Using raffles to fund public goods: Lessons from a field experiment ☆

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ABSTRACT

Despite a long tradition of using lotteries, raffles and similar mechanisms to fund public goods, there has been little systematic study of the design features of these mechanisms and how the resulting incentives affect the level of provision. Partnering with a charity that provides public goods locally, we conducted a field experiment in which participants were randomly assigned to one of four raffle treatments to examine the effectiveness of alternative incentive schemes designed to encourage either participation or "volume." Contrary to theory which anticipates that gains can be made mostly on volume, our results indicate that significant revenue gains are available on both margins. Indeed, the large opportunity cost of using the standard linear raffle (in which the price per chance to win is fixed) that we find suggests the importance of mechanism design when considering the voluntary provision of public goods.

1. Introduction

The historical record suggests that voluntary contributions to fund public goods using mechanisms like lotteries and raffles have always been a viable alternative to taxation. The overseers of Roman public finance, for example, relied on both of these means to fund the Empire. Soon after Emperor Augustus started a lottery to fund the building of roads between 29 BCE and 14 CE, Nero raffled off horses and slaves to rebuild after the Rome fire of 64 CE (Baker, 1958). Considering the importance of educational lotteries to the finances of many American states (Jones, 2015), raffles and lotteries continue to be important fundraising mechanisms.

In the standard raffle, tickets are sold at a fixed price and therefore one's chance of winning is a simple linear function of one's expenditure. There is no reason to believe, however, that the standard linear scheme is optimal. The research question we consider is whether one can increase the level of provision by manipulating the incentives at both the extensive and intensive margins of the mechanism. On the extensive margin, we ask whether the allocation of winning chances can be redesigned to encourage participation and, if so, what the consequences for revenue might be. On the intensive margin, we ask whether the allocation mechanism can be redesigned to encourage donors to purchase more tickets, conditional on participation. Our field experiment was designed to examine these fundamental questions and to shed light on how mechanism design can affect the provision of public goods.

The related theoretical literature has shown that modeling charitable fundraisers by including "revenue proportional benefits" in models of familiar mechanisms like raffles and auctions is not innocuous and that important principles like revenue equivalence can fail. For our study this work implies that on theoretical grounds alone there is some reason to believe that a redesigned raffle could indeed enhance provision. For example, it is sometimes said

(e.g., Goeree et al., 2005) that raffles are just inefficient "all-pay auctions" because the participant who spends or "bids" the most is not a certain winner, just the most probable one. If participants with high valuations for the donated good purchased tickets expecting more than proportional increases in the likelihood of winning, they might spend more. In other words, a *convex* raffle in which the marginal number of tickets received increases as one spends more might extend the mechanism's intensive margin - conditional on participating at all, people might decide to purchase more tickets.

On the extensive margin, one reason that people seem to like to participate in raffles is the perception that everyone, even someone who purchases a single ticket, has a chance to win. This is broadly consistent with the Clotfelter and Cook (1990) "chance to buy hope" hypothesis, and with some anecdotal evidence reported in Carpenter et al. (2008). With this in mind, one could instead construct a *concave* raffle, in which the marginal number of tickets received actually decreases as participants spend more. Potential donors who are equity-minded, for example, might be more willing to participate because "anyone can win," especially in cases where the marginal cost of tickets rises very sharply after the first few.

It is worth underscoring, however, that these incentives work in opposite directions. In the concave raffle, more potential donors will participate but each will purchase a small(er) number of tickets, while in the convex raffle, fewer participants should each purchase more tickets. From a common reference point, say the expenditure of $5 for five tickets in each format, in the convex raffle participants should purchase more tickets because they find it easier to overcome the externality emitted from additional purchases by other participants. Here the marginal cost of another ticket falls and so if one's competitor buys another ticket reducing one's chances to win it is less costly to nullify this externality. This is different in the concave raffle, however. Here, because the marginal cost of another ticket is increasing, if your competitor buys another ticket, it is increasingly costly to recover.

Despite their implications for the provision of public goods, both the theoretical and empirical literatures on raffles are small. However, because the incentives of lotteries and all-pay auctions are related to those of raffles, it is important to situate our study in this broader (though still developing) literature. Beginning with theory, Morgan (2000) was influential because it integrated lotteries into the provision of a public good, showing that the combined mechanism could, in some circumstances, raise more money. However, the lottery mechanism posited by Morgan (2000) is the simple linear one mentioned above in which the chances of winning accumulate proportionately with the expenditure. As we see in Section 2, Morgan's model can be generalized by considering a more flexible contest success function like that proposed by Tullock (1980). In particular, when the chances of winning accrue disproportionately to very generous donors, the raffle converges to an all-pay auction similar to the models discussed in Goeree et al. (2005) and Engers and McManus (2007). Additionally, when the raffle/lottery aspect of this hybrid mechanism dominates the public good one, the large literature on contests is instructive (e.g., Baye et al., 1994; Szidarovszky and Okuguchi, 1997; Cornes and Hartley, 2005; Corchon, 2007 or Chowdhury and Sheremeta, 2011).

In the end, however, the question as to which margin matters more for raffle organizers is an empirical one. Informed by the existing theory and in the spirit of Mason's (2013) recent case for using field experiments to "put charity to the test," we conducted an experimental evaluation of the effects of convex and concave schemes on raffle revenues and the provision of a public good. We sold raffle tickets door-to-door in Addison County, Vermont to benefit a local charity and randomly assigned households to one of four treatments: a standard linear raffle in which the marginal number of tickets remained constant as one's expenditure increased, a convex raffle in which the marginal number of tickets received increased, and two

concave raffles in which the marginal number of additional tickets fell as one spent more. The two concave raffles differ in the severity of their incentives. In what we call the concave raffle, the marginal number of tickets falls gradually as one increases one's expenditure (a natural opposite of the convex raffle) and in what we call the "pay what you want" raffle every participant who contributes the minimum receives the same fixed number of tickets but (like Gneezy et al., 2010) is free to contribute whatever they like above the minimum. Here the incentives are sharp and fairness is particularly salient: every participant is allocated exactly the same number of tickets and there is no way to increase your chances of winning by spending more.

The predictions of our model on the extensive and intensive margins follow directly from the intuition provided above, though the ultimate question is which pricing scheme should raise the most money? We find that though the countervailing effects of convexity on efficiency and contributions are balanced to some extent by the effect on participation of making the raffle less convex, in the end the intensive margin dominates. In other words, theory predicts that to maximize contributions to the public good, the raffle organizer should opt for the convex raffle - though fewer people will participate, their comparatively large donations will more than compensate.

The results from our three more conventional treatments: the concave, linear and convex raffles jibe to a great extent with theory. Revenue per solicitation is lowest in the concave raffle, higher in the linear and greater still in the convex raffle. However, in the limit, the concave raffle converges to our pay what you want raffle (wherein additional expenditures do not increase one's chances of winning the prize) which does surprisingly well, in complete contradiction to the incentives. Because of its defining feature - that you can't improve your odds of winning by spending more - no one should donate to the pay what you want raffle but the same observation makes the raffle seem fair (or so informal debriefings suggested). Perhaps because of this fairness the pay what you want raffle actually defied theory and begot considerably more contributors than any other format, enough so that it also raised more revenue (per solicitation) than the linear benchmark.

Couching our results in terms of previous empirical work, at the broadest level of comparison, like the relevant lab studies, we confirm that adding a raffle to the standard voluntary contribution mechanism does improve donations, though the foci of these lab studies are considerably different. While Morgan and Sefton (2000) focus on linear lotteries, Dale (2004) compares the standard lottery to a self-financing, pari mutuel form of lottery, Lange et al. (2007) investigate how donations are determined by the number of prizes available and Goerg et al. (2016) develop a two-stage raffle to improve public good provision, our study concentrates on how the individual incentives provided by the contest success function can affect participation, contributions and revenue. Considering our field setting, which differentiates our experiment from those just discussed, our study is perhaps closest to Landry et al. (2006) who also solicit donations to a local charity, door-to-door. In the spirit of their lab work (Lange et al., 2007), the authors of this paper compare single- and multiple-prized lotteries to the voluntary contribution mechanism, finding again that lotteries are effective at increasing contributions.

Given that the limiting case of our convex raffle is the all-pay auction, our results also dovetail with the nascent experimental literature assessing whether auctions can increase contributions to a public good too. Orzen (2008) compares both lotteries and all-pay auctions to the voluntary contribution mechanism in a lab experiment and finds that both alternative mechanisms yield larger contributions, with the first-price all-pay doing better than the lottery, a result that is consistent with both our theory and results. The comparison of lotteries and all-pay auctions has also been studied