measurement of treatment effects.

type and would be called only once or twice a year. If subjects joined the Registry with this invitation, they were placed into what we will refer to as the General Registry. If subjects declined this invitation, they were then asked whether they would consider joining a Critical Registry that would only solicit donations if the Blood Service had less than a three day supply of blood. If they declined both of these invitations, then they were not placed in either Registry.

In Round 2, we conducted a second round of calls between July and September 2012 and in March 2013 to test the Registry's effect on subsequent donation behavior as well as the motivations of donors crowded back in by Registry (that will allow us to address questions 2 and 3 above). In Round 2, we treated all subjects who answered the phone in Round 1 and a further random sample from the Control condition in Round 1 (henceforth: Control 1). The remaining sample that was not contacted in either Round 1 nor in Round 2 was thus not treated in Round 2 (henceforth: Control 2). The Round 2 treatment manipulated whether subjects received a Standard Shortage Appeal or a Critical Shortage Appeal. The key difference between the Standard and Critical Appeal is that the Critical Appeal informed donors that there was a *critical shortage* and that donations were *needed within the next few weeks*. The standard donation appeal consisted of the Blood Service's standard donation solicitation and did not inform the donors of any critical shortages or time frames. When there was not a critical shortage, only standard donation solicitation calls were made, whereas during critical shortage periods donors were randomly assigned to receive either a standard or critical appeal script.

To empirically answer questions (2) and (3), our main results compare the behaviors of the subjects in the Donation Only condition to subjects in the Registry + Donation condition since these subjects are treated exactly the same throughout the experiment except for the Round 1 Registry invitation. Our first hypothesis concerns the causal effects of the Registry; that is, whether the introduction of the Registry in Round 1 crowds-in donations and that subjects assigned to the Registry + Donation condition will be more likely to donate within three weeks of a solicitation than Donation Only condition, but will not be more likely to donate beyond the period of critical need (i.e., improves coordination of the supply). To test this hypothesis, we estimate an intention-to-treat effect, in which we compare the Round 2 donation rates between the subjects assigned to the Donation Only condition and those assigned to the Registry + Donation condition, regardless of Registry membership.

Hypothesis 1. *The invitation to join the Registry in Round 1 will*

- (i) increase supply in Round 2; and*
- (ii) improve coordination in Round 2.*

Next, we hypothesize that the Registry serves as a screening mechanism; that is, subjects who join the Registry are (1) more likely to donate when solicited and (2) *no more* likely to donate when not solicited than subjects in all other conditions who were not invited to join the Registry. Thus we hypothesize that subjects who select into (select out of) the Registry in Round 1 will be more (less) likely to donate in Round 2 than subjects in the Control 2, Control 1 and Donation Only conditions.

Hypothesis 2. *The invitation to join the Registry serves as a selection or screening mechanism.*

Finally, we consider the preferences of subjects who are crowded-in by the Registry and hypothesize that the Registry will crowd-in donations from individuals who are motivated to donate by pure altruism and from individuals who need a commitment to donate.

The following hypotheses are developed in detail in 4 and Supplementary Material B. Here, we provide a brief intuitive explanation for why the Registry crowds-in donors with preferences for pure altruism and a need for commitment, and how the experiment was designed to test these hypotheses.

A subject with pure altruist preferences is motivated by the benefit that her donation provides to the recipient (Andreoni, 1989). The Registry should thus attract donors with pure altruist preferences since joining the Registry in Round 1 implies a promise to help in the future (Round 2) if there is a need. To test whether the Registry crowds-in donors with a preference for pure altruism, we should observe that Registry members will be more responsive to the critical than standard appeal solicitation in Round 2 compared to subjects in the Donation only condition since the critical appeal solicitation signals a greater need (which is the main reason for the inclusion of the Round 2 for critical and standard appeal treatment conditions).

Hypothesis 3. *The Registry crowds-in donations from long-lapsed donors with pure motives.*

We also hypothesize that the Registry crowds-in donors with a preference for a commitment mechanism. During the Round 1 calls, subjects assigned to the Registry were told that there would be a future solicitation if they joined, thus joining the Registry gives donors an opportunity to make an implicit promise (or commitment) to donate when called later. To test this hypothesis, note that since there was no promise to donate prior to the Round 1 solicitations, a preference for commitment should not affect donations from the Registry + Donation subjects differently than the Donation Only subjects in Round 1, whereas in Round 2 Registry members will now have made a commitment that Donation Only members will not have had the chance to make, and thus Registry subjects should be more responsive in Round 2 than Round 1 to a donation solicitation than Donation only subjects.

Hypothesis 4. *The Registry crowds-in donations from long-lapsed donors who have a preference for commitment.*

2.2 Details of the Experimental Design & Description of Data

In this Section, we elaborate on the details of the experimental design outlined in Section 2.1. In particular, we discuss in further detail the sample for our experiment, the details of Round 1 and the details of Round 2.

2.2.1 Sample

We identified 44,223 eligible long-lapsed donors in Australia from which we randomly drew 15,388 for the Registry project.¹¹ Of the 15,388 donors assigned to the Registry project, we identified 1,827 donors who were subsequently (during our study) contacted by Blood Service staff for campaigns unrelated to the Registry project and outside of the parameters of the project. Since these donors have been contacted for other purposes including to make donations, we have discarded them from the main analysis, resulting in an effective sample of 13,561 long-lapsed donors that are randomly assigned to a treatment arm.¹² We then conducted two rounds of calls. No calls were made to either control group during the Round 1 calls, but Control Group 1 receives a solicitation call in Round 2. Table 1 presents the sample sizes in each treatment condition. Table 2 shows that donor characteristics and treatment assignment are orthogonal.¹³

2.2.2 Round 1 Calls

The Round 1 calls occurred from April to June 2012. The design in Round 1 was a 2×2 between-subjects design, where the two treatments were a donation solicitation and Registry

¹¹The criteria for the population we identified required (a) donated whole blood at least once in the past four years, (b) maximum age (since some older donors may have permanently retired from donating) and (c) blood types O and A (since these are the most commonly needed during shortages) and constitute approximately 87% of the Australian population and (d) excluded donors who donated for medical reasons, since the Registry would presumably not motivate them. While the age, blood type and non-medical requirements restricted this population somewhat, the major restriction was having donated at least once in the past 4 years. The Blood Service provided us with the universe of donors meeting our criteria which is this 44,223 sample.

¹²In Figure S2 we show the proportion of subjects from each of the treatments that were dropped from our analysis due to this outside contact.

¹³In randomly assigning subjects to conditions, we balanced on gender, age, past donation categories (1 donation, 2-3 donations, 4+ donations), telephone call dates and call agents. The benefit of a field experiment is that participants do not select into treatment and are unaware that they are taking part in an experiment (Harrison and List, 2004).

invitation, resulting in four distinct treatment groups: Registry + Donation, Registry Only, Donation Only, and the Control condition where subjects were not called in Round 1. Subjects in the control group were randomly assigned into Control 1 (who received a donation solicitation in Round 2) and Control 2 (who did not receive a call in Round 2).¹⁴ Whether a subject received treatment in Round 1 depends on whether he answered the phone call.¹⁵ Table S1 shows that males and older donors were more likely to answer the phone in Round 1, though this was equally true across all treatments. When a subject was solicited for a donation, we used the standard Blood Service solicitation script. Subjects who were not invited to join the Registry were not aware of the existence of the Registry.

TABLE 1: TREATMENT ASSIGNMENT

	Round 1 Treatment Assignments			
	Donation Solicitation	Registry Invitation	N	Effective N
Registry + Donation	Yes	Yes	5,999	5,249
Registry Only	No	Yes	3,000	2,610
Donation Only	Yes	No	1,799	1,556
Control 1	No	No	2,838	2,324
Control 2	No	No	1,752	1,752
Total			15,388	13,561
	Round 2 Treatment Assignments			
	Donation Appeal Type			
	Standard	Critical	Not Assigned	
Registry + Donation	817	142	814	
Registry Only	516	116	238	
Donation Only	276	55	165	
Control 1	1,770	554		
Control 2	No	No		
Total	3,379	867	1,217	

The difference between N and Effective N reflects those donors who were treated, but subsequently excluded from analysis due to receiving solicitations from other units of the Blood Service that were not part of the experimental treatments.

¹⁴The Registry+Donation condition consisted of two closely related sub-treatments, both of which involved donors being asked to both make a donation and to join the registry. In the Simultaneous condition, donors were first informed of the registry and then simultaneously asked to make a donation and join the registry, whereas in the Sequential condition, donors were first asked to make a donation, and then informed and asked to join the registry. The initial purpose of including the Simultaneous and the Sequential treatments was to identify whether knowledge of the Registry crowded-out donations. We never found any significant differences between the two conditions in any of our analyses, so we combined these two conditions for increased power and to simplify the presentation of the results.

¹⁵Supplementary Material C contains the script the call agents used for each call condition.

TABLE 2: SUMMARY STATISTICS, BY ASSIGNED ROUND 1 TREATMENT

	All	Registry + Donation	Registry Only	Donation Only	Control
Female	.50 (.50)	.50 (.50)	.50 (.50)	.50 (.50)	.48 (.50)
Past Donations	4.57 (6.45)	4.49 (6.38)	4.50 (6.5)	4.38 (5.99)	4.78 (6.97)
Days Since Last Donation	1082 (129)	1088 (125)	1085 (126)	1084 (125)	1084 (140)
Current Age	36.45 (10.39)	36.33 (10.36)	36.25 (10.22)	36.06 (10.21)	36.60 (10.61)
State					
Australian Capital Territory	.03	.03	.02	.03	.02
New South Wales	.27	.28	.28	.25	.29
Queensland	.12	.13	.12	.13	.12
South Australia	.09	.09	.10	.09	.08
Tasmania	.04	.04	.04	.04	.04
Victoria	.33	.33	.32	.33	.33
Western Australia	.12	.11	.11	.12	.12
Urban Donor Center	.72	.71	.73	.72	.73
Observations	13,561	5,249	2,610	1,556	4,146

Standard deviations in parentheses.

2.2.3 Round 2 Calls

The second round of calls occurred either during July and September 2012 when shortages (and, specifically, critical shortages) of whole blood usually occur every year or in March 2013 (when the next shortage occurred). During Round 2, we intended to treat all subjects who answered the phone in Round 1 plus a random subset of the Control group (i.e., Control Group 1).¹⁶ Thus, in Round 2 we contacted subjects who were in the Registry Only and Registry + Donation conditions who answered the phone call in Round 1, regardless of whether they selected in or out of the Registry, subjects in the Donation Only condition who answered the phone call in Round 1, and Control group 1. The two treatment conditions in Round 2 were the Critical Appeal or Standard Appeal.¹⁷ The Blood Service placed some restrictions on the timing of calls. In particular, the Blood Service did not want to make calls to subjects in the Registry condition who selected out of the Registry in July

¹⁶The Blood Service did not want to call donors who had not answered calls in Round 1 since their view was that these donors would also be unlikely to answer in Round 2 and would thus be costly to attempt to call.

¹⁷For completeness, we also include Supplemental Table S3, which shows that there are no treatment differences in the propensity to answer the phone call in Round 2, except that Control Group 1 is less likely to answer. This is not surprising since donors in the Registry and Donation Only treatments have already answered the phone in Round 1, thus, as a group, they are more likely to answer the phone than donors assigned to Control Group 1.

and September 2012 and instead preferred to wait until March 2013 (along with a random subset of subjects from Control 1). Unlike the July and September 2012 calls, there was no critical shortage in March 2013 and therefore all calls in March used the Standard Appeal. Including those subjects who selected-out of the Registries, we are thus able to examine both the causal effects of the Registry (i.e., the intention-to-treat) and the selection effects of Registry membership. While it would have been desirable to have had some subjects who chose not to join the Registry be assigned to receive a Critical Appeal, we argue that this feature means that we are likely underestimating the causal impact of the Registry. We return to this in Section 3.2.

Finally, note that treatment calls in Round 2 were restricted to subjects who were eligible to make a donation during this shortage period. This restriction was necessary because there are subjects who answered the phone in Round 1, but were ineligible to make a donation at the time of Round 2 for reasons such as medical ineligibility or having recently donated. Since this ineligibility was not random, we *include* the “Not Assigned” group in our Intention-to-Treat Analysis in Section 3.2.

3 Main Results

In this section, we report our main results. Section 3.1 uses the Round 1 data to discuss the populating of the Registry. Section 3.2 uses the Round 2 data to test Hypotheses 1 and 2. Third, we use the results from Section 3.2 to simulate a solicitation campaign to show the cost effectiveness of using the Registry.

3.1 Populating the Registry: Round 1 Calls

The purpose of Round 1 was to randomly assign subjects to either the Registry or non-Registry conditions (i.e., Donation only condition) in order to test our main research questions about the effectiveness of the Registry in Round 2. However, the 2×2 design in Round 1 also allows us to examine (1) if combining a donation solicitation with the Registry solicitation affects the populating of the registry compared to only having a Registry solicitation without the donation solicitation; and (2) whether combining the Registry solicitation with a donation solicitation adversely affects donations compared to only soliciting donations.

Examining subjects in the two Registry Conditions (Registry Only and Registry + Donation), Table 3 shows that (1) 22 percent of total subjects joined the General Registry, while conditional on answering the phone in Round 1, 66 percent joined; (2) the likelihood

of joining the General Registry is similar across the Registry Conditions; and (3) subjects' characteristics are not significant predictors of joining the Registry.

Also, recall that in Round 1, subjects in the Donation Only and Registry + Donation conditions were also asked to make a donation. These results are shown in Table S2. We find that subjects assigned to the Registry + Donation condition are no more likely to make a donation than subjects assigned to the Donation Only condition (18.03% and 16.89% conditional on answering the phone, respectively). However, subjects who selected-into the General Registry from the Registry + Donation condition were significantly more likely to donate in Round 1 (24.27%) than (1) subjects who selected-out of the Registries (7.80%) and (2) subjects in the Donation only condition (16.89%). In summary, in Round 1, we find a high take-up rate for joining the General Registry, that the decision to join the Registry was not affected by being asked to concurrently make a donation, and similarly the decision to make a donation in Round 1 was not affected by being concurrently asked to join the Registry.

TABLE 3: REGISTRY TAKE-UP

	Join General Registry	Join General Registry Answered R1	Join Critical Registry	Join Critical Registry Answered R1	Join Either Registry	Join Either Registry Answered R1
Reg + Don	-0.008 (0.01)	-0.03 (0.02)	-0.003 (0.003)	-0.02* (0.009)	-0.01 (0.01)	-0.05*** (0.02)
Female	0.005 (0.009)	0.02 (0.02)	-0.008*** (0.003)	-0.02*** (0.008)	-0.007 (0.01)	-0.01 (0.02)
Age	0.0008** (0.0004)	0.0001 (0.0009)	-9.64e-06 (0.0001)	-0.0003 (0.0004)	0.0009* (0.0005)	-0.0002 (0.0009)
Yearly Donation Rate	0.17 (0.19)	1.02 (0.8)	0.003 (0.04)	0.05 (0.23)	0.18 (0.21)	1.08 (0.82)
Days Since Last Donation	0.24 (0.36)	0.47 (0.75)	-0.06 (0.09)	-0.24 (0.32)	0.18 (0.39)	0.28 (0.72)
Observations	7858	2697	7858	2697	7858	2697
Pseudo R^2	0.32	0.02	0.11	0.06	0.34	0.03
State and Site FE	Y	Y	Y	Y	Y	Y
Call Day FE	Y	Y	Y	Y	Y	Y
Call Agent FE	N	Y	N	Y	N	Y
Omitted Group	Reg Only	Reg Only	Reg Only	Reg Only	Reg Only	Reg Only
Mean Probability of Omitted Group	.22	.66	.03	.20	.24	.73

Marginal coefficients from a probit regression reported. Columns (3) and (4) are conditional on not joining the General Registry. Robust Standard Errors in parentheses and *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

3.2 Registry Calls: Round 2

In this section, our outcome of interest is the Round 2 donation behavior of subjects *assigned* to the various treatments. Throughout our analysis we control for gender, age, yearly blood

donation rate prior to becoming long-lapsed and days since last donation. We also include state fixed effects and a dummy for whether the donor donated at a metropolitan site. Additionally, where appropriate, we also use day of week fixed effects and call agent fixed effects in order to control for any differences in solicitation styles across agents.¹⁸

We begin by examining the donation behavior in Round 2 when the Blood Service conducted its shortage calls. In Round 2, a subject received either a "Standard Appeal" or a "Critical Appeal" for a donation. The Standard Appeal is the Blood Service's standard donation solicitation that reminds donors of the importance of blood donations and asks the donor to make a donation, while the Critical Appeal is the typical solicitation used when there is a critical shortage, which tells the donor that the Blood Service is experiencing a critical shortage and that there is less than a few weeks of blood supply remaining.¹⁹

In Panel A of Table 4 we present our intention to treat analysis, where we compare the behavior of all subjects assigned to treatment in Round 2 from the Registry + Donation condition (regardless of whether they *joined* one of the Registries) with those assigned to the Donation Only condition in Round 1.²⁰ In columns (1) & (2), we report marginal effects from a probit regression where the outcome variable takes a value of 1 if the subject donated before the Blood Service contacted them again, on average 9 months later, and 0 otherwise. Columns (1) and (2) show that the subjects in the Registry + Donation condition are more likely to donate, but not significantly, than subjects in Donation Only.

However, in columns (3) & (4), we consider a different outcome variable that examines whether the Registry improves coordination. Recall, the invitation to join the Registry informed individuals that they would only be invited to donate "when the community has a critical need for blood," so, if the Registry improves coordination, subjects in the Registry Conditions should be more likely to donate in a shorter time frame than subjects not in the Registry Conditions. We find, in support of Hypothesis 1, that subjects assigned to the Registry + Donation condition are more responsive to a solicitation; they are 2 percentage points more likely to donate within 3 weeks than individuals in the Donation Only condition, representing a 66 percent relative increase. Moreover, and in further support of Hypothesis 1, this greater responsiveness only occurs during the time of greater need. Columns (5) & (6) show that subjects assigned to the Registry + Donation condition do not donate significantly more (p-value=.85) than Donation Only subjects during the following nine weeks after the critical need has passed. The greater immediate responsiveness of Registry members (when

¹⁸Agents were instructed to read the scripts, but if donors need additional information or clarification, then individual differences across call agents can emerge.

¹⁹The call scripts for these calls are presented in Supplementary Material C.

²⁰As explained in Section 2.1, our intention-to-treat analysis only uses data from these two conditions because they are treated identically except for the Registry invitation in Round 1.

shortages occur), but not later (when the shortages have passed) provides the first evidence of the effectiveness of the Registry to improve market efficiency. We discuss efficiency in much greater detail in Section 3.3. We also find that the Critical Appeal treatment further improves coordination; Column (3) shows that individuals who receive the Critical Appeal are 10 percentage points more likely to donate within 3 weeks, while Column (5) shows that the critical appeal has a significantly weaker and no longer significant effect after the first three weeks.

Result 1 *Consistent with Hypothesis 1, subjects assigned to Registry + Donation condition are more responsive to the solicitation than subjects in the Donation Only condition; specifically, subjects assigned to the Registry + Donation condition are 2 percentage points more likely to donate within 3 weeks of solicitation (a 66 percent increase), but no more likely to donate in weeks 4-12 than subjects assigned to the Donation Only condition.*

The results presented in Panel A of Table 4 show that the introduction of the Registry improves coordination of supply to meet demand. However, from a practical perspective, once the Registry is implemented it provides a population of potential donors that the Blood Service can continually return to during periods of excess demand. Thus, it is also important to consider the effect of calling Registry members relative to the subjects in the Donation Only and Control conditions. We now examine this selection effect.

In Panel B of Table 4 we replicate Panel A, but separately estimate the likelihood of donating for subjects assigned to the Registry + Donation condition based on their Round 1 decision about joining the Registry. We consider three distinct groups: subjects who selected-into the General Registry, subjects who selected-out of the General Registry but into the Critical Registry and subjects who selected out of both Registries. As we hypothesize in Hypothesis 2, the Registry invitation serves as an effective screening mechanism: those who select-into the General Registry are significantly more likely to donate than subjects who select-out of the General Registry into either the Critical Registry or into no Registry, as well as compared to those who were in the Donation Only condition. Moreover, subjects who select-out of both Registries are significantly less likely to donate than subjects assigned to the Donation Only conditions.

Result 2 *Consistent with Hypothesis 2, subjects who selected into the General Registry are 5 percentage points more likely to donate than subjects in non-Registry Conditions (a 42 percent increase), while subjects who selected out of the Registry are 5 percentage points less likely to donate than non-Registry condition subjects. Further, General Registry members, compared to subjects in the Donation only condition, are 3 percentage points more likely to*

TABLE 4: INTRODUCTION OF REGISTRY: CAUSAL & SELECTION EFFECTS ON DONATION BEHAVIOR

	Likelihood to Donate		Likelihood to Donate within 3 weeks		Likelihood to Donate within weeks 4-12	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Intention-to-Treat Effects of Registry						
Registry + Donation	0.01 (0.02)	0.01 (0.02)	0.02* (0.009)	0.02** (0.008)	0.0008 (0.007)	0.001 (0.007)
Critical Appeal, Round 2	0.09*** (0.03)	0.09*** (0.03)	0.1*** (0.03)	0.1*** (0.02)	0.01 (0.01)	0.01 (0.01)
Female	.	-0.02* (0.01)	.	-0.02** (0.008)	.	-0.01 (0.006)
Age	.	0.002*** (0.0006)	.	0.0003 (0.0004)	.	-0.000056 (0.0003)
Yearly Donation Rate	.	0.6 (0.58)	.	0.02 (0.38)	.	-0.48 (0.54)
Days Since Last Donation	.	-0.37 (0.56)	.	0.23 (0.32)	.	0.002 (0.24)
Observations	2269	2269	2269	2269	2269	2269
Pseudo R^2	0.007	0.02	0.04	0.06	0.003	0.01
Omitted Group	Don Only	Don Only	Don Only	Don Only	Don Only	Don Only
Mean Probability of Omitted Group	.12	.12	.03	.03	.02	.02
Panel B: Effects of Registry Membership						
Registry + Donation \times Gen Registry Member	0.05*** (0.02)	0.05*** (0.02)	0.03*** (0.01)	0.03*** (0.01)	0.007 (0.008)	0.007 (0.007)
Registry + Donation \times Crit Registry Member	-0.08*** (0.02)	-0.08*** (0.02)	-0.02 (0.01)	-0.02 (0.01)	-0.02** (0.008)	-0.02** (0.007)
Registry + Donation \times Non-Registry Member	-0.05*** (0.02)	-0.05*** (0.02)	-0.02 (0.01)	-0.02 (0.01)	-0.009 (0.008)	-0.008 (0.008)
Critical Appeal, Round 2	0.12*** (0.04)	0.12*** (0.04)	0.11*** (0.03)	0.11*** (0.03)	0.02 (0.02)	0.02 (0.02)
Female	.	-0.03* (0.01)	.	-0.02** (0.007)	.	-0.01* (0.006)
Age	.	0.002*** (0.0006)	.	0.0002 (0.0003)	.	-0.0000432 (0.0003)
Yearly Donation Rate	.	0.53 (0.56)	.	-0.002 (0.35)	.	-0.44 (0.51)
Days Since Last Donation	.	-0.36 (0.54)	.	0.17 (0.29)	.	0.01 (0.23)
Observations	2269	2269	2269	2269	2269	2269
Pseudo R^2	0.04	0.04	0.08	0.09	0.02	0.03
Omitted Group	Don Only	Don Only	Don Only	Don Only	Don Only	Don Only
Mean Probability of Omitted Group	.12	.12	.03	.03	.02	.02
Controls						
Demographics	No	Yes	No	Yes	No	Yes
State & Site FE	No	Yes	No	Yes	No	Yes

Marginal effects from probit regressions reported. Robust Standard Errors in parentheses and *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

donate within 3 weeks of solicitation (a 100 percent increase), but also no more likely to donate during weeks 4-12. On the other hand, subjects who selected out of the Registry, compared to the Donation Only condition, are significantly less likely to donate both within 3 weeks of the solicitation and in the subsequent 4-12 weeks.

3.3 Improved Efficiency in a Simulated Solicitation Campaign

In this section, we show the extent to which using the Registry as a screening mechanism can improve market outcomes. Throughout, we compare the behavior of donors who joined the General Registry from the Registry + Donation treatment (henceforth: Registry Members) to those in the Donation Only treatment, who were never invited to join nor informed of the Registry (henceforth: non-Registry members). We restrict our attention to these two treatment groups since all donors in these groups received one solicitation call in both Round 1 and Round 2, whereas donors in all other treatments did not receive a solicitation call in Round 1. To do so, we simulate a solicitation campaign to show that (1) soliciting Registry members, rather than non-Registry members, is cost effective and (2) both the expected probability of excess demand and excess supply are smaller when the campaign targets Registry members rather than non-Registry members. These results are driven by Registry members being more likely to donate and a smaller standard error on mean donation rates for Registry members than non-Registry members.

We calculate the probability distribution of donating within 3 weeks of a solicitation using estimates from a probit regression (see Table S5). We focus on donations within three weeks in order to address the timing needs during critical shortage periods when demand temporarily exceeds supply. The means of the distributions are .104 (standard error .003) and .051 (standard error .002) for Registry and non-Registry members, respectively, implying that Registry members are more responsive than non-Registry members (see Figure S3a).

Suppose the Blood Service wants to construct a solicitation campaign such that they can expect 100 donations during a critical shortage period, then they would need to solicit 958 General Registry members or 1949 non-Registry members. Calling this requisite number of non-Registry and Registry members will result in two distributions of expected donations, both with means of 100 (see Figure S3b).

Based on making these calls, we generate the cumulative distribution of expected donations to calculate the probability that the Blood Service's campaign will result in excess supply or excess demand and how these likelihoods differ when the campaign solicits Registry versus non-Registry members. Figure 1a shows the cumulative distribution functions that represent the probability of this solicitation campaign resulting in x or fewer donations.

FIGURE 1: EXCESS SUPPLY AND EXCESS DEMAND

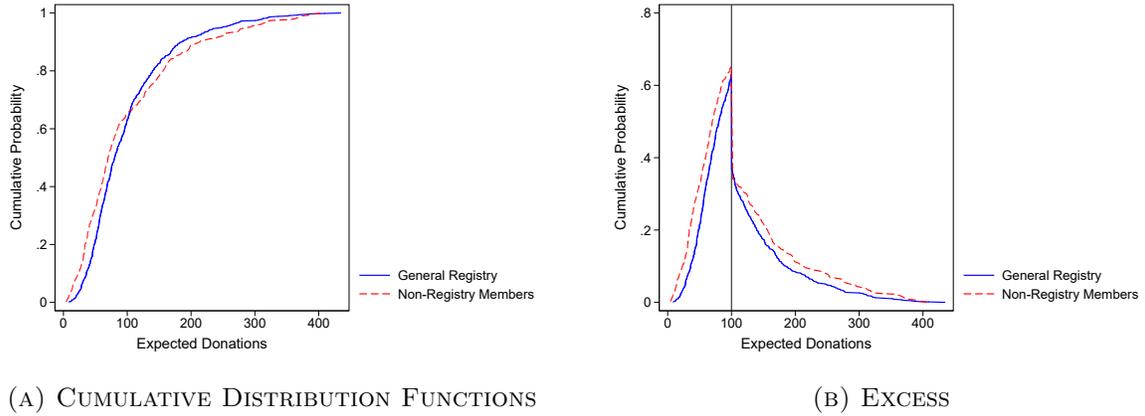


Figure 1a shows that the CDF for non-Registry members is a mean-preserving spread of the CDF for Registry members. Figure 1b shows the same CDF, $Prob[X < x]$ as Figure 1a for $x < 100$, but shows the inverse CDF, $Prob[X > x]$, for all $x > 100$.

In particular, Figure 1a shows that the probability of excess supply and the probability of excess demand is greater among non-Registry members than Registry members. This is more clearly illustrated in Figure 1b, which shows that for all expected donations that would result in excess demand (the area of Figure 1b to the left of the expected 100 donations) and excess supply (the area to the right of expected 100 donations), the probability is strictly greater from soliciting non-Registry members versus Registry members. In sum, to obtain the requisite amount of blood to address a critical temporal shortage will require 100% more calls to non-Registry members than to Registry members and the probability of both excess supply and excess demand is greater when those solicitations are made to non-Registry members than Registry members.

To further emphasize the cost-effectiveness of the Registry, suppose the Blood Service faces a critical shortage and needs to be nearly certain of collecting the 100 donations in the next three weeks. For example, the shortage may be so critical that the Blood Service needs to be 90% confident that their collection efforts will yield the needed 100 donations. Using similar probability distributions as calculated above, we find that the Blood Service would need to solicit 212% more non-Registry members (8,321 solicitations) than Registry members (2,662 solicitations). To obtain 95% confidence, the Blood Service would need to solicit 287% more non-Registry members (13,377 solicitations) than Registry members (3,441 solicitations). In general, the Registry's value increases as the Blood Service seeks more certainty over satisfying excess demand.

4 Understanding Registry Demand: Donor Motivation

Table 4, and particularly Panel B, shows that the Registry is effective at “crowding-in” donations from long-lapsed donors; that is, donors who had not given in at least 24 months are more willing to give after joining the Registry. In this section, we examine the preferences and motivations of donors who were crowded-in by the Registry. We consider two main motivations based on well-developed models of altruism and commitment, but we examine other motivations in Section 4.3 that may also be consistent with our results, including ask avoidance.

Section 4.1 considers the crowding-in of pure altruists; that is, the Registry provides information about the (critical) need for whole blood, which can crowd in the volunteers with pure altruism motives who get utility from this information. Similarly, in Section 4.2, we consider the crowding-in of donors with a preference for commitment. If a donor has self-control problems, then the Registry may provide the needed psychological commitment to crowd-in the long-lapsed volunteer.

Table 3 in Section 2 shows that, conditional on answering the phone call, approximately two-thirds of individuals joined the General Registry, while the remaining one-third selected-out of the General Registry. The table shows that the available demographics do not significantly predict who selects-in and who selects-out of the Registry. However, our set of available demographics is quite limited and it is not clear that these demographics should be correlated with the preferences (pure altruism and need for commitment) that we hypothesize predict selection into the Registry. For example, Gangadharan et al. (2015) find no relationship between demographics and purely altruistic versus warm-glow donors,²¹ while Tanaka et al. (2016) find no relationship between age or gender and present bias. Thus, the lack of the demographic variables to predict selection into the Registry does not shed light on whether there is preference-based selection, as we hypothesize.

4.1 Pure Altruists

A pure altruist is motivated only by “need” and cares about the overall supply of the good, while in contrast, an individual motivated by warm glow cares about their private contribution and obtains utility from the “warm glow” of personal sacrifice (Becker, 1974; Andreoni,

²¹While a series of studies have looked for a link between gender and altruism, the findings are mixed (Andreoni and Vesterlund, 2001; Andreoni et al., 2003; Conlin et al., 2003; Cox and Deck, 2006; Dellavigna et al., 2013).

1989). One of the key parts of the Registry is that it promises to call members only when their blood is needed, thus reducing any uncertainty about the overall level of need. This information is valuable to an individual motivated by pure motives, but not valuable to an individual motivated by warm glow. Further, the greater is the need, the more motivated a pure altruist will be. Thus, if the Registry’s informational content drives its effectiveness then we would expect that individuals motivated by pure altruism will be more likely to select into the Registry. The testable implication in the data is that Registry members would be relatively more responsive the greater is the need than individuals not invited to join the Registry.

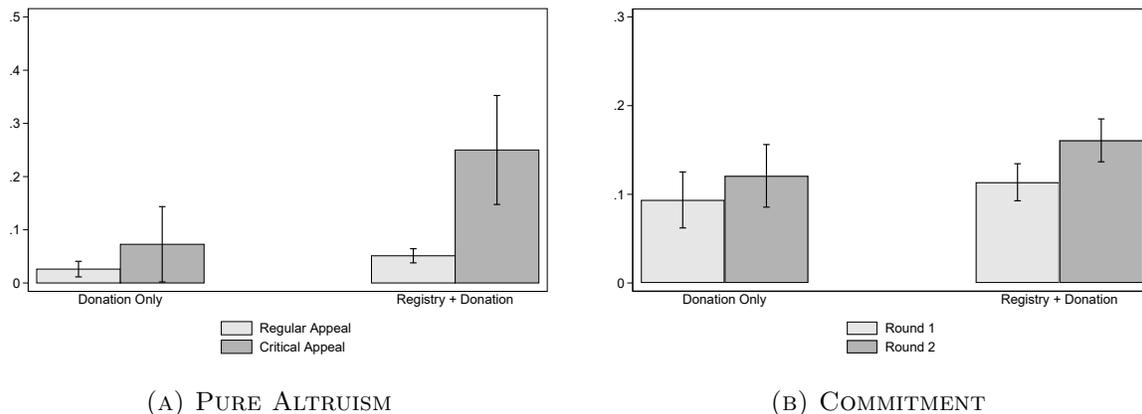
The Round 2 treatment conditions give us this difference in the need; recall, in Round 2, subjects were treated with either a critical call, informing them of the dire need for their donation in the next few weeks, or a standard shortage call. Following this hypothesis, we test whether the Registry crowds-in individuals with pure motives by comparing the probability of donating within 3 weeks of the solicitation in Round 2 for individuals who received a critical call and those who received a standard call. If the Registry crowds-in individuals motivated by pure altruism, then we expect the increase in donation rates between those who received a critical call versus those who received a standard call will be greater among Registry members than the control groups (i.e., those who never received an invitation).

The results are presented in Figure 2. Figure 2a shows that approximately 25% and 9% of Registry members who were assigned to receive a critical call or standard call, respectively, donated within 3 weeks, indicating an increase of approximately 16 percentage points. We compare this to the behavior of individuals not invited to join the Registry, where there was no significant increase in donation rates between those assigned to the critical call and those assigned to receive the standard call (7% versus 4%, respectively) . Supplementary Material B formally models this intuition and Table S6 shows that this result is statistically significant in a difference-in-difference regression framework.

4.2 Commitment Device

Next, we consider whether joining the Registry serves as an effective commitment and thus crowds-in individuals who have ceased donation activity due to commitment problems. During the Round 1 calls, subjects assigned to the Registry + Donation treatment and the Donation only treatment were both asked to donate and the former was also invited to join the Registry with a promise that there would be a future solicitation, in Round 2, to those who joined. Thus, in Round 1, the subjects randomly assigned to the Registry + Donation and the Donation Only treatments faced the same donation situation, and in particular, had

FIGURE 2: CROWDING-IN DONATIONS



made no commitment to donate at the time of the Round 1 donation invitation. However, during the Round 2 solicitations, subjects who *joined* the Registry have now self-selected, while there was no self-selection among subjects in the Donation Only treatment and thus, in Round 2, Registry members had made a (psychological) commitment to donate, whereas the Donation Only subjects had not made this commitment. Thus, if the Registry crowds-in donors who need a commitment and would not have donated without such a commitment, then we expect that the increase in donation rates between Round 1 and Round 2 will be greater among Registry members than among subjects in the Donation Only treatment.

Figure 2b shows that among Registry members from the Registry + Donation treatment, there was approximately a 6 percentage point increase in donation rates between Round 1 and Round 2, while among subjects assigned to the Donation Only treatment, there was only an approximately 3 percentage point increase. Supplementary Material B models the Registry as a commitment device following the Gul and Pesendorfer (2001) model of temptation and self control. Table S7 estimates an individual fixed effects model to show that the greater increase in donations in Round 2 over Round 1 among Registry members relative to Donation Only subjects shown in Figure 2b is statistically significant in an individual fixed effects regression framework.

4.3 Other Motivations

While we focused on the well-developed models of altruism and commitment, we briefly examine other possible motivations behind the Registry’s effectiveness, including a crowding-in of donors who (1) experience solicitation dis-utility or ask avoidance; or (2) have a preference for efficiency.

Solicitation Dis-Utility One possible explanation for the Registry increasing donations is that it crowds-in donations from volunteers who experience direct utility loss when they are solicited for a donation. Dis-utility from being asked to make a donation has been observed in other contexts (DellaVigna et al., 2012; Kamdar et al., 2015; Exley and Petrie, 2016; Andreoni et al., 2017). To explore whether dis-utility from solicitations might have crowded-in donations from Registry members, note that a donor’s status, “active” versus “long-lapsed”, is determined by the time since his last donation, which, in turn, determines the number of solicitations he receives from the Blood Service. An active donor receives regular solicitations from the Blood Service, while a long-lapsed donor receives a significantly reduced number of solicitations. A donor remains long-lapsed until he makes another donation, at which point he returns to the active donor pool and receives (more) regular solicitations. In our sample, all donors are long-lapsed at the beginning of our study

When volunteers are invited to join the Registry, a main characteristic is the promise to “contact Registry members only once or twice a year but never more than four times” in a year. Thus, joining the Registry provides substantially fewer expected solicitations than a long-lapsed donor can expect to receive if he rejoins the active donor pool without the Registry (i.e., making a donation without Registry membership). Thus, if a volunteer joins the Registry and donates, then he can expect the number of future solicitations following the donation to be fewer than if he donates and does not join the Registry. This means that the Registry may crowd-in donors who would like to make a donation, but refrain from doing so because they anticipate the dis-utility from increased number of solicitations as an active donor. By promising to only call once or twice, the Registry provides an avenue for these ask-avoidant donors to resume donation activities. In Supplementary Material B, we derive two testable implications from the experimental design and also provides analysis that shows little empirical support for dis-utility of solicitations crowding in donations through the Registry. However, given that we do not have any direct measures on subjects expectations of future donations, we are unable to satisfactorily test this hypothesis.

Preference for Efficiency Another possible explanation for the Registry’s effectiveness is that the development of a Registry may signal a commitment to efficiency on behalf of the Blood Service and that the Registry may crowd in donors who have a preference for more efficient blood collection. In other contexts, the idea that a preference for efficiency drives donations is mixed (see Tinkelman and Mankaney (2007) for a review of the literature). More recently, Gneezy et al. (2014) report results that are consistent with donors being driven by a preference for their donation to have an impact, rather than a preference for efficiency. Thus, a donor motivated by a preference for efficiency may be observationally

similar to a donor motivated by pure motives. However, without more data and information on the changes in the Blood Service’s costs and subjects’ beliefs about those changes, we are unable to test hypotheses about the role of a preference for efficiency.

5 Conclusion

This paper addresses volunteer labor markets, where the lack of price signals, non-pecuniary motivations to supply labor, and limited fungibility of supply lead to market failure. We introduce a market-clearing mechanism, the Registry, that takes these market aspects into account. The Registry was designed to appeal to volunteers across two behavioral preferences: volunteers motivated by pure altruism and volunteers in need of a commitment device.

We find that the introduction of the Registry is effective at improving market outcomes. The primary result, based on the intention-to-treat analyses, indicates that the invitation to join the Registry increases the responsiveness to a solicitation by 66 percent compared to those who were not invited to join the Registry. Further, soliciting Registry members, rather than individuals never invited to join a Registry, decreases the costs associated with a critical need campaign by at least 50%. This positive effect is driven by the Registry successfully screening for donors who find the Registry appealing enough (i.e., those who select-in) that they are motivated to resume donation activities. In particular, we find evidence consistent with the Registry crowding-in volunteers with pure motives and volunteers who have a preference for commitment.

Although we introduce the Registry in the whole blood market, the Registry provides a general framework for managing voluntary labor markets. Because the supply of voluntary labor operates quite differently from traditional labor markets dictated by wages, we believe that identifying the behavioral mechanisms is an important contribution, providing useful insights into how to design future Registries or expand existing Registries.²²

²²The costs associated with building and maintaining a Registry are not prohibitive. In Australia, the Blood Service added the Registry invitation to already planned solicitation campaigns.

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