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ABSTRACT

This study develops theory and uses a door-to-door fundraising field experiment to explore the economics of charity. We approached nearly 5000 households, randomly divided into four experimental treatments, to shed light on key issues on the demand side of charitable fundraising. Empirical results are in line with our theory: in gross terms, our lottery treatments raised considerably more money than our voluntary contributions treatments. Interestingly, we find that a one standard deviation increase in female solicitor physical attractiveness is similar to that of the lottery incentive¡ªthe magnitude of the estimated difference in gifts is roughly equivalent to the treatment effect of moving from our theoretically most attractive approach (lotteries) to our least attractive approach (voluntary contributions).

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I. Introduction

In 2003, more than $240 billion—exceeding 2 percent of U.S. GDP—was contributed to American philanthropic organizations. Even though charitable giving continues to grow at rapid rates, relatively little is known about the economics of charity. Early fundraising efforts typically relied on voluntary contributions mechanisms (VCM), but recently other methods have surfaced. For example, lotteries have helped to fund everything from the universities of Harvard, Princeton, and Yale to local public goods such as bridges and municipal buildings. Frank Fahrenkopf Jr., the gaming industry's chief lobbyist, notes that "We probably wouldn't have been a nation (without) the lotteries."[1] While lotteries grow increasingly popular, their relative efficacy remains under-researched. Indeed, even the most primitive empirical facts concerning alternative fundraising mechanisms are largely unknown.

Our study focuses on several key issues in the economics and practice of charitable fundraising by providing a theoretical model as well as a door-to-door field experiment to test the theory.[2] Our theory models individual contribution decisions under the VCM, the VCM with an initial seed money donation, and both the single- and multiple-prize variants of a charitable lottery. The underlying framework includes an extension of Andreoni's (1989; 1990) impure altruism model, thereby allowing solicitor/solicitee interaction to influence contribution levels. Our theory predicts that the

[1] Interestingly, President Washington purchased the first ticket for a federal lottery—sponsored to finance improvements in Washington, D.C.—in 1793. By the 1830s, more than 420 lotteries nationwide offered prizes. While a subsequent backlash ignited anti-gambling crusades, since the mid-1960s lotteries and other forms of legalized gambling have spread to every state but Utah and Hawaii. The above Fahrenkopf quotation is taken from the *Cincinnati Post* article of Barry M. Horstman (September 13, 1997).

[2] We would have preferred to test our theory using a much less labor intensive fundraising method—such as a phone or mail solicitation—but regulatory guidelines concerning lotteries prohibit the use of these types of solicitations for such a gambling exercise.

total provision of the public good in the VCM treatment where seed money is provided exceeds that elicited from a VCM without seed money. Furthermore, every lottery we consider dominates the VCM both in total dollars raised and the number of contributors attracted. The intuition behind this result is that competition for a private lottery prize introduces a compensating externality that attenuates the free-rider problem (Morgan, 2000). This negative externality reduces the difference between private and social benefits from contributing to the public good and thereby increases total contributions to the public good relative to a situation where no lottery prize is provided.

We investigate the effects of using lotteries and seed money in an actual charitable giving campaign by taking advantage of a unique opportunity to organize a capital campaign at East Carolina University (ECU). We designed the campaign closely following fundraiser guidance and our theoretical model by randomly dividing solicitors into four treatments, two that made use of the VCM and two that used lotteries.

Several interesting insights emerge. For example, the lottery treatments raised roughly 50 percent more in gross proceeds than our VCM treatments. This result is largely driven by greater participation rates in the lotteries: lotteries increase participation rates by roughly 100 percent. This finding highlights an attractive feature of lotteries: they provide fundraisers with a tool to generate "warm lists," or a larger pool of active donors to draw from in future fundraising drives. This result is important in light of the fact that fundraising strategists typically rank building a "donor development pyramid" as the most important aspect of a successful long-term fundraising effort.[3] In

[3] This long-term aspect of building a donor base is invaluable because start-up fundraisers typically lose money in their first few attempts (see, e.g., Sargeant et al., 2005).

this spirit, use of lotteries provides the fundraiser with a "double dividend," earning more funds immediately as well as securing a larger warm list than VCMs garner.

Our experimental design also permits an exploration of whether, and to what extent, individual solicitor characteristics influence fundraising success. We find that a one-standard deviation increase in physical attractiveness among women solicitors increases the average gift by 50%-135%. This result is largely driven by increased participation rates among households where a male answered the door. While this finding might not be surprising to marketers, such an "apples-to-apples" comparison between "mechanism" and "non-mechanism" treatment effects is rare in the literature. In this sense, our finding that the "physically attractive" treatment effect is in the neighborhood of the difference in fundraising success between our theoretically most attractive approach (lotteries) and our least attractive approach (voluntary contributions) is of significant note. There is also some limited evidence that other solicitor characteristics, such as obesity and self-confidence, influence fundraising success, and that social connectivity between the solicitor and household matters.

The remainder of our study proceeds as follows. The next section provides our theoretical framework on which we base our field experiment. Section III describes our field experimental design. Section IV summarizes our findings. Section V concludes.

II. Theoretical Model

We develop a simple model of the voluntary provision of public goods to provide direction to our field experimental design and to highlight clearly the factors determining giving in a door-to-door fundraising campaign. Besides risk aversion and heterogeneous marginal valuations for the public good, the actual interaction between solicitors and solicitees might play an important role in the context of fundraising.[4] For example, potential contributors might feel more inclined to give to a solicitor who has certain personal attributes or one with whom he shares certain qualities. This could come in many forms, such as a "warm-glow" from giving. We therefore apply a variant of Andreoni's (1989, 1990) impure altruism model.

We begin by modeling n symmetric agents, $i = 1,...,n$, who derive utility from consuming a numeraire good, y_i, a public good at level G, and (possibly) from their own contribution b_i to the public good. Agents face a budget constraint $y_i + b_i \leq w$ and ex-post utility is additively separable in the following way:

$$U_i = u(y_i) + \theta h(G) + \gamma f(b_i), \qquad (1)$$

where $u(\cdot)$, $h(\cdot)$, and $f(\cdot)$ are (strictly) increasing and concave, and $\theta \in \{0,1\}$. We allow for risk-aversion with respect to the numeraire consumption good ($u''(\cdot) \leq 0$).[5] The term $\gamma f(\cdot)$ depicts the warm-glow effect from giving, which depends on the solicitor and solicitee characteristics, as described by the parameter γ. The value of the public good is given by $\theta h(G)$ and is assumed to satisfy the Samuelson condition $nh'(0) > u'(w)$. As such, the provision of the public good is socially desirable whenever

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[4] There is some evidence from laboratory experiments that such relational matters are important. For example, Andreoni and Petrie (2004a, 2004b) find experimental evidence that identifying participants in a public goods experiment by showing their pictures has a substantial influence on giving behavior. Evidence on the importance of social interaction on trust and cooperative behavior can also be found in Glaeser et al. (2000) and Dufwenberg and Muren (2002).

[5] The additive separability allows us to concentrate on the impact of increased risk-aversion with respect to the numeraire as measured by $-u''(\cdot)/u'(\cdot)$. We do not make any specific assumption on the functional form of $u(\cdot)$; thus, properties such as constant/increasing/decreasing absolute or relative risk-aversion are special cases of our analysis. As our gamble sizes do not differ substantially (chance to win \$250 in one treatment and \$1000 in the other treatment), we suppress discussion of differing local or global risk attitudes (see, e.g., Chetty 2003, Rabin 2000). The interested reader should see Chetty and Szeidl (2004) for a discussion of preferences that might be locally CRRA.

$\theta = 1$. Further, we assume that agents have incomplete information regarding the value of the public good (or the credibility of the charity), and attach a probability $0 < \mu^{nS} \leq 1$ that the value is $h(G)$ ($\theta = 1$) and probability $1 - \mu^{nS}$ that the value is zero ($\theta = 0$).

As discussed in Vesterlund (2003), a charity can possibly gain credibility and/or reveal the type and value of the public good by announcing "seed money" contributions that it has already received prior to eliciting contributions from the public at large.[6] To reflect the informational value of announcing contributions, we assume that an agent's beliefs regarding the value of the public good change to $\mu^S > \mu^{nS}$ whenever the fundraiser announces seed money in a VCM. Further, we assume that beliefs change to μ^L when running a lottery whose prizes have been provided by an external donor.

Voluntary Contributions Mechanism

Under the VCM, individuals give according to the first-order condition (for an interior solution):

$$u'(w - b^{nS}) = \mu^{nS} h'(nb^{nS}) + \gamma f'(b^{nS}), \qquad (2)$$

without seed money, and according to

$$u'(w - b^S) = \mu^S h'(P_0 + nb^S) + \gamma f'(b^S), \qquad (3)$$

if a seed money contribution $P_0 > 0$ is announced. In this case, b^{nS} and b^S denote the respective individual contribution levels.

6 Andreoni (1998) discusses a different effect of seed money: his model of charitable giving for a threshold public good has multiple equilibria, and in the absence of seed money there exists a Nash equilibrium with zero charitable giving. The zero-contribution equilibrium can be eliminated, however, by initial commitments of seed money, which lower the remaining amount needed to be raised in the public fundraising campaign. Thus, in his model seed money is used as an elimination device rather than as a credibility device. List and Lucking-Reiley (2001) provide a test of this effect of seed money and find evidence in favor of seed money acting as a credibility device, consonant with our theoretical model.

Seed money contributions, therefore, have two partially offsetting effects on individual contribution levels. First, seed money reduces uncertainty about the credibility and value of a charitable organization, which generates an increase in equilibrium contributions. Second, seed money increases the provision level of the public good. This reduces marginal utility, which may lead to a reduction in individual contributions. Despite these offsetting effects, the total provision of the public good in the case of a VCM with seed money ($nb^S + P_0$) exceeds that elicited from a VCM without seed money, nb^{nS}.[7] Further, concavity of the utility functions immediately implies that contributions under both VCMs increase in the weight on warm-glow, γ.

Charitable Lotteries

We examine a charitable fundraiser who chooses to use a lottery in order to alleviate the strong free-riding incentives in the VCM.[8] For simplicity, we assume that the fundraiser has to decide between a single prize lottery (*SPL*), which pays one prize ($P^{SPL} = P$), and a multi-prize lottery (*MPL*), which splits the prize money into two identically valued prizes ($P_1 = P_2 = P^{MPL} = P$) and each agent can win only one prize (all arguments extend to the more general k-prize lottery). The probability π_i^L of agent *i* winning a prize in lottery $L \in \{SPL, MPL\}$ depends on all agents' contributions b_j ($j = 1,...,n$).[9]

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[7] This follows immediately from the first-order condition (3) as $u(\cdot)$, $h(\cdot)$, and $f(\cdot)$ are concave, and $\mu^S > \mu^{nS}$.

[8] In this sense, our theoretical model contributes to the literature by studying the incentives to contribute under risk-aversion in an impure altruism model. Further, we concentrate on risk-aversion regarding the numeraire consumption.

[9] If the agent purchases b_i tickets and each opponent contributes b_{-i}, her probability of winning the prize in lottery *SPL* is given by: $\pi_i^{SPL} = b_i / B$ where $B = b_i + (n-1)b_{-i}$, while in lottery *MPL* the probability

The expected utility of an agent *i* for lotteries $L \in \{SPL, MPL\}$ is given by

$$EU_i^L = \pi_i^L u(w - b_i + P^L) + (1 - \pi_i^L) u(w - b_i) + \mu^L h(B) + \gamma f(b_i)\,, \qquad (4)$$

where *B* represents aggregate contributions to the public good. Maximizing (4) with respect to b_i leads to the following first-order condition for the optimal contribution level of agent *i*:

$$\begin{aligned} 0 = \frac{\partial \pi_i^L}{\partial b_i}[u(w - b_i + P^L) - u(w - b_i)] - \pi_i^L u'(w - b_i + P^L) \\ - (1 - \pi_i^L) u'(w - b_i) + \mu^L h'(B) + \gamma f'(b_i) \end{aligned} . \qquad (5)$$

This optimality condition directly implies that individual (and therefore aggregate) contributions to the public good are increasing in γ, i.e. in the weight on the warm-glow effect. Based on first order condition (5), we can compare the equilibrium contributions with those under the VCM:

Proposition 1. *With symmetric agents, under any lottery and any finite level of risk-aversion, average individual contribution levels to the public good exceed those under the VCM with and without seed money if the credibility of the charity satisfies* $\mu^L \geq \mu^S$ *and* $\mu^L \geq \mu^{nS}$ *, respectively. If running the lottery makes the charity less credible than the VCM, the rank ordering of the mechanisms is ambiguous.*
Proof: see Appendix A

This result highlights that the lottery provides additional incentives to contribute to the public good beyond the incentives inherent in the VCM. If announcing donations

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of winning either the first or the second (equally valued) prize is given by $\pi_i^{MPL} = \frac{b_i}{B} + (n-1)\frac{b_{-i}}{B}\frac{b_i}{B - b_{-i}} = \frac{b_i}{B}(1 + \frac{(n-1)b_{-i}}{B - b_{-i}})$. In our theoretical model, we concentrate on symmetric equilibria. For those, the probabilities are given by $\pi_i^{SPL} = 1/n$ and $\pi_i^{MPL} = 2/n$, and for the partial derivatives we obtain $\frac{\partial \pi_i^{SPL}}{\partial b_i} = \frac{1}{nb}\frac{n-1}{n} =: \frac{1}{nb} H^{SPL}$ for lottery *SPL* and $\frac{\partial \pi_i^{MPL}}{\partial b_i} = \frac{1}{nb}[2\frac{n-1}{n} - \frac{1}{n-1}] =: \frac{1}{nb} H^{MPL}$ for lottery *MPL*.

of prizes provides the charity with no less credibility than announcing a seed gift, the contribution levels in a charitable lottery exceed those under the VCM. If this assumption does not hold, then we cannot compare the rank ordering of contributions across these two mechanisms. Since we cannot ensure that this assumption holds in our field experiment, our results provide a conservative test on the dominance of the lottery as a fundraising mechanism. This is indicative of field experiments of this type, which are not as "clean" as well-designed laboratory experiments—where researchers have more control by inducing preferences to accord with theoretical assumptions and by excluding other complicating factors.

Single- Versus Multiple-Prize Lottery

We now turn to the issue of comparing contribution levels across the single- and multiple-prize variants of the charitable lottery. Comparing contribution levels for the two lotteries, we obtain the following result:

Proposition 2. *With symmetric agents and for low levels of individual risk aversion, equilibrium average contribution levels are higher if only one prize is provided, whereas for highly risk averse agents, average contributions are larger when the prize is split into two identical prizes.*

Proof: see Appendix A

We can therefore increase contributions by splitting the prize and providing more than one prize if the level of risk aversion exceeds a certain threshold, i.e. $u(\cdot)$ is sufficiently concave. The same reasoning holds for the introduction of up to $n-1$ prizes. In addition to risk-aversion, the level of heterogeneity in individual valuations of the public good will also influence the ranking of the two lotteries. This result is shown in Appendix A.[10]

[10] Of course, we cannot control for risk-aversion and valuation of agents in our field experiment which makes it impossible to provide an unambiguous hypothesis on the ranking of single- vs. multi-prize lotteries.

Effects on the Extensive Margin

Thus far our comparisons have concentrated on symmetric agents and symmetric equilibrium, leading to mechanism gains arising on the intensive margin, i.e. participation rates are identical, but average contributions increase. This changes if we allow agents to have heterogeneous marginal valuations for the public good. Assuming that agents' marginal valuation of the public good allows a ranking $h_i'(G) \geq h_j'(G)$ for all $i < j$ and all provision levels G, it is found that only agents with the highest marginal valuation contribute under the VCM and VCM with seed money treatments: $\max_i \mu^{S,nS} h_i'(G^{\text{VCM}}) = 1$. Charitable lotteries, however, may induce participation by agents with lower marginal valuations. This leads to the following proposition:

Proposition 3. *With risk-neutral agents whose marginal valuation can be ranked independently of the provision level of the public good and for lotteries providing identical credibility to the charity as seed money ($\mu^S = \mu^L$), lotteries yield higher or identical participation rates and higher average contribution levels than a VCM.*
Proof: see Appendix A

This result highlights a potential "double-dividend" of using lotteries: not only are aggregate contributions enhanced, but the prize structure can induce greater participation rates. Fundraising strategists around the globe understand the importance of building a "donor development pyramid," which includes as its base first-time donors. The base is commonly understood to be the most difficult, yet most important, component in building a successful long-term fundraising effort.

Individual Characteristics

In our experimental setting of door-to-door fundraising, the face-to-face interaction of solicitors and solicitees permits a potentially rich exploration of social interaction effects. Our theoretical model captures this interaction via the parameter γ.

There are several underlying mechanisms that might be at work in our environment. For example, evidence from the psychology, marketing, and economics literatures suggest that not only the personal characteristics of the solicitor matter, but also the social distance between solicitor and solicitee (see Bertrand et al., 2005, for a review and novel field experiment that "prices" psychology).

In this spirit, there is a growing empirical literature that examines the effects of individual personal attractiveness on labor market outcomes (see, e.g., Hamermesh and Biddle, 1994; Biddle and Hamermesh, 1998; Mobius and Rosenblatt, 2004). These studies demonstrate a positive relationship between the physical attractiveness of a worker and labor market outcomes. In addition, economists have recently begun to provide theoretical models relating individual self-confidence (or related personality constructs) and market outcomes, conjecturing that there is a positive link (see, e.g., Bearden et al, 2001; Benabou and Tirole, 2002).

Concerning social distance, Andreoni and Petrie (2004b, pg. 6) note that "working with familiar others can reduce transactions costs, as familiarity can enhance trust." If a similar phenomenon occurs in our field environment – i.e., potential donors trust (or prefer) solicitors of like social groupings – then one might expect to see differential rates of giving between solicitors and donors of similar race and/or gender. In our field experiment we carefully measure each of these factors, allowing us to determine their importance and control for their influences when exploring tests of our theory.

III. Experimental Design

Following our theory, we designed a door-to-door fundraising solicitation to allow a clean comparison between four different treatments – a VCM with and without seed money, a fixed-prize lottery with only a single cash prize, and a fixed-prize lottery with multiple cash prizes. Door-to-door fundraising is widely used by a diverse range of organizations. While there is a large literature on the benefits of inter-personal, door-to-door solicitations as opposed to less personal solicitation methods (see, e.g., Fraser et al. 1988), to our knowledge these comparisons consider only VCMs.[11]

Part I: The Experimental Treatments

In each treatment, households in predetermined neighborhood blocks in Pitt County, North Carolina, were approached by a paid solicitor and asked if they would like to make a contribution to support the Center for Natural Hazards Mitigation Research at East Carolina University.[12] Households that answered the door were provided an informational brochure about the Hazards Center and read a fixed script that outlined the reason for the solicitors' visit. The script included a brief introduction which informed the resident of who the solicitors were, the purpose of their visit, a two-sentence summary of the non-profit organization, and the details of the charitable raffle (when applicable). A copy of the script for the single-prize lottery is provided in Appendix B.

Across all treatments, potential donors were informed that proceeds raised in the campaign would be used to fund the Hazards Center. In the VCM with seed money treatment, potential donors were also informed that the Hazards Center had already received a commitment of $1000 from an anonymous donor. In the single-prize lottery

[11] Recently, the economics literature has witnessed a nice surge of natural field experiments (see Harrison and List, 2004, for field experimental terminology) exploring charitable fundraising using mail and phone solicitations (see, e.g., Frey and Meier, 2004; Falk, 2004; Croson and Shang, 2005; Eckel and Grossman, 2005).

[12] The Natural Hazard Mitigation Research Center was authorized to begin operations in the fall of 2004 by the North Carolina state government. The Hazard Center was founded in response to the widespread devastation in Eastern North Carolina caused by hurricanes Dennis and Floyd, and designed to provide support and coordination for research on natural hazard risks. For more information on the Hazard Mitigation Research Center see www.artsci.ecu.edu/cas/auxiliary/hazardcenter/home.htm.

treatment, households were informed that each dollar contributed to the Hazards Center would provide them with one ticket for a raffle where the winner would receive a $1000 pre-paid credit card. In the multiple-prize lottery treatment, households were informed that each dollar contributed would provide one chance in a raffle that would award four $250 pre-paid credit cards as prizes. Households were informed that they were eligible to win only one of the four pre-paid credit cards. Agents in the lottery treatments were informed that their chances of winning the raffle would be based upon their ticket purchases relative to the number of tickets purchased by other households in Pitt County.

At this point, it is important to consider that we attempted to make the field experiment correspond closely to naturally occurring door-to-door fundraising drives. Thus, when crafting our script, we closely followed generally accepted guidelines in such matters as the provision of information and other theoretically important factors. Such an approach is different from laboratory experiments, wherein the scholar attempts to create a sterile environment that necessitates careful control of individual preferences, others' preferences, group size, and the like.

Table 1 summarizes our experimental design. The experimental treatments were conducted on four different weekends between October 2nd and November 13th, 2004. Our design resulted in a sample of 4833 households approached – 1186 in the VCM, 1282 in the VCM with seed money, 963 in the single-prize lottery, and 1402 in the multiple-prize lottery. Of the households approached, a total of 1755 answered the door and spoke to a solicitor, and 522 made a contribution to the Hazards Center.

Part 2: Recruiting and Training the Solicitors

As Table 1 reveals, we employed forty-four solicitors – seven in the VCM treatment, twelve in the VCM with seed money treatment, ten in the single-prize lottery treatment, and fifteen in the multiple-prize lottery treatment. All solicitors participated during a single weekend and elicited contributions within a single treatment. Solicitors were not aware of the alternate treatments and while running the experiment we took great care to ensure that solicitors in different experimental treatments were isolated from one another to prevent cross-contamination and information exchange across treatments. Each solicitor's experience typically followed four steps: (1) consideration of an invitation to work as a paid volunteer for the research center, (2) an in-person interview, (3) a training session, and (4) participation as a solicitor in the door-to-door campaign.

Undergraduate solicitors were recruited from the student body at ECU via flyers posted around campus, announcements on a university electronic bulletin board, advertisements in the local campus newspaper, and direct appeal to students during undergraduate economics courses. All potential solicitors were told that they would be paid $10 per hour during training and employment. Interested solicitors were instructed to contact the Economics Department to schedule an interview.

Initial fifteen-minute interviews were conducted in private offices of the Economics Department faculty. Upon arrival to the interview, students completed an application form and a short survey questionnaire. In addition to questions about undergraduate major, GPA, and previous work experience, the job application included questions about height and weight which were used to construct an indicator of body mass index (BMI). The survey questionnaire (see Appendix C) was composed of 20 categorical-response questions – scaled from (1) strongly disagree to (5) strongly agree –

providing information about five potentially important personality traits of the applicant.[13] Questions were designed to elicit measures of assertiveness, sociability, self-efficacy, performance motivation, and self-confidence. The survey contained two questions each from both a positive and a negative frame for the five traits. Following the literature, we scaled responses from -5 to -1 (negative frame) and 1 to 5 (positive frame); thus, individual measures for the personality traits lie within the set {-8, 8}.

All applicants delivered completed forms to the interviewer prior to the in-person interview. Before the interview began, the interviewer explained the purpose of the non-profit research center and the nature of the solicitation work that was to be performed. The interview process consisted of a brief review of the applicants' work experience, followed by questions relating to his or her communication skills, confidence in soliciting donations for a non-profit organization, ability to handle rejection in this context, and motivation for being in college. We video-recorded all in-person interviews, which lasted approximately 10 minutes. Upon concluding the interview, *every* applicant was offered employment as a solicitor.

Once hired, all solicitors attended a one-hour training session. Solicitors were randomly assigned to an experimental treatment and training session. Each training session was conducted by the same researcher and covered a single treatment.[14] The training sessions provided the solicitor with background/historical information of the Hazards Center and reviewed the organization's mission statement and purpose.

[13] In constructing the personality survey, we followed the International Personality Item Pool (see www.ipip.org).

[14] For each round of the experiment, we ran separate training sessions for each treatment, scheduled every 75 minutes throughout the Friday morning before the solicitors canvassed the neighborhoods. The training sessions were typically held a few days after the initial interview process.

Solicitors were provided a copy of the informational brochure and the press release announcing the formation of the Hazards Center. Once solicitors were familiarized with the Hazards Center, the trainer reviewed the data collection procedures. Solicitors were provided with a copy of the data record sheet which included columns to record the race, gender, and approximate age of potential donors, along with their contribution level. The trainer stressed the importance of recording contribution (and non-contribution) data immediately upon conclusion of each household visit.

Next, the trainer reviewed the solicitation script with the solicitors and, in the lottery treatments, explained the lottery rules/procedures. At the conclusion of the training session, the solicitors practiced their script in front of the trainer and the other solicitors. When necessary, the trainer provided immediate feedback to the solicitor on ways in which the pitch could be improved. Next, the solicitors had two further opportunities to practice their script by knocking on two different office doors and soliciting contributions in the Economics Department. Personnel in the Economics Department evaluated the "sales pitch," which was used to provide feedback to the solicitor on his or her performance.

Part 3: Further Solicitor Information: Personal Attractiveness Rankings

In the final step, we gathered one last piece of information. In the spirit of the procedures of Biddle and Hamermesh (1998), we derived measures of physical attractiveness for each solicitor. Digital photos of each solicitor were taken during the initial interview to prepare an identification badge. Photographs were then randomly allocated into files that contained the pictures of three other solicitors. The files were printed in color and independently evaluated by 152 different observers. The independent observers were undergraduate students from one of two large introductory-level economics courses at the University of Maryland–College Park.[15]

Each observer evaluated twelve different photographs and was asked to place each photograph on a scale of (1) homely, extremely unattractive, to (10) model beautiful or handsome. This resulted in a total sample of 1824 personal attractiveness rankings. Each rater's scores were normalized to yield a standardized scale across different raters. Normalized ratings a_{ij}^N were generated as $a_{ij}^N = \frac{a_{ij} - \overline{a}_j}{\sigma_j}$, where a_{ij} is the personal attractiveness ranking of evaluator *j* for solicitor *i*, $\overline{a}_j$ is the mean personal attractiveness ranking across all solicitors for evaluator *j*, and σ_j is the standard deviation in personal attractiveness rankings for evaluator *j*. The normalization procedure results in personal attractiveness rankings that are distributed standard normal. To generate our final personal attractiveness measure, the standardized ratings a_{ij}^N for each solicitor *i* were averaged over the evaluators *j*.

Before proceeding to the results discussion, we should highlight a few important design issues. First, as previously noted, in carrying out our door-to-door campaign, we wished to solicit donors in a way that matched, as closely as possible, the current state of the art in fundraising. We therefore used the local newspaper to advertise the fundraising campaign to notify the public that the Hazards Center was a legitimate entity and that ECU representatives might be visiting their households in the near future. Second,

[15] As noted in Biddle and Hamermesh (1998), the notion that physical attractiveness can systematically affect economic outcomes critically depends on the assumption that there are common standards of beauty in any population. Such common standards have been demonstrated in studies by Zebrowitz et al. (1993), Biddle and Hamermesh (1998), and Mobius and Rosenblatt (2004). We therefore are comfortable in using University of Maryland students to evaluate ECU students' physical attractiveness.

solicitors were provided an attractive polo shirt on which the name of the non-profit organization was professionally embroidered and were instructed to wear khaki pants (or shorts) during their door-to-door solicitations in order to provide a formal, standardized appearance. Third, each solicitor wore an identification badge that included his or her picture, name, and city solicitation permit number. Fourth, solicitors distributed an information brochure after introducing themselves to potential donors. Fifth, we randomly allocated solicitors across neighborhoods and treatment type, and solicitors remained in the same treatment throughout the weekend.

Finally, to summarize, we have gathered a rich set of solicitor and household control variables. Not only do we have measures of several potentially relevant solicitor attributes (age, race, gender, work experience, beauty, BMI, and personality scores), we also have gathered data on the households that our solicitors approached. After the interaction with the household, each solicitor filled out forms that included the estimated age, gender, and race of the potential contributor.

IV. Experimental Results

Our first set of hypotheses compares the VCMs with the lotteries. Table 2 presents summary statistics, which includes information on the success of the various treatments, as well as solicitor and household characteristics. Table 2 indicates, for example, that our solicitors approached 1186 households in the VCM treatment, and had a chance to speak to 446 of these households, of which 113 chose to contribute to the Hazards Center.

In total, we raised \$452, \$526, \$688, and \$752 in the four treatments.[16] Consistent with our theory, the lottery treatments raised considerably more money than the VCM treatments. Our theory predicts that this increase might occur on both the intensive and extensive margins: first, the percentage of households contributing in the lotteries exceeds the percentage of households contributing in the VCM treatments. Second, the average contribution in the lottery treatments dominates the average contribution in the VCM treatments. We consider these two possibilities in turn.

As summarized in Table 2, in the VCM treatment, 25.3% of the households (113 out of 446) made a contribution to the Hazards Center. In the seed money treatment, this proportion was only 14.8% (67 out of 453). For the single- (multiple-) prize lotteries the respective proportions of contributing households were 45.5% (165 out of 363) and 35.9% (177 out of 493). In constructing a statistical test for these data, it is important to realize that these proportions are independent across the four treatments, but dependent within treatment—i.e., any given solicitor approaches a number of households. We therefore use a conservative test at the solicitor level by calculating the individual solicitor average success rate, and then rank solicitors via these averages.

Figure 1 summarizes success rates by plotting the percentages of households that contributed at the solicitor level—i.e., each observation is a solicitor average. One clear data pattern is that the lotteries induce households to make non-zero donations; for instance, while none of the solicitors in the VCM had a success rate exceeding 40%,

[16] An astute reader will realize that we lost money in this fundraising drive given our wage rates and fixed costs. This outcome is in line with "best practice" fundraising results and therefore provides evidence that our field experiment was "externally valid." For example, Sargeant (2005) shows that most charities lose money on their first fundraising endeavors (typically about half of what they invest). Indeed, in personal communications, fundraising experts state that over 90% of first efforts lose money. This fact highlights the significance of building a long-term relationship with donors, as charities typically earn positive returns on subsequent campaigns from soliciting households on "warm lists" (Sargeant and Kähler, 1999).

more than half of the solicitors in the single-prize lottery had a success rate exceeding 40%. Using a Mann-Whitney rank sum test on these data, we find that (i) the percentage of households that contributed in the single-prize lottery is significantly greater than the percentage of households that contributed in either the VCM or VCM with seed money treatments at the $p < 0.01$ level, and (ii) the percentage of households that contributed in the multiple-prize lottery is significantly greater than the percentage of households that contributed in the VCM with seed money treatment at the $p < 0.01$ level.[17]

Considering average contributions, as Table 2 summarizes, we find that the average donation per contact is greater in our two lottery treatments than in either of the VCM treatments: average contribution levels per household was $1.89 ($1.52) in the single-prize (multiple-prize) lottery treatment, considerably larger than average contributions under the VCM (VCM with seed money) of $1.01 ($1.16). Figure 2 presents the average contribution per household at the solicitor level and highlights the effectiveness of the lottery design. Using the average earnings per household for each solicitor as the unit of observation, we find that the $0.88 ($0.73) difference in the single-prize lottery and the VCM (VCM with seed money) treatment is statistically significant at the $p < 0.05$ level. For the multiple-prize lottery treatment, the $0.51 difference from the VCM treatment is statistically significant at the $p < 0.10$ level, whereas the difference from the VCM with seed money is not statistically significant.[18]

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[17] Figure 1 highlights that the observed treatment effect is not merely driven by a few solicitors. Indeed, assuming independence across solicitors, the probability that the top 7 solicitors were randomly placed in the SPL (MPL) rather than being placed in the VCM is 0.6% (3.4%).

[18] Considering conditional contributions, we find that while the VCM and both lottery treatments yield an average conditional contribution of $4, $4.17, and $4.25, the VCM with seed money treatment yielded a much larger average gift of $7.85 (see Table 2). Using a Mann-Whitney rank sum test of treatment differences at the solicitor level, we find that the differences in conditional contributions in the VCM with seed money treatment are significantly greater than those for the VCM and both lottery treatments at the p

To complement these unconditional insights, we estimate a series of linear regression models that explicitly control for observable and unobservable differences across solicitors. Specifically, we estimate a linear regression model of the amount contributed for each household that answered the door (including zero contributions) on dummy variables for our experimental treatments and other covariates:

$$L_{ij} = v(Z_{ij}) + \varepsilon_{ij} \qquad (6)$$

where L_{ij} is the contribution level of the j^{th} household to the i^{th} solicitor, and $v(Z_{ij})$ is a linear function of the vector Z_{ij} which includes treatment effects and weekend-specific effects to control for temporal heterogeneity in giving rates. To account for unobservable heterogeneities at the solicitor level, we cluster the standard errors by solicitor.

Empirical estimates are presented in Column 1 of Table 3, and provide insights consistent with the unconditional results: households contributed \$1.00 (\$0.79) more in the single (multiple) prize lottery treatment than in the baseline VCM treatment with both of these differences statistically significant at the $p < 0.05$ level.

To gain insights into the factors that influence the decision of households to contribute to the Hazards Center, we estimate a probit model of the contribution decision of households that answered the door:

$$C_{ij} = \beta X_{ij} + e_{ij} \qquad e_{ij} \sim N[0,1] \ , \qquad (7)$$

where C_{ij} equals unity if solicitor i received a contribution for household j, and equals zero otherwise; X_{ij} includes the treatment effects and weekend-specific effects to control for temporal heterogeneity. We again cluster the standard errors by solicitor.

< 0.05 level. All remaining differences in conditional contributions across treatment are insignificant at conventional levels.

Empirical estimates are presented in Column 3 of Table 3, and indicate that households were more likely to contribute if they were approached by a solicitor who was randomly placed into one of the lottery treatments: households are 21.2% (16.8%) more likely to contribute in the single-prize (multiple-prize) lottery compared to the VCM treatment. And, households were roughly 31.5% (27.1%) more likely to contribute in the single-prize (multiple-prize) lottery compared to the VCM with seed treatment. All of these differences are statistically significant at the $p < 0.05$ level.

As a robustness check, we apply the two-step selection model of Butler and Moffitt's (1982)

Step 1: $C_{ij} = \beta` X_{ij} + e_{ij}$, (8)

Step 2: $L_{ij} = v(Z_{ij}) + \varepsilon_{ij}$, (9)

where variables are defined above. We specify $e_{ij} = u_{ij} + \alpha_i$, where the two components are independent and normally distributed with mean zero. It follows that the variance of the disturbance term e_{ij} is $Var(e_{ij}) = \sigma_u^2 + \sigma_\alpha^2$. By construction, the individual random effects α_i will capture important heterogeneity across solicitors that would be left uncontrolled in a standard cross-sectional model. And, $\varepsilon_{ij} = \alpha_i + u_{ij}$; $E[\alpha_i] = 0$, $E[\alpha_i^2] = \sigma_\alpha^2$, $E[\alpha_i \alpha_l] = 0$ for $i \neq l$; and α_i and u_{ij} are orthogonal for all i and j.[19]

Empirical estimates from this model are presented in columns 1 and 2 of Table 4. We include coefficient estimates, standard errors, and estimated marginal effects from the two-stage model. Empirical estimates are similar to those obtained in the simple models

[19] Identification is achieved in this model because the inverse Mills ratio is a nonlinear function of the regressors. Accordingly, it is important to highlight certain robustness checks that we employed. First, we estimated the model by including regressors in the first stage probit (a Sunday dummy variable, household characteristics, solicitor characteristics, etc.) that we excluded from the second stage. Every such

presented in Table 3: households were more likely to contribute if they were approached by a solicitor in one of the lottery treatments, and conditional on contributing, we find that the lotteries yield greater contributions than the VCM. The power of seed money is highlighted in the second-stage regression estimates—the VCM with seed money treatment yields considerably larger conditional contributions versus the VCM ($3.54, or nearly 100% increase).

Overall, we interpret the empirical results and data patterns as suggesting three major findings:

> *Result 1: Gross proceeds in both lottery treatments are larger than proceeds in the VCM and VCM with seed money treatments.*
>
> *Result 2: The increased revenue stream in lotteries is largely due to increased participation rates, but average contributions are also slightly higher in the lotteries.*
>
> *Result 3: Conditional on contributing, the VCM with seed money treatment induces the largest average gifts.*

The first two results on gross contributions are consistent with our theory, but it is clearly of interest under which circumstances lotteries would yield a higher provision level of the public good.[20] Consider the single-prize lottery treatment. In this case, 963 households were approached and $688 was raised, for an average yield of $0.71 per household approached. In the VCM treatment, the average yield is roughly $0.38. Thus, if we make the assumption that gift rates would have continued in the same pattern if we

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specification yielded similar results to those presented below. Second, further robustness tests are reported below.

[20] For certain parameter values, the theory would predict such a superiority of lotteries even for net revenues. As the simplest example, consider symmetric risk-neutral agents which do not experience any warm-glow from giving and a perceived credibility $\mu^L = \mu^S = 1$. Then, VCM with seed provision would be given by $1 = h'(G^S)$ while the single prize lottery gives: $1 - h'(G^{SPL}) = \frac{n-1}{n}\frac{P}{G^{SPL}} > 0$ which immediately implies a larger contribution level under the lottery treatment than under the VCM, i.e. $G^{SPL} > G^S$.

visited a larger number of homes, a reasonable conjecture given our randomization scheme, we would need to approach roughly 3030 households in each treatment for the single-prize lottery to net more money than the VCM.

For charities interested in long-run success, *Result 2* is quite important, as it provides evidence of a "double-dividend" associated with lotteries: not only is the level of contributions higher, but the participation rate is enhanced.[21] Fundraisers understand that securing a "warm list" of donors is an important requirement for the long-term viability of a charity. In this light, it is important to realize that 40% to 80% more households contribute in the lotteries compared to the VCM treatments. Informal investigation of what this additional 40%-80% pool of active contributors actually means to a charity leads us to believe that each extra contributor amounts to roughly $65 per year in donations.[22] *Result 3* highlights that seed money is a powerful incentive mechanism in the field.

People Give to People, Not Causes: The Role of Individual Characteristics

An interesting anecdote among fundraisers is that "people give to people, not causes." This anecdote perhaps has its roots in a famous statement made by Diogenes

[21] Early work on the provisioning of public goods found solutions once every participant decided to participate in the mechanisms (see, e.g., Groves and Ledyard, 1977), and therefore focused on increasing contributions along the intensive margin. In this literature, the provision problem is framed within the context of a social planner whose objective is to provide a desired aggregate level of a public good. The distinction between increased contributions along the intensive and extensive margins is extraneous from the perspective of such a social planner. In many practical applications, fundraisers are concerned with both the aggregate level of contributions received and the total number of contributors. The participation problem and mechanisms that induce gains along the extensive margin are thus important considerations for practitioners in the field. Our result has an analog in the success of certain types of government procurement contracts (McAfee and McMillan, 1989), the success of some auction institutions (McAfee and McMillan, 1987; Englebrecht-Wiggans, 1993), and the design of income transfer programs (Saez, 2002).

[22] This is a back-of-the-envelope calculation using estimates provided by several charities. First, charities suggest that the retention rate is roughly 50%-80% (i.e., 50%-80% of those who initially donate will contribute during the next round of solicitations). Second, of those 50%-80% who are retained, they give approximately $100 per year. Our next step in this investigation is to explore this anecdotal evidence.

Laertius: "He [Aristotle] used to say that personal beauty was a better introduction than any letter."[23] In our theory, such effects manifest themselves through the γ parameter.

Our data set is sufficiently rich to enable us to examine such an assertion by exploring the effects of individual characteristics – i.e., physical attractiveness, obesity, self-confidence, etc. – on observed contribution levels. Some of these characteristics have been shown, in quite different environments, to have an important influence on economic outcomes (see, e.g., Hamermesh and Biddle, 1994; Biddle and Hamermesh, 1998; Mobius and Rosenblatt, 2004).

Alternatively, there is growing experimental evidence that suggests trusting behavior and trustworthiness rise with social connection (see, e.g., Glaeser et al., 2000; Fershtman and Gneezy, 2001; Andreoni and Petrie, 2004b). Thus, we might expect to find greater contributions received from donors of the same racial group or gender as the solicitor who approached their residence. We visit these conjectures in turn.

Physical Attractiveness and Giving Behavior

The middle panel of Table 2 summarizes solicitor characteristics across the four treatments. These figures can be read as follows: in the VCM treatment, the average standardized personal attractiveness rating was 0.31 with a standard deviation of 0.69. There are notable differences in standardized personal attractiveness ratings across our experimental treatments, but these differences are not statistically significant at any meaningful level using either a two sample t-test for differences in means or a non-parametric Mann-Whitney test.

[23] This quote is taken from Hamermesh and Biddle (1994).

While our use of "beauty" follows a rich literature, measures of individual body mass have also been used in economic analyses (see, e.g., Coller et al., 2002). As discussed previously, we gathered information on solicitor height and weight, which allows us to compute a body mass index for each individual, which is a measure of body fat based on height and weight that applies to both adult men and women.[24] BMI categories are as follows: underweight, BMI = <18.5; normal weight, BMI = 18.5-24.9; overweight, BMI = 25-29.9; and obese, BMI of 30 or greater.

We estimated augmented variants of our equations above by expanding X_{it} and Z_{it} to include subject-specific measures. These empirical estimates are contained in columns 2 and 4 of Table 3 and columns 3-8 in Table 4. In terms of the beauty rating, there is some evidence that personal attraction matters. For example, from column 3 in Table 4 we learn that an increase in the personal attractiveness rating of one unit generates an approximate 6.36% increase in the probability that a household will contribute, though this effect is only marginally significant. Furthermore, conditional on contributing, a one-unit increase in average personal attractiveness generates an approximate $0.61 increase in the level of contributions (column 4 in Table 4).

Exploring this result a level deeper in a series of empirical models that include interaction effects to allow a test of gender-specific treatment effects leads to an interesting asymmetry. We find that the empirical results presented in Tables 3 and 4 are entirely driven by white females (and primarily driven by households where a male answers the door). It is instructive therefore to consider the effects of personal attractiveness for white female solicitors in isolation. We provide summary empirical

[24] BMI is calculated as: 703*(weight in pounds/(height in inches)^2) or, equivalently, as weight in kilograms divided by (height in meters)^2.

estimates in Table 5. The table provides the influence of changes in the personal attractiveness ranking of a white female solicitor across the treatments. The first two rows highlight the influence of personal attractiveness on the expected contribution for a household that answered the door: across all treatments a one standard deviation increase in female personal attractiveness considerably increases the expected gift.

Rows 3-6 in Table 5 reveal that this effect is not due to increases in the average gift, but rather that it is largely driven by increased participation: more personally attractive female solicitors induce a higher proportion of households to contribute. This result suggests that the effect of personal attractiveness is similar to that of the lottery incentive – personal attractiveness elicits contributions from agents who would otherwise elect not to contribute. This insight leads to our next result:

> *Result 4: Physically attractive female solicitors raise more money than their peers, and this is largely due to increased participation rates among contributors.*

This result can be pushed a bit harder by considering the hourly earnings of solicitors. Such estimates provide a rare glimpse at real productivity differences across agents of varying personal attractiveness. The raw data show that a one-standard deviation increase in personal beauty increases hourly returns from approximately $6 to more than $12, or about 100%.

Considering the correlation between BMI and solicitor effectiveness, we find only a marginal relationship. Columns 5 and 6 of Table 4 show that only those solicitors labeled obese (BMI $\geq$ 30) raise lower amounts of money than their peers. Such solicitors were roughly 9% less successful in securing contributions (column 5), and received conditional contributions that were approximately $6.25 lower than their non-obese peers. Yet it is important to point out that these estimates are measured imprecisely and that only the latter is statistically significant ($p < .10$, using a two-sided alternative).

Self-Efficacy and Performance Motivation: The Influence of Personality

Economists have recently begun to provide theoretical models relating individual self-confidence (or related personality constructs) and market outcomes (see, e.g., Bearden et al, 2001; Benabou and Tirole, 2002). The lower portion of the middle panel in Table 2 presents summary statistics on such measures across our solicitors. Again, there is variation in these measures across our four treatments.

We examine the role of personality attributes on solicitor earnings by augmenting vectors X_{it} and Z_{it} with these five personality traits. Empirical estimates are presented in columns 2 and 4 of Table 3 and 7 and 8 of Table 4. Our empirical results suggest that solicitor self-efficacy and assertiveness are both marginally significant, with the former having a positive influence on the probability of a positive contribution (of roughly 4%) and the latter having a 3.2% negative influence. We again explore this result more thoroughly in ancillary regression models, and find that a one-unit increase in self-motivation and self-efficacy for the median white male solicitor – i.e., a white male solicitor with mean physical attributes – in the single-prize lottery treatment generates a 5.5% increase in the probability that the solicitor elicits a contribution from each household visited. Given that the average contribution level for households that contribute in the single-prize lottery treatment is $4.16 – a single unit increase in performance motivation and self-efficacy generates an increase in average contributions of approximately $0.23 (12.2 percent) per household approached. Overall, the set of empirical estimates leads us to our next result:

> *Result 5: Personality attributes are correlated with solicitor productivity. The effects of these personality traits are on the probability that the solicitor will elicit a contribution.*

Equally as important, however, are the findings reported in columns 9 and 10 of Table 4. In this "full-blown" empirical model, we find that measured treatment and personal attractiveness effects remain strongly significant, lending further support to Results 1-4. And, in ancillary regression models, all of the results noted above hold in the "full-blown" empirical model. We discuss this in greater detail below.

Social Connection and Giving Behavior

Our theoretical model highlights the importance of credibility. Given the uncertainty regarding the credibility of charitable organizations, actions that signal quality might increase individual contribution levels. If a similar phenomenon occurs at the individual level – potential donors trust (and prefer) solicitors of like social groupings more than those of different social groupings – then one might expect to see differential rates of giving between solicitors and donors of similar race and/or gender.

The bottom panel of Table 2 summarizes the racial and gender composition of our solicitors and the households visited across our four experimental treatments. One stark feature of the data is the high percentage of potential donors approached who are Caucasian relative to the percentage of Caucasian solicitors. Between 85% to 91% of the households were Caucasian. In contrast, the percentage of Caucasian solicitors employed ranges from 50% to 72%. Across all four treatments, the percentage of both Caucasian male and female solicitors is less than the percentage of households of the corresponding racial and gender mix at the $p < 0.05$ level using a two-sample test of proportions.

Table 6 summarizes the average contributions received per household at the solicitor level across our different treatments by social grouping. The figures can be read as follows: the average Caucasian solicitor raised \$1.68 when visiting a household of the same race, and when the identical solicitor approached a household of a different race the solicitor raised on average \$0.95. In the pooled data, the difference in contributions between Caucasian and non-Caucasian households to Caucasian solicitors (\$0.73 = \$1.68−\$0.95) is larger than the comparable difference among non-Caucasian solicitors (\$0.53 = \$1.31−\$0.78), suggesting that, upon controlling for solicitor-specific effects by exploiting purely within person deviations, there is a tendency for Caucasian households to give more to Caucasian solicitors. The difference is roughly on the order of 40%. If one simply is agnostic about solicitor effects, then a simple comparison between \$1.68 and \$1.31 (column 1, rows 1 and 2 of Table 6) yields similar insights.

Alternatively, if one considers differences along gender lines, the data suggest that male solicitors secure on average \$0.19 more from male households (\$1.39-\$1.20), whereas women secured on average \$0.58 (\$1.86-\$1.28) more from male households, suggesting that even after solicitor effects are controlled, there is a tendency for male households to give more to women solicitors than to male solicitors. Upon more carefully examining these data in a fully-interactive regression model similar to equations (8) and (9), we find that the \$0.58 difference is largely due to more physically attractive women having greater success among male households, leading to our final result:

Result 6: There is some evidence of social connection among racial groups, but not among genders.

The first portion of *Result 6* is consistent with the recent laboratory evidence that suggests trusting behavior and trustworthiness rise with social connection (see, e.g., Glaeser et al., 2000; Fershtman and Gneezy, 2001). The latter part of *Result 6* provides a bound to this insight: examining gifts from male households, physically attractive female solicitors elicit higher contributions than male solicitors (of equal personal attractiveness), causing the social connection argument to break down between genders.[25]

Alternative Theoretical Interpretation

The goal of our theoretical framework is to provide a parsimonious model, allowing risk aversion and heterogeneous tastes, to compare the critical link between lotteries and public good provisioning. The model highlights that lotteries can outperform VCMs even when traditional explanations, such as risk loving behavior or consumption of gambling, are suppressed. Given that our field experiment provides a glimpse of behavior in the natural environment that our theory intends to explain, alone it cannot discriminate between such alternative explanations. What is necessary to explore the underlying structure at work is complementary evidence.

If the motive for giving in our lotteries is pure love of gambling or risk-loving behavior, then variation in the social value of the public good should have no effect on betting behavior. Further, under either of these alternative motives, variation in the structure of the prize payment scheme should have no effect on giving rates. We present

[25] As a robustness check, it is important to discuss how our estimated treatment effects varied as we added numerous solicitor and household controls to the various specifications. A few general remarks hold. First, Results *1-6* are each robust to inclusion of the full complement of solicitor controls (age, race, gender, work experience, beauty, BMI, and personality scores) and household controls (age, gender, race, census block income level) in all models. For example, across all specifications, we find that households are *more* likely to contribute to the Hazards Center when contributions are linked to a chance of winning a lottery prize. Thus, the "double-dividend" result that we highlighted earlier is robust to quite demanding environments. Additionally, the effect of personal attractiveness remains robust, with estimates indicating that a one standard deviation increase in female solicitor physical attractiveness is roughly equivalent to the difference in gifts between the lotteries and VCMs. We provide one set of empirical estimates in Appendix D.

new experimental evidence, evidence from naturally-occurring data, and anecdotal evidence that is at odds with these alternative motives and in support of our theory.

For our experimental evidence, ideally we would have preferred to conduct a "pure" lottery field treatment to examine the relationship between the social value of the public good and betting behavior, but North Carolina statute § 14-309.15 states that it is illegal to run a raffle in North Carolina for which the proceeds do not go to a non-profit. We are, however, able to provide evidence from laboratory experiments to test this critical link.

In Appendix E, we describe our experimental design and present our data. In our setting, if agents de-link lottery contributions from the provision of the public good, then altering the marginal per capita return (MPCR) to such contributions should not impact contributions. Figure E summarizes average contribution levels for agents within each of the three different MPCR levels across both the single- and multiple-prize lottery treatments. As illustrated in the figure, average contribution levels are increasing in the per capita return to the public account. In the single-prize lottery, average contribution levels for agents with an MPCR of 0.10 is approximately 45 percent of the original endowment (100 tokens). As the MPCR increases to 0.90, the average contribution level increases to approximately 75 percent of the original endowment. A similar pattern of behavior emerges for the multiple-prize lottery. Such a pattern of behavior is inconsistent with a "love of gambling" theory and provides support for our theoretical model.

We have also gathered naturally-occurring data in an effort to understand the causes of the data patterns observed in our field experiment. Our approach is to compare annual per capita lottery expenditures across states that earmark lottery proceeds for primary education versus those that allocate lottery proceeds to the state's "general fund".[26] If agents de-link lottery contributions from the provision of the public good, then we would not expect there to be any differences in per capita lottery expenditures.

Using state-level panel data from 1990-2000, we estimated several empirical models that regressed the natural logarithm of annual per capita lottery expenditures on a vector of regressors, including a dichotomous variable for the earmarking of lottery proceeds. We included state and year fixed/random effects in some models and clustered the standard errors by state in other models. Empirical estimates from these models provide insights suggestive of the importance of linking lottery purchases with the provision of a public good: per capita lottery expenditures are greater when proceeds are earmarked for primary education versus the state's general fund, with this difference being statistically significant at the $p < 0.05$ level across these various specifications.

Further empirical support of our theory can be obtained by recognizing that the jackpot "rollover" characteristic of many naturally-occurring lotteries presents a useful natural experiment about lottery motives. For example, Cook and Clotfelter (1993) show that the betting response to the rollover amount is disproportionate compared to the pari-mutuel part. This is consistent with our theory but inconsistent with the proposed alternatives.[27]

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[26] From 1990-2000, we observe per capita lottery expenditures in twelve states that exclusively allocated proceeds to the state's general fund, nine states that earmarked funds exclusively for primary education, and six states that switched the allocation of lottery proceeds between the state's general fund and primary education. Of the six states that switched how lottery proceeds were allocated, Montana went from designating funds for primary education to the state's general fund. The remaining five states changed the designation of lottery proceeds from the state's general fund to primary education. All data on lottery revenue come from the United States Bureau of the Census, *State Government Finances*, series GF, No. 3 annual. Population data are taken from the 2004-2005 *Statistical Abstract of the United States*.

[27] See also the laboratory evidence in Dale (2004).

Finally, there is considerable anecdotal evidence in support of the linkage as well, as noted by comments from a Pennsylvania official who stated (Douglas, 1995, p. 365): "One of the secrets of the Pennsylvania lottery is having targeted the proceeds. And having the public know where the money goes really seems to help ticket sales."[28]

V. Concluding Remarks

This study moves toward an understanding of the economics of charity by exploring the demand side of charitable fundraising. We approached nearly 5000 households in an actual door-to-door fundraiser designed to test our theory while simultaneously raising capital for the Natural Hazards Mitigation Research Center. Following our theoretical model, we randomly divided solicitors into four distinct treatments, two that made use of variants of the popular voluntary contribution mechanism and two that used lotteries.

Empirical results provide confirmation of our theoretical predictions – lottery treatments raised roughly 50% more in gross proceeds than our VCM treatments. This result is driven largely by greater participation rates in the lotteries, as lotteries increase participation rates by roughly 100%. As such, this finding highlights an attractive feature of lotteries that is rarely discussed: they provide fundraisers with a tool to generate "warm lists." Interestingly, this result has several analogs in the economics literature. For example, inducing participation among agents who would otherwise not participate is at the crux of the seminal work on the success of certain types of government

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[28] As an aside, consider another piece of anecdotal evidence. Suppose that risk-loving motives were paramount. In this case, if one assumed the analog of decreasing absolute risk aversion, then richer individuals would be the most risk-loving and hence the most likely to play lotteries. We tested this conjecture by regressing lottery bets on income. Rather than finding a positive coefficient, we found a negative estimate. Thanks to John Morgan for pointing us in this direction and providing the citation.

procurement contracts (McAfee and McMillan, 1989). Whereas these authors are concerned with minimizing costs—they find that granting price preferences to certain bidders can *reduce* expected contracting costs—the underlying mechanism works in much the same manner that lotteries operate to induce higher revenues. Other parallels to this finding can be found in the mechanism design literature for publicly provided public goods, auction design, and the like.

We also find that a one-standard deviation in physical attractiveness among women solicitors is roughly equivalent to the increase in contributions when we move from the VCM to the lottery treatments (or ≈ 50%-100%). This result is largely driven by increased participation rates among male households. Such a finding is interesting in light of the fact that there is little evidence on the relative efficacy of institutional and non-institutional factors. In this sense, it is surprising to find that a change from the most inferior treatment (VCM) to perhaps one of the most attractive (lotteries), in a theoretical sense, yields a treatment effect that is similar to a one-standard deviation change in personal attractiveness.

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Table 1: Experimental Design

	Session 1 Oct 2nd – 3rd	Session 2 Oct 23rd – 24th	Session 3 Nov 6th – 7th	Session 4 Nov 13th
VCM 7 Solicitors	3 Solicitors 607 Approach 208 Home	4 Solicitors 579 Approach 238 Home		
VCM – Seed $1000 Donation 12 Solicitors	3 Solicitors[29] 173 Approach 51 Home	6 Solicitors 662 Approach 236 Home	3 Solicitors 447 Approach 166 Home	
Single-Prize $1000 Prize 10 Solicitors	2 Solicitors 186 Approach 56 Home	5 Solicitors 515 Approach 194 Home	3 Solicitors 262 Approach 113 Home	
Multiple-Prize 4 Prizes - $250 15 Solicitors	3 Solicitors 248 Approach 99 Home	4 Solicitors 440 Approach 148 Home	4 Solicitors 393 Approach 115 Home	4 Solicitors 321 Approach 131 Home

Note: Each cell represents one unique session in which we gathered data using one of the four treatments – VCM, VCM with Seed Money, Single-Prize Lottery, and Multiple-Prize Lottery. For example, row 1, column 1, denotes that session one of the VCM treatment employed three solicitors that approached a total of 608 houses, of which 208 answered the door. Each solicitor participated in a single session and each household was approached by a single solicitor.

[29] In this treatment, the solicitors worked only 5 hours on Saturday before quitting.

Table 2: Summary Statistics

	VCM	VCM with Seed Money	Single-Prize Lottery (SPL)	Multiple-Prize Lottery (MPL)
Total Households Approached	1186	1282	963	1402
Total Households Home	446	453	363	493
# of Households that Contributed	113	67	165	177
Percent of Households Contributing	25.3%	14.8%	45.5%	35.9%
Total Amount Raised	$452.27	$526.00	$688.04	$752.00
Average Conditional Contribution	$4.00 (3.62)	$7.85 (7.97)	$4.17 (5.74)	$4.25 (4.66)
Average Donation per Household that answered the door	$1.01 (2.52)	$1.16 (4.13)	$1.89 (4.39)	$1.52 (3.45)
Solicitor Characteristics				
Total # of Solicitors	7	12	10	15
Average Earnings per Hour	$5.71	$4.35	$7.13	$5.81
Mean Beauty Rating	0.31 (0.69)	0.03 (0.64)	0.04 (0.68)	-0.12 (0.58)
Mean Body Mass Index	22.91 (4.04)	21.60 (2.21)	27.11 (6.71)	25.51 (5.93)
% of Male Caucasian Solicitors	28.6%	16.7%	40%	33.3%
% of Female Caucasian Solicitors	42.8%	33.3%	30%	26.7%
% of Male Non-Caucasian Solicitors	14.3%	33.3%	10%	13.3%
% Female Non-Caucasian Solicitors	14.3%	16.7%	20%	26.7%
Mean Sociability	5.28 (1.98)	5.17 (2.48)	4.5 (2.22)	5.33 (2.50)
Mean Assertiveness	6 (2.16)	4.75 (2.22)	5.3 (1.7)	6.27 (1.22)
Mean Self-Efficacy	5.14 (1.86)	4.33 (1.97)	5 (2.26)	4.6 (2.02)
Mean Performance Motivation	5.28 (2.63)	4.92 (1.93)	5.4 (2.32)	6.20 (1.7)
Mean Self-Confidence	4.28 (2.43)	5.67 (1.87)	5.9 (1.79)	5.4 (1.88)
Household Characteristics				
Percent of Households – Male Caucasian	43.7%	46.2%	47.1%	40.4%
Percent of Households – Female Caucasian	46.9%	41.6%	38.0%	46.5%
Percent of Households – Male Non-Caucasian	4.0%	5.5%	6.1%	6.7%
Percent of Households – Female Non-Caucasian	3.4%	4.6%	8.0%	6.3%
Estimated Average Age	42.3 (14.4)	38.6 (13.8)	43.1 (13.1)	44.2 (12.4)

Note: Figures in the table represent summary statistics across the different treatments.

Table 3: Household Contribution Decisions

	Model A $’s Donated	Model B $’s Donated	Model A Pr (C_{ij} > 0)	Model B Pr (C_{ij} > 0)
Constant	1.06** (0.20)	1.10** (0.53)	-0.60** (0.09)	-0.51* (0.28)
Seed Money	0.29 (0.33)	0.55 (0.38)	-0.39** (0.16)	-0.29** (0.19)
SPL	1.00** (0.36)	0.89** (0.37)	0.54** (0.17)	0.52** (0.19)
MPL	0.79** (0.33)	1.04** (0.29)	0.43** (0.14)	0.52** (0.15)
Beauty		0.28 (0.19)		0.19* (0.10)
Solicitor Overweight BMI 25-29.9		0.57 (0.40)		0.11 (0.15)
Solicitor Obese BMI ≥ 30		-0.19 (0.31)		-0.004 (0.18)
Solicitor Underweight BMI < 18.5		-0.15 (0.55)		-0.14 (0.28)
Assertiveness		-0.12 (0.11)		-0.08 (0.05)
Confidence		-0.09 (0.07)		-0.02 (0.03)
Sociability		-0.08 (0.05)		-0.05** (0.02)
Self Efficacy		0.20** (0.09)		0.09** (0.04)
Performance Motivation		0.07 (0.06)		0.04 (0.03)
Weekend Fixed Effects	Yes	Yes	Yes	Yes
Clustered on Solicitor	Yes	Yes	Yes	Yes
# Observations	1754	1754	1754	1754

** Denotes significance at the $p < 0.05$ level; * Denotes significance at the $p < 0.10$ level

Note: Cell entries in columns 1 and 2 provide parameter estimates for a linear regression model of contribution levels (including the zeroes) for our experiment. Cell entries in columns 3 and 4 provide parameter estimates for a model estimating the probability that a household made a contribution to the Hazards Center. Standard errors are in parentheses and have been clustered around individual solicitor effects. Cell entries can be read as follows – average contribution levels in the SPL treatment (column 1, row 3) are approximately $1.00 greater than those for our baseline VCM treatment. Furthermore, agents in this treatment (column 3, row 3) are more likely to contribute to the Hazards Center than in the VCM.

Table 4: Regression Estimates

	Selection	Contribution Level	Selection	Contribution Level	Selection	Contribution Level	Selection	Contribution Level	Selection	Contribution Level
	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b	Model 4a	Model 4b	Model 5a	Model 5b
Constant – Baseline VCM	-0.62** (0.15) [27.1%]	39.51** (18.23) [$3.99]	-0.73** (0.16) [23.6%]	35.56** (10.12) [$3.38]	-0.59** (0.15) [27.8%]	29.59^ (16.25) [$4.23]]	-0.51^ (0.28) [30.5%]	7.63 (8.55) [$3.28]	-0.54* (0.28) [24.8%]	8.25 (6.29) [$3.13]
Seed Money Treatment	-0.37* (0.19) [-9.00%]	-8.04* (6.12) [$3.54]	-0.31^ (0.18) [-8.7%]	-5.35^ (3.15) [$4.37]	-0.39* (0.19) [-11.4%]	-5.20 (5.90) [$3.62]	-0.35^ (0.19) [-11.0%]	3.59 (2.56) [$4.82]	-0.30^ (0.8) [-9.6%]	3.63* (1.78) [$5.03]
SPL Treatment	0.61** (0.19) [23.3%]	26.98** (13.55) [$1.13]	0.68** (0.18) [24.4%]	30.29** (9.45) [$1.65]	0.64** (0.21) [24.2%]	19.06 (12.12) [-$0.01]	0.57** (0.19) [21.9%]	3.85 (5.42) [$1.28]	0.57** (0.20) [24.8%]	4.09 (4.37) [$0.75]
MPL Treatment	0.41** (0.19) [14.6%]	17.12** (8.59) [$0.84]	0.47** (0.18) [16.1%]	20.23** (6.30) [$1.38]	0.41* (0.18) [15.1%]	12.13 (7.52) [$0.49]	0.47** (0.18) [17.9%]	3.11 (4.25) [$1.04]	0.51** (0.17) [16.5%]	3.96 (3.59) [$1.02]
Normalized Beauty Rating			0.16^ (0.11) [6.36%]	7.19** (2.23) [$0.61]					0.18^ (0.11) [5.17%]	1.40 (1.48) [$0.44]
Underweight BMI < 18.5					-0.05 (0.39) [-1.9%]	-2.48 (2.25) [$3.49]			-0.19 (0.39) [0.8%]	-0.19 (2.53) [$0.71]
Overweight BMI 25-29.9					-0.07 (0.20) [-2.8%]	-1.27 (1.59) [$0.73]			0.08 (0.18) [-1.2%]	1.71^ (0.99) [$1.28]
Obese BMI ≥ 30					-0.23 (0.18) [-9.1%]	-7.61^ (4.33) [-$6.25]			-0.07 (0.19) [-5.99%]	-0.77 (1.14) [-$0.41]
Solicitor Self-Confidence							-0.02 (0.04) [-0.8%]	-0.32 (0.26) [-$0.25]	-0.02 (0.04)	-0.40 (0.25) [-$0.30]
Solicitor Assertiveness							-0.08* (0.04) [-3.2%]	-0.27 (0.71) [$0.06]	-0.09* (0.04)	-0.40 (0.61) [$0.07]
Performance Motivation							0.04 (0.03)	0.13 (0.36)	0.05^ (0.03)	0.31 (0.39)

							[1.6%]	[-$0.04]		[$0.03]
Solicitor Sociability							-0.04 (0.03) [-1.6%]	-0.15 (0.35) [$0.01]	-0.04 (0.03)	-0.22 (0.31) [$0.01]
Solicitor Self-Efficacy							0.10* (0.04) [3.98%]	0.62 (0.84) [$0.22]	0.09* (0.04)	0.65 (0.57) [$0.20]
Mills Ratio		-78.83* (40.29)		-80.46** (25.49)		-54.70 (34.64)		-8.284 (16.919)		-10.54 (13.09)
Weekend Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of Observations	1754	522	1754	522	1754	522	1754	522	1754	522

** Denotes statistical significance at the $p < 0.01$ level; * Denotes statistical significance at the $p < 0.05$ level; ^ Denotes statistical significance at the $p < 0.10$ level

Note: Cell entries in Columns 1, 3, and 5 are the parameter estimates for the first-stage selection model. The selection process is estimated using a random-effects probit model. Cell entries in Columns 2, 4, and 6 are the parameter estimates from the second stage random effects model of contribution levels conditioned on non-zero donations. Standard errors are in parentheses and marginal probabilities (marginal effects) are in brackets. Marginal probabilities for beauty, the body mass index indicators, and personality traits were calculated as the difference of $\text{Prob}[Z \leq 0 + \beta_i]$ and $\text{Prob}[Z \leq 0]$ and are thus upper bounds on the underlying marginal probabilities. The marginal probability for the i^{th} treatment effect was calculated as the difference between $\text{Prob}[Z \leq \beta_{VCM} + \beta_i]$ and $\text{Prob}[Z \leq \beta_{VCM}]$. Marginal effects for the treatments are calculated at the mean values of the Mills ratio and weekend dummies and are the difference between contributions in the VCM and the given treatment.

Table 5: Predicted Contributions and Personal attractiveness – Majority Female Solicitor

	Pooled VCM Treatments	**Pooled Lottery Treatments**
$E\left(C_{it} \middle| Beauty = 0\right)$	\$0.99	\$2.17
$E\left(C_{it} \middle| Beauty = 1\right)$	\$2.19	\$3.23
$\Pr\left(C_{it} > 0 \middle| Beauty = 0\right)$	17.6%	43.7%
$\Pr\left(C_{it} > 0 \middle| Beauty = 1\right)$	37.5%	60.7%
$E\left(C_{it} \middle| C_{it} > 0, Beauty = 0\right)$	\$5.65	\$4.97
$E\left(C_{it} \middle| C_{it} > 0, Beauty = 1\right)$	\$5.84	\$5.33

Note: Cell entries are estimated probabilities and conditional contributions (from Columns 3 and 4 in Table 8) for a majority female solicitor with indicated personal attractiveness ranking. Both the estimated probabilities and conditional contribution levels are evaluated at the treatment mean values (see Table 2) for all model covariates except personal attractiveness. Cell entries can be read as follows: in the VCM treatments, a majority female solicitor with mean beauty ranking (beauty ranking = 1) is predicted to elicit contributions from 17.6% (37.5%) of the households visited. The conditional contribution for such a solicitor is \$5.65 (\$5.84), which generates an expected contribution per household of \$0.99 (\$2.19).

Table 6: Average Contributions per House by Social Connection – Solicitor Level

	All Data	*VCM*	*Seed*	*SPL*	*MPL*
Caucasian Solicitor					
Same Race	$1.68** (1.06)	$1.23 (0.47)	$1.55** (1.37)	$2.42* (0.90)	$1.43 (1.04)
Different Race	$0.95 (1.15)	$1.29 (0.74)	$0.00	$1.12 (1.06)	$1.28 (1.49)
Non-Caucasian Solicitor					
Same Race	$0.78 (1.29)	$0.21 (0.30)	$1.50 (2.38)	$0.43 (0.21)	$0.67 (0.77)
Different Race	$1.31** (0.89)	$0.55 (0.19)	$0.97 (0.99)	$1.67** (0.87)	$1.72** (0.80)
Male Solicitor					
Same Gender	$1.39 (1.19)	$0.76 (0.38)	$1.04* (1.30)	$2.67* (1.09)	$1.04 (0.79)
Different Gender	$1.20 (0.96)	$0.67 (0.48)	$0.42 (0.37)	$2.14 (0.79)	$1.43 (0.94)
Female Solicitor					
Same Gender	$1.28 (0.78)	$1.05 (0.52)	$1.09 (0.58)	$1.33 (1.07)	$1.50 (0.87)
Different Gender	$1.86** (1.28)	$1.51* (0.60)	$2.11 (1.87)	$1.90 (0.85)	$1.81 (1.41)

** Denotes statistical significance at the $p < 0.05$ level using a matched pairs t-test
* Denotes statistical significance at the $p < 0.10$ level using a matched pairs t-test

Note: Cell entries are the solicitor average for mean donations per household visited across social connection. Standard deviations are in parentheses. For example, a Caucasian solicitor approaching a household of the same race in the VCM treatment would expect to raise $1.68 on average. The same solicitor approaching a household of a different race would expect to raise $0.95 on average.

Figure 1: Percent of Households Contributing – Solicitor Level

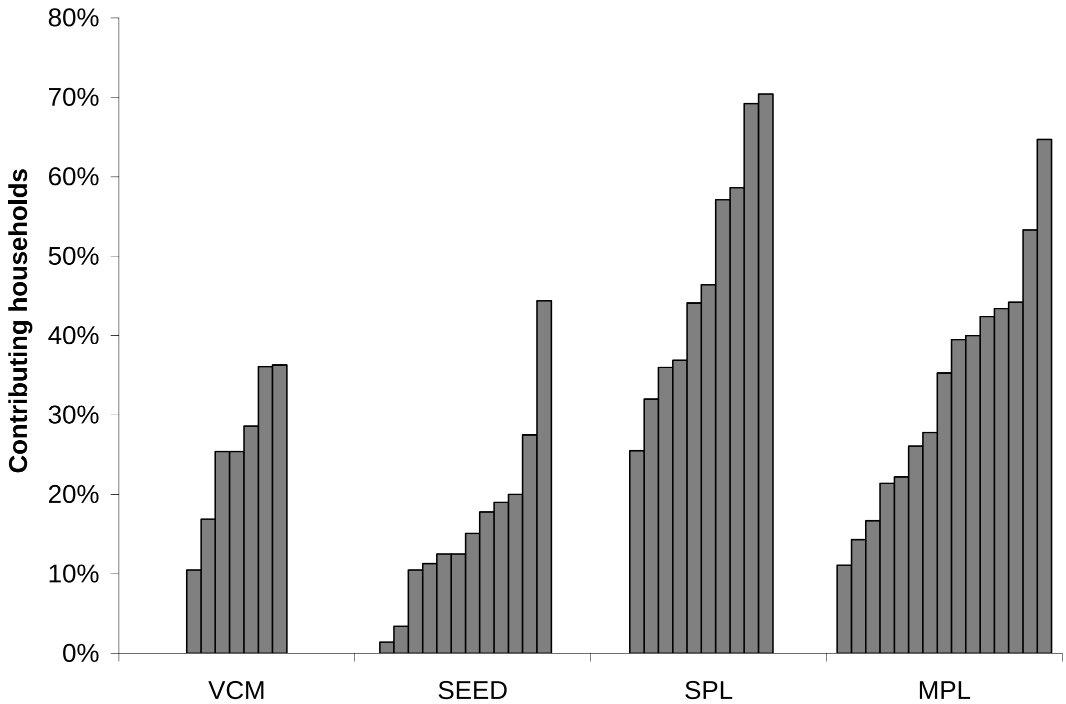
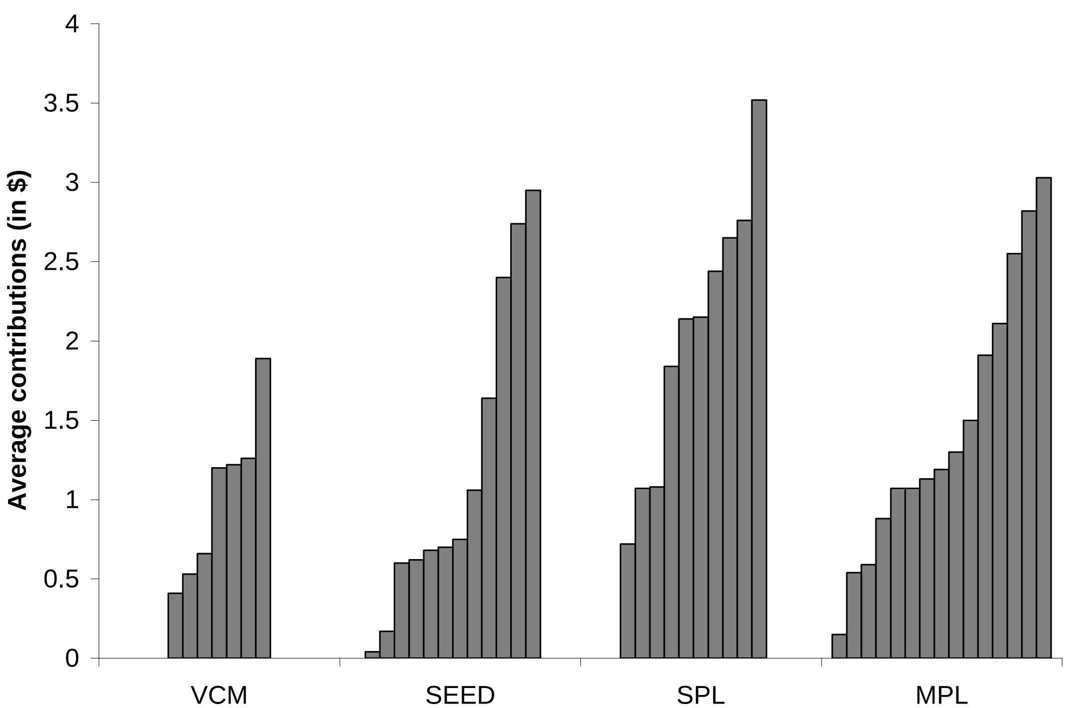


Figure 2: Average Contributions per Household – Solicitor Level



Appendix A – Proofs of Propositions

Proof of Proposition 1:

From the first-order conditions (2) and (3) we obtain that b^S and b^{nS} are smaller than the contribution level b^{VCM} given by $u'(w-b^{VCM}) = \mu^S h'(nb^{VCM}) + \gamma f'(b^{VCM})$. For the symmetric equilibrium under lottery $L \in \{SPL, MPL\}$, condition (5) reads as

$$\begin{aligned} &-u'(w-b) + \mu^L h'(nb) + \gamma f'(b) \\ &= -H^L \frac{1}{nb}[u(w-b+P^L) - u(w-b)] + \pi_i^L [u'(w-b+P^L) - u'(w-b)] \\ &< 0 \end{aligned} \tag{A1}$$

where H^L was defined in footnote 9. The inequality in condition (A1) immediately implies the claim for $\mu^S \le \mu^L$. The ambiguity for the case $\mu^S > \mu^L$ can easily be seen by choosing $\mu^S > \mu^L = 0$ and $\gamma = 0$.

Proof of Proposition 2:

In order to compare contributions to the two lotteries, we have only to compare the respective right-hand sides (RHS) of (A1): If RHS^{MPL} is larger (smaller) than RHS^{SPL} when evaluated at b^{SPL}, b^{SPL} is larger (smaller) than b^{MPL}. Consider first the case of small risk-aversion in the extreme of risk neutrality. Here,

$$RHS^L \to u'(w-b)\left[-H^L \frac{1}{nb} P^L\right]$$

which implies as $H^{SPL}P^{SPL} = \frac{n-1}{n} P > \left[2\frac{n-1}{n} - \frac{1}{n-1}\right] P/2 = H^{MPL}P^{MPL}$ that $b^{SPL} > b^{MPL}$.

For the other extreme of infinite risk-aversion, $-u''(\cdot)/u'(\cdot) \to \infty$, we obtain using $H^{SPL} = \frac{n-1}{n}$ and $H^{MPL} = 2\frac{n-1}{n} - \frac{1}{n-1}$:

$$\frac{RHS^{SPL}}{RHS^{MPL}} = \frac{-\frac{n-1}{n}\frac{1}{nb}[\int_0^P \frac{u'(w-b+z)}{u'(w-b)} dz] + \frac{1}{n}[\frac{u'(w-b+P)}{u'(w-b)} - 1]}{-\left(2\frac{n-1}{n} - \frac{1}{n-1}\right)\frac{1}{nb}[\int_0^{P/2} \frac{u'(w-b+z)}{u'(w-b)} dz] + \frac{2}{n}[\frac{u'(w-b+P/2)}{u'(w-b)} - 1]}$$

$$< \frac{-2\frac{n-1}{n}\frac{1}{nb}[\int_0^{P/2} \frac{u'(w-b+z)}{u'(w-b)} dz] + \frac{1}{n}[\frac{u'(w-b+P)}{u'(w-b)} - 1]}{-2\frac{n-1}{n}\frac{1}{nb}[\int_0^{P/2} \frac{u'(w-b+z)}{u'(w-b)} dz] + \frac{2}{n}[\frac{u'(w-b+P/2)}{u'(w-b)} - 1]}$$

which, using $u'(w-b+z)/u'(w-b) \to 0$ (for $z > 0$, $-u''(\cdot)/u'(\cdot) \to \infty$) implies $RHS^{SPL}/RHS^{MPL} < 1$, i.e. $0 > RHS^{SPL} > RHS^{MPL}$, and therefore $b^{SPL} < b^{MPL}$ for sufficiently large levels of risk aversion.

Ranking of Single vs. Multi-prize lotteries – Heterogeneity

To see the ambiguity in comparing the revenues of the two lotteries consider the case where $\gamma = 0$. For symmetric agents, Proposition 2 implies that *MPL* yields less than *SPL*. However, examples can easily be constructed where contributions increase by splitting the prize: assuming 2 agents with $h'_{high}(B) = 1 - B/50$ and another $n-2$ agents with $h'_{low}(B) = 1 - B/25$, we obtain (i) zero contributions under the VCM, (ii) a socially optimal provision level of $G^* = 25$, (iii) in lottery *SPL* zero contributions of the low valuation player, total contributions of $B^{SPL} = 5P^{1/2}$ by the two high-value players (from condition (A2)), (iv) participation of the remaining $n-2$ players in lottery *MPL* (from condition (3)), and (v) a higher total contribution level in *MPL* than in *SPL* if and only if $n \geq 10$ (using numerical methods).

Proof of Proposition 3:

We assume that all agents are risk neutral, i.e. without loss of generality $u'(\cdot) = 1$ and that $\mu = \mu^S = \mu^L$. In order to compare lotteries with a VCM, let k denote the number of agents with highest marginal valuation $h_1'(G) = ... = h_k'(G) > h_{k+1}'(G)$, i.e. the number of participants in the VCM with seed treatment which gives $\mu h_i'(B^S + P) + \gamma f'(B^S / k) = 1$ ($i = 1,...,k$). Consider incentives of player $k+1$ to contribute in the single prize lottery *SPL* (condition (5). She will contribute if and only if

$$-1 + \mu h_{k+1}'(B^{k,SPL}) + \gamma f'(0) + P / B^{k,SPL} > 0 \qquad \text{(A2)}$$

where $B^{k,SPL}$ is given by the total contribution level in *SPL* if only the *k* highest value players contribute:

$$(1 - \mu h_k'(B^{k,SPL}) - \gamma f'(B^{k,SPL} / k))B^{k,SPL} = P(k-1)/k\,. \qquad \text{(A3)}$$

As $P / B^{k,SPL} > 0$ is increasing in *P*, gets the participation of additional players the more likely the larger the prize level is. An analogous argument holds for the 2 prize lottery *MPL*. Here, player $k+1$ will contribute if and only if

$$-1 + \mu h_{k+1}'(B^{k,MPL}) + \gamma f'(0) + P / B^{k,MPL} + P/(2B^{k,MPL}(k-1)) > 0 \qquad \text{(A4)}$$

where $B^{k,MPL}$ would result as contributions in the 2-prize lottery if only the *k* highest value players participated:

$$(1 - \mu h_k'(B^{k,MPL}) - \gamma f'(B^{k,MPL} / k))B^{k,MPL} = P(k-1)/k - P/(2(k-1))\,. \qquad \text{(A5)}$$

Thus, player $k+1$ will contribute in *SPL* if

$$\frac{1 - \mu h_{k+1}'(B^{k,SPL}) - \gamma f'(0)}{1 - \mu h_k'(B^{k,SPL}) - \gamma f'(B^{k,SPL} / k)} < \frac{k}{k-1} =: T^{SPL}$$

and in *MPL* if

$$\frac{1 - \mu h_{k+1}'(B^{k,MPL}) - \gamma f'(0)}{1 - \mu h_k'(B^{k,MPL}) - \gamma f'(B^{k,MPL} / k)} < \frac{1 + 1/(2(k-1))}{(k-1)/k - 1/(2(k-1))} =: T^{MPL}\,.$$

It is easily shown that $T^S < T^M$. In general, it therefore depends on the curvature of $h'_k(\cdot)$, $h'_{k+1}(\cdot)$, and $\gamma f'(\cdot)$, and the comparison of $B^{k,MPL}$ and $B^{k,SPL}$ whether or not it is more likely that agent $k+1$ participates in *MPL* than in *SPL*. □

<u>Appendix B – Solicitation Scripts</u>

ECU Center for Natural Hazards Mitigation Research - Script

(If a minor answers the door, please ask to speak to a parent. Never enter a house.)

Hi, my name is ______________________. I am an **ECU student** visiting Pitt County households today on behalf of the newly formed *ECU Natural Hazards Mitigation Research Center*.

(Hand the blue brochure to the resident).

You may recall **hurricanes Dennis and Floyd** five years ago led to **widespread devastation** in Eastern North Carolina, hence the State authorized the new *Hazards Center*.

This research center will provide **support and coordination for research on natural hazard risks**, such as *hurricanes, tornadoes*, and *flooding*.

The primary goal of the center is to <u>reduce the loss of life and property damages due to severe weather events</u>.

We are collecting contributions today on behalf of the new *ECU Hazards Center*. The Center is a <u>non-profit organization</u>.

(Single-Prize Lottery)

<u>To raise funds for the new ECU Hazard Center we are conducting a charitable raffle</u>:

- **The winner receives a <u>$1,000 prepaid MasterCard</u>.**
- **For every dollar you contribute, you will receive 1 raffle ticket.**
- **The odds of winning this charitable raffle are based on your contribution and total contributions received from other Pitt County households.**
- **The charitable raffle winner will be drawn at the Center on December 17th at noon. The winner will be notified and the results posted on the Center's web site.**
- **<u>All proceeds</u> raised by the raffle will fund the Hazards Center, which is a non-profit organization.**

Would you like to make a contribution today?

*(If you receive a contribution, please write a receipt that includes their **name and contribution amount)***.

(solicitors in the VCM (lottery) treatments were told that if the resident asks, contributions are (not) tax deductible).

If you have questions regarding the Center or want additional information, there is a phone number and web site address provided on the back of this blue brochure.

Thank you.

Appendix C – Personality Questionnaire

Assertiveness
1. I take control of things (Positive Frame)
2. I express myself easily (Positive Frame)
3. I am not highly motivated to succeed (Negative Frame)
4. I cannot come up with new ideas (Negative Frame)

Sociability
1. I talk to a lot of different people at parties (Positive Frame)
2. I am skilled in handling social situations (Positive Frame)
3. I have difficulty expressing my feelings (Negative Frame)
4. I often feel uncomfortable around other people (Negative Frame)

Self-Efficacy
1. I formulate ideas clearly (Positive Frame)
2. I am able to think quickly (Positive Frame)
3. I undertake few things on my own (Negative Frame)
4. I never challenge things (Negative Frame)

Performance Motivation
1. I set high standards for myself and others (Positive Frame)
2. I do more than what is expected of me (Positive Frame)
3. I do just enough work to get by (Negative Frame)
4. I think that in some situations it is important that I not succeed (Negative Frame)

Self-Confidence
1. I just know that I will be a success (Positive Frame)
2. I have a lot of personal ability (Positive Frame)
3. I often think that there is nothing I can do well (Negative Frame)
4. I question my ability to do my work properly (Negative Frame)

Appendix D: Regression Results with Controls for Household Characteristics

	Model A		Model B	
	1st Stage	2nd Stage	1st Stage	2nd Stage
Constant	-0.66** (0.29)	3.24 (4.25)	-.61** (0.28)	5.74 (4.39)
Seed	-0.26 (0.17)	3.84** (1.34)	-0.28* (0.17)	4.08** (1.42)
SPL	0.66** (0.20)	2.67 (3.75)	0.62** (0.19)	1.88 (3.51)
NPL	0.60** (0.17)	2.31 (3.22)	0.57** (0.17)	1.69 (3.06)
White Male Beauty	-0.18 (0.23)	-2.94* (1.59)	-0.21 (0.24)	-2.89* (1.69)
White Female Beauty	0.48** (0.15)	1.92 (2.76)	0.45** (0.15)	1.33 (2.67)
Non-White Male Beauty	-0.14 (0.22)	2.98** (1.37)	-0.16 (0.22)	2.87** (1.40)
Non-White Female Beauty	0.23 (0.17)	0.42 (1.64)	0.23 (0.17)	0.12 (1.65)
Under Weight BMI < 18.5	-0.06 (0.38)	-0.09 (2.34)	-0.11 (0.38)	-0.56 (2.37)
Over-Weight BMI 25 – 29.9	0.04 (0.17)	0.77 (0.88)	0.05 (0.17)	0.76 (0.90)
Obese BMI ≥ 30	-0.10 (0.17)	-0.78 (1.09)	-0.09 (0.18)	-0.68 (1.07)
Solicitor Self-Confidence	-0.03 (0.04)	-0.30 (0.26)	-0.03 (0.04)	-0.25 (0.24)
Solicitor Assertiveness	-0.08** (0.04)	-0.09 (0.47)	-0.09** (0.04)	-0.09 (0.49)
Performance Motivation	0.08** (0.03)	0.28 (0.43)	0.08** (0.03)	0.23 (0.43)
Solicitor Sociability	-0.03 (0.03)	-0.01 (0.17)	-0.03 (0.03)	0.002 (0.17)
Solicitor Self-Efficacy	0.06 (0.04)	0.22 (0.36)	0.06 (0.04)	0.21 (0.35)
Household over 60	-0.25** (0.09)	-0.21 (1.45)	-0.26** (0.08)	-0.001 (1.45)
Household under 30	-0.36** (0.12)	-1.20 (1.93)	-0.37** (0.12)	-0.96 (1.94)
White Household	-0.06 (0.11)	1.89** (0.78)		
Male Household	0.09 (0.07)	1.07* (0.62)		
White Female Household			-0.07 (0.07)	-1.06* (0.59)
Non-White Male Household			0.12 (0.15)	-2.13* (1.16)
Non-White Female Household			-0.06 (0.15)	-2.79** (1.09)
Weekend Fixed Effects	Yes	Yes	Yes	Yes
Mills Ratio		-5.81 (9.65)		-4.01 (9.60)
Number of Observations	1734	517	1754	522

** Denotes statistical significance at the $p < 0.05$ level; * Denotes statistical significance at the $p < 0.10$ level.

Note: Cell entries provide parameter estimates for a two-stage sample selection model that includes controls for household characteristics. Standard errors are in parentheses.

Appendix E: Laboratory Experiments to Test Alternative Theories

To examine the impact of MPCR on contribution level in the single fixed-prize lottery (SPL) and a multiple-prize lottery (MPL) counterpart of the fixed-prize lottery, we ran a series of laboratory experiments that followed the basic design of Morgan and Sefton (2000). The data reported come from four different treatments (a single treatment each for the symmetric multiple-prize and single-prize lotteries and a single treatment each for the asymmetric counterparts of these lotteries). All treatments were conducted at the University of Maryland-College Park and are comprised of multiple sessions held on separate days with different subjects.

At the beginning of the session, each subject was seated at linked computer terminals that were used to transmit all decision and payoff information. The sessions each consisted of 12 rounds, the first two being practice. The subjects were instructed that the practice rounds would not affect earnings. Once the individuals were seated and logged into the terminals, a set of instructions and a record sheet were handed out. The subjects were asked to follow along as the instructions were read aloud. After the instructions were read and the subjects' questions were answered the first practice round began.

At the beginning of each round subjects were randomly assigned to groups of four. The subjects were not aware of whom they were grouped with, but they did know that the groups changed every round. Each round the subjects were endowed with 100 tokens. Their task was simple: decide how many tokens to place in the group account and how many to keep in their private account. The decision was entered in the computer and also recorded on the record sheet. When all subjects had made their choice, the computer would inform them of the total number of tokens placed in their group account, the number of points from the group account and the private account, as well as the number of bonus points earned. The payoff for the round was determined by summing the points from the group account, points from the private account, and any bonus points received. Once each of the subjects had recorded this information, the next round would begin.

The points for each round were determined as follows. For all sessions, subjects received 1 point for each token placed in their private account. In the sessions with symmetric valuations for the public good, they were awarded either 0.3 points for each token placed in the group account by themselves and other members of their group. In the sessions with asymmetric valuations for the public good, subjects were awarded wither 0.9 or 0.1 points for each token placed in the group account by themselves and the other members of their group.[30] Additionally each session had a different method for earning bonus points.

In the single fixed-prize lottery sessions, group members competed for a lottery prize of 80 points. Each subject's chance of the winning the prize was based on his or her contribution to the group account relative to the aggregate number of tokens placed in the group account by all group members. For the n-prize lottery sessions, group members

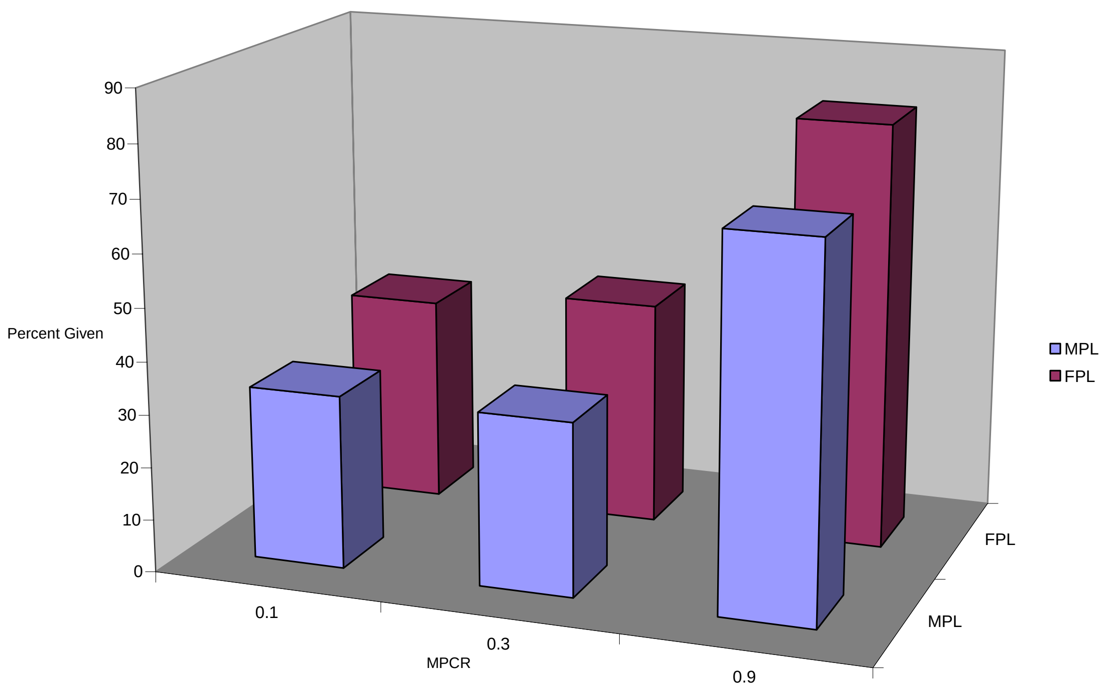
[30] In the asymmetric sessions, there was one agent in each group of four that had a valuation for the public account of 0.9 and three agents who had valuations of 0.1 for tokens placed in the group account. Individual valuations were held constant through the sessions and each group of four had exactly one member with the high valuation and three members with the low valuation.

competed for three lottery prizes of values 50, 20, and 10 points, respectively, where each agent could not win more than one prize. As in the single fixed-prize lottery sessions, a subject's chance of winning first prize was based on his or her share of group contributions. The three prizes were awarded in order of value and without replacement.

At the end of the session, one of the non-practice rounds was chosen at random as the round that would determine earnings. Subjects were paid $1.00 for every 15 points earned. In a second experiment, we obtained measures of individual risk aversion coefficients for every participant.

Figure E summarizes average contribution levels for agents with each of the four different MPCR levels across both the single- and multiple-prize lottery treatments.[31]

Figure E: Lottery Contributions as Function of MPCR in Laboratory Markets



Note: This figure reports the percentage of tokens contributed to the public account across a series of laboratory experiments. For each session, the total value of the prize provided to the lottery winners was held constant at 80 bonus points (approximately $5.33). The data provide information on 144 unique subjects – 36 subjects in each treatment with an MPCR = 0.30, 27 subjects in each treatment with an MPCR = 0.10, and 9 subjects in each treatment with an MPCR = 0.90.

[31] In terms of testing the alternative hypotheses, these results are in line with Morgan and Sefton (2000).