COMPARING CHARITABLE FUNDRAISING SCHEMES: EVIDENCE FROM A NATURAL FIELD EXPERIMENT*

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Abstract

We present evidence from a natural field experiment designed to shed light on the efficacy of alternative fundraising schemes. In conjunction with the Bavarian State Opera House, we mailed 25,000 regular opera attendees a letter describing a charitable fundraising project organized by the opera house. Recipients were randomly assigned to one of six treatments designed to explore behavioral responses to a variety of linear and non-linear matching schemes, and their response to large lead gifts that might serve as a signal of the quality of the project. Our main results are—(i) linear matching schemes partially crowd out donations and so do not pay for fundraisers; (ii) well designed non-linear matching schemes crowd in donations; (iii) the presence of lead gifts trigger the largest increases in donations. Our research design allows us to provide external validity to aspects of giving behavior that have been documented in other settings, to provide novel evidence on other dimensions of giving behavior, and to shed light on the optimal design of fundraising schemes.

Keywords: charitable giving; fundraising schemes; natural field experiment.

JEL Classification: C93, D12, D64.

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1 Introduction

This paper presents evidence from a large-scale natural field experiment designed to shed light on the efficacy of alternative fundraising schemes. While vast sums are donated to charitable causes—in 2002, $241billion was given in the US, three quarters of which stemmed from individuals [Andreoni 2006a]—evidence on the relative effectiveness of alternative fundraising schemes within the same empirical setting is scarce.[1]

Much of the existing literature has focussed on responses to two forms of commonly observed fundraising schemes—linear matching [Eckel and Grossman 2006, Karlan and List 2007] and the provision of lead gifts [List and Lucking-Reily 2002]. We build on this literature by enlarging the set of fundraising schemes to encompass both commonly observed and novel schemes, and to compare them within the same setting. Our design provides external validity to aspects of giving behavior that have been previously documented, allows us to provide new evidence on other dimensions of giving behavior, and sheds light on the optimal design of fundraising schemes.[2]

In conjunction with the Bavarian State Opera in Munich, in June 2006, we mailed 25,000 opera attendees a letter describing a charitable fundraising project organized by the opera house. In this setting, a natural field experiment allows us to implement various fundraising schemes in a natural and straightforward way, holding everything else constant.

Individuals were randomly assigned to one of six treatments designed to explore behavioral responses to—(i) linear matching schemes where contributions were matched at either 50% or 100%, analogous to considerable reductions in the relative price of charitable giving vis-à-vis own consumption; (ii) non-linear matching schemes, where contributions above a fixed threshold would be matched at a given rate; (iii) leveraged matching schemes, in which *any* positive donation would be matched by a fixed amount, analogous to donors receiving a small income transfer that can be spent on either the charitable good or own consumption; (iv) schemes that provide information about a substantial lead donor, which may act as a signal of project quality [Andreoni 2006b].

The design allows us to estimate aspects of giving behavior, such as the price elasticity of charitable giving, that have been previously documented exploiting non-experimental [Randolph 1995, Auten *et al* 2002] and experimental variation [Eckel and Grossman 2006, Karlan and List 2007], as well as on the presence of lead donors [List and Lucking-Reiley 2002, Karlan and List

[1] Andreoni [2006a] presents evidence from the US that in 1995, 70% of households made some charitable donation with an average donation of over $1000, or 2.2% of household income. In terms of donations specifically to the arts, in 1995 9% of households made some donation with the average household donating around $200.

[2] Eckel and Grossman [2003] report that matching schemes that reduce the relative price of charitable giving, are increasingly common features of corporate philanthropy. In a series of laboratory and field experiments they also provide evidence of how such schemes are significantly more effective in raising donations than the theoretically equivalent rebate scheme [Eckel and Grossman 2003, 2006]. Hence our design does not involve any such rebate schemes.

2007, Potters *et al* 2007].

The design also allows us to provide innovative results that build on the existing evidence from large-scale field experiments on charitable giving [Eckel and Grossman 2006, Karlan and List 2007] along the following dimensions—(i) both linear and non-linear matching schemes allow us to examine price responses and study whether donations can be crowded in and to what extent; (ii) non-linear matching schemes allow us additionally to study the role of interior corner solutions and focal point influences in charitable giving; (iii) the leveraged matching scheme, which induces a change in the budget set equivalent to individuals experiencing a small exogenous increase in income, allows us to derive the income elasticities of charitable giving; (iv) we can compare behavioral responses to small changes in income or prices to those induced by the mere presence of a substantial lead donor that may serve as a signal of project quality.

Our main results are as follows. First, despite their ubiquitous prevalence in fundraising campaigns, linear matching schemes do not pay for the fundraiser. As the charitable good becomes cheaper vis-à-vis own consumption, individuals demand more of it in terms of donations received including the match, but spend less on it themselves in terms of donations given prior to the match. As a result, the own price elasticity of charitable donations received is found to be less than one in absolute value, so that linear matching leads to partial crowding out of donations received.

Second, well-designed non-linear matching schemes that require a minimum donation before the match rate kicks in are profitable in that they cause donations given to be crowded in with little or no change in the overall proportion of recipients that donate in the first place. This effect is in line with neoclassical consumer theory which predicts that when individuals face a non-convex budget set, those that would give relatively little in the presence of no matching might find it optimal to choose an interior corner solution and donate more. As the effect of such non-linear matching schemes on behavior along the intensive margin differs across recipients, this implies the optimal fundraising scheme might entail tailoring non-linear schemes to different individuals.

Third, the leveraged matching scheme—which theory predicts should induce donations from all individuals with some positive marginal utility from giving—leads to the highest response rates, as expected. However, we find that even among this targeted group of regular opera attendees, 95% make no contribution to the project. These individuals either do not value the project at all, or, face transactions costs that are sufficiently high to offset any warm glow they feel from giving to this particular cause. Furthermore, in line with standard theory, the new donations drawn in with this treatment are relatively small in magnitude. For larger donors we find that this fundraising scheme leads to an almost full crowding out of donations given—individuals reduce one-for-one donations given in response to the effective income transfer received, to leave unchanged the donation actually received by the project, and to increase own consumption by the amount of the transfer. Hence such matching schemes do not pay for the fundraiser.

Fourth, recipients are quantitatively most sensitive to the presence of a lead donor. Relative to a control group in which no information on lead gifts is provided, donations increase by 44%, with no effect on response rates. Comparing this effect with the results from our 100% linear matching treatment we find that individuals are quantitatively more sensitive to lead gifts than to a halving of the relative price of charitable giving for example. Given the nature of the charitable project, which has no fixed-cost element, one explanation is that the presence of the anonymous lead donor—who commits to provide €60,000 or over 400 times the average donation—serves as a credible signal of the project's quality as predicted by Andreoni [2006b]. Moreover, the effect of the signal is heterogeneous across individuals—the effect is increasing in the amount individuals would have donated in the absence of the signal, so more generous donors are more affected.[3]

Taken together, our analysis proves a rich set of results that have both practical importance for fundraisers, shed new light on individual giving behavior and the optimal design of fundraising schemes, and provide avenues for future research on the role of signaling in charitable giving.

The paper is organized as follows. Section 2 describes the natural field experiment, and presents a standard model of consumer choice from which to understand behavior across the treatments. Section 3 provides descriptive evidence on responses on the extensive and intensive margins of charitable giving in each treatment. Section 4 presents the econometric analysis of individual decisions of whether and how much to donate in each treatment. Section 5 concludes. The precise format and wording of the mail out is provided in the Appendix.

2 The Natural Field Experiment

2.1 Design

In June 2006 the Bavarian State Opera organized a mail out of letters to 25,000 individuals designed to elicit donations for a social youth project the opera was engaged in, "Stück für Stück". The project's beneficiaries are children from disadvantaged families whose parents are almost surely not among the recipients of the mail out. Hence the fundraising campaign relates to a project

[3] This is in line with the results of Potters *et al* [2007] who examine the role of lead contributions in a laboratory setting. They find support for the signaling hypothesis as modelled by Andreoni [2006b]. Karlan and List [2007] also provide field evidence of such signaling effects—they find the announcement of the availability of a match from a lead donor, but no specific information on the total value available for matching, increases responses on both extensive and intensive margins of charitable giving. Providing recipients with additional information on the value available for matching—ranging from $25,000 to $100,000—however had little additional effect. List and Lucking-Reiley [2002] study the role of seed money on charitable giving but in their research design, seed money serves both as a signal of quality, and also reduces the amount that needs to be collected as the project is of a discrete nature and has a fixed fundraising target. Their design estimates the combined effects of quality signals and the effects of reducing the additional required donations to reach the target.

that conveys no immediate benefits to potential donors and is therefore more similar to fundraising by aid charities, rather than the typical forms of opera fundraising used to finance projects that benefit opera attendees directly. This ensures there is no role for gift exchange or reciprocity in driving donations, as in Falk [2007]. Nor is there any role in our design for social recognition to drive donor behavior, as in Andreoni and Petrie [2004], as donors are not publicly announced.[4]

The recipients were randomly selected from the opera's database of customers who had purchased at least one ticket to attend either the opera or ballet, in the twelve months prior to the mail out. Recipients were randomly assigned to one of six treatments. The treatments varied in two dimensions—whether information was conveyed about the existence of an anonymous lead donor, and how individual donations would be matched by the anonymous lead donor. The mail out letters were identical in all treatments with the exception of one paragraph. The precise format and wording of the mail out is provided in the Appendix.[5]

The control treatment, denoted T1, was such that recipients were provided no information about the existence of a lead donor, and offered no commitment to match individual donations. The wording of the key paragraph in the letter read as follows,

T1 (Control): *This is why I would be glad if you were to support the project with your donation.*

This paragraph is manipulated in the other treatments. In the second treatment, denoted T2, recipients were informed that the project had already garnered a lead gift of €60,000. The corresponding paragraph read as follows,

T2 (Signaling): *A generous donor who prefers not to be named has already been enlisted. He will support "Stück für Stück" with €60,000. Unfortunately, this is not enough to fund the project completely which is why I would be glad if you were to support the project with your donation.*

The control and signaling treatments differ only in that in the latter recipients are informed of the presence of a lead donor. There is no offer to match donations in any way in either treatment—a donation of one Euro corresponds to one Euro being received for the project. A comparison of individual behaviors over the two treatments sheds light on whether and how individuals respond to the existence of such lead donors. For example, as suggested by Andreoni [2006b], such substantial

[4] The project finances small workshops and events for schoolchildren with disabilities or from disadvantaged areas. These serve as a playful introduction to the world of music and opera. It is part of the Bavarian State Opera's mission to preserve the operatic art form for future generations and the project is therefore a key activity to fulfill this mission. As it is not one large event that donations are sought for, but rather a series of several smaller events, it is clear to potential donors that additional money raised can fund additional activity. In other words, the marginal contribution will always make a difference to the project.

[5] All letters were designed and formatted by the Bavarian State Opera's staff, and addressed to the individual as recorded in the database of attendees. Each recipient was sent a cover letter describing the project, in which one paragraph was randomly varied in each treatment. On the second sheet of the mail out further details on the "Stück für Stück" project were provided. Letters were signed by the General Director of the opera house, Sir Peter Jonas, and were mailed on the same day—Monday 19th June 2006.

lead gifts might serve as a signal about the quality of the project.[6]

The next two treatments provided recipients with the same information on the presence of a lead donor, but introduced linear matching. The first of these treatments, denoted T3, informed recipients that each donation would be matched at a rate of 50%, so that giving one Euro would correspond to the opera receiving €1.50 for the project. The corresponding paragraph in the mail out letter then read as follows,

T3 (50% Matching): *A generous donor who prefers not to be named has already been enlisted. He will support "Stück für Stück" with up to €60,000 by donating, for each Euro that we receive within the next four weeks, another 50 Euro cent. In light of this unique opportunity I would be glad if you were to support the project with your donation.*

The next treatment, denoted T4, was identical to T3 except the match rate was set at 100%, so the corresponding paragraph in the mail out letter read as follows,

T4 (100% Matching): *A generous donor who prefers not to be named has already been enlisted. He will support "Stück für Stück" with up to €60,000 by donating, for each donation that we receive within the next four weeks, the same amount himself. In light of this unique opportunity I would be glad if you were to support the project with your donation.*

Comparing behavior in the linear matching treatments T3 and T4 to T2 allows us to estimate the own price elasticity of donations received, as the price of giving relative to the price of own consumption is experimentally varied.

The final two treatments introduce less common fundraising schemes. The fifth treatment presented recipients with a non-linear, non-convex matching scheme. The letter offered a match rate of 100% conditional on the donation given being above a fixed threshold—€50. Below this threshold the match rate was zero. This was explained in the mail out letter as follows,

T5 (Non-linear Matching): *A generous donor who prefers not to be named has already been enlisted. He will support "Stück für Stück" with up to €60,000 by donating, for each donation above €50 that we receive within the next four weeks, the same amount himself. In light of this unique opportunity I would be glad if you were to support the project with your donation.*

This treatment serves two purposes. First, it allows us to study the role of corner solutions as

[6] Andreoni [2006b] highlights the problem that lead donors have incentives to overstate the quality of the project. Since such deception cannot arise in equilibrium it follows that lead gifts need to be extraordinarily large to be credible signals of quality. In our study the lead gift is 400 times larger than the average donation. The literature has also proposed alternative explanations of the behavior of lead donors such as providing prestige to the lead donor [Harbaugh 1988], or allowing the lead donor to signal their wealth [Glazer and Konrad 1996]. However, in our field experiment the lead donor is anonymous so that such concerns are of less relevance. Finally, there remain alternative models of the effect of lead donors on others, even when those lead donors are anonymous—(i) in the presence of increasing returns such lead gifts eliminate an equilibrium in which all donations are equal to zero [Andreoni 1998]; (ii) a snob appeal effect that makes individual contributions increase in the contributions of others [Romano and Yildirim 2001].

recipients who would otherwise have given a positive amount below €50 in treatment T4 might find it optimal to move either to an exterior corner solution and donate nothing, or to an interior corner solution and give precisely €50. Second, the non-convexity might introduce a focal or reference point for donations at €50. If such reference points influence behavior, then recipients who would have otherwise given at least €50 under treatment T4, might be pushed to reduce their donation given towards €50 under T5.

The final treatment offered recipients a fixed positive match of €20 for *any* positive donation. This corresponds to a parallel shift out of the budget line that is similar to a pure income effect. We refer to this treatment as the 'leveraged matching' treatment because any small donation slightly above zero has large leverage, namely, a very high implicit matching rate. This treatment was explained in the mail out letter as follows,

T6 (Leveraged Matching): *A generous donor who prefers not to be named has already been enlisted. He will support "Stück für Stück" with up to €60,000 by donating, for each donation that we receive within the next four weeks regardless of the donation amount, another €20. In light of this unique opportunity I would be glad if you were to support the project with your donation.*

This treatment serves two purposes. First, as small donations have enormous leverage, it allows us to bound the share of recipients who do not value the project and would therefore never donate under any realistic circumstances. Second, it allows us to estimate expenditure and income elasticities of charitable giving, and so determine what fraction of such pure income transfers individuals pass onto the charitable project and what fraction they retain for own consumption.

Four points are worth bearing in mind regarding the experiment. First, a key distinction between our experimental design and that of Karlan and List [2007] is that they do not have a treatment that isolates the pure signalling effect of a lead donor in the absence of any linear matching. This is precisely what our signalling treatment T2 captures. Rather they compare their matching treatments with the equivalent of our control treatment T1 where there is no lead gift. One key advantage of our design is to allow us to decompose the effect of matching into its signalling component and its pure price component. This is important given the quantitatively large effect the presence of a lead donor, absent any matching, has on the behavior of individuals. As discussed later, this decomposition is also crucial for reconciling our price elasticity estimates with those in Karlan and List [2007].

Second, the opera had no explicit fundraising target in mind, nor was any such target discussed in the mail out. This is key to interpreting behavior when comparing the control and signaling treatments. For example, by announcing a lead donor that had committed to providing €60,000 in treatment T2, recipients may feel their individual donation is less needed. However, as mentioned in Section 2, the money raised for the project is not used to finance one large event but rather a series of several smaller events, as made clear in the mail out letter. Hence the project is of a linearly expandable nature such that recipients know that marginal contributions will make a difference.[7,8]

Third, in treatments T3 to T6, recipients were told the matching schemes would be in place for four weeks after receipt of the mail out. Although in principle such a deadline might affect behavior, we note that—(i) over 97% of recipients that donated did so during this time frame and the median donor gave within a week of the mail out; (ii) we find no evidence of differential effects on the time for donations to be received between any treatment and the control treatment, in which no such deadline was announced.[9]

Finally, recipients are told the truth—the lead gift was actually provided and each matching scheme was implemented. The value of matches was capped at €60,000 which ensured subjects were told the truth even if the campaign was more successful than anticipated and, crucially, this holds the commitment of the lead donor and, hence, the quality signal, constant across treatments.

2.2 Conceptual Framework

We now present a simple framework in which to think through the individual utility maximization problem under each treatment, and what can be inferred from a comparison of behavior across treatments. Following standard consumer theory, we assume individuals have complete, transitive, continuous, monotone, and convex preferences over two arguments, their private consumption, c, and the donation received by the project, d_r. Each individual's utility maximization problem is,

$$\max_{d_r} u(c, d_r) \text{ subject to } c + d_g \leq y,\ c, d_g \geq 0, \text{ and } d_r = f(d_g), \tag{1}$$

where the first constraint ensures consumption can be no greater than income net of any donation given, $y - d_g$; the second constraint requires consumption and donations given to be non-negative; and the third constraint denotes the matching scheme that translates donations given into those

[7] The effects of such seed money are in general ambiguous and depend on whether individuals believe the project is far from, or close to, its designated target, and whether these beliefs encourage or discourage donations [List and Lucking-Reiley 2002]. Rondeau and List [2008] present experimental evidence on the effects of lead donations in the presence of explicit targets.

[8] If recipients have the same belief that others had donated to such an extent that the 60,000 of the lead donor was already exhausted and so the match scheme would no longer be in place, there should be no difference in behaviors across treatments T2 to T6. This hypothesis is rejected by the data.

[9] As recipients were drawn from the database of attendees to the opera, it might be the case that recipients know each other. Having knowledge of whether another opera attendee had received the mail out, and the form of the letter they received, may in principle lead to some changes in behavior if there are strong peer effects in charitable giving. We, however, expect such effects to be qualitatively small and, indeed, the opera house received no telephone queries regarding treatment differences. In addition, assuming individuals are more likely to know other opera attendees that reside in the same geographic neighborhood, we control for the zip code of recipients in our empirical analysis. Throughout we find no evidence of heterogeneous responses by zip code—on either the extensive or intensive margins of charitable giving—to any treatment.

received by the opera house. Under linear matching treatments for example, $d_r = \lambda d_g$. This utility function captures the notion that potential donors care about their own consumption and the *marginal* benefit their donation provides. Given the linearly expandable nature of the project, this marginal benefit relates to d_r.

Figure 1 graphs the budget sets induced by the six treatments in $(y - d_g, d_r)$-space. In the control treatment (T1) the budget line has vertical intercept y and a slope of minus one as for each Euro given by an individual, the project receives one Euro ($d_r = d_g$). The budget set is identical under the signaling treatment (T2) as there is no matching and so the relative price of donations received is unchanged. However, if individuals infer the project is of high quality due to the existence of a lead donor, the marginal rate of substitution between net income and donations received may be altered and so affect behavior on both the extensive and intensive margins.

On the other hand, if the extent to which the MRS between consumption and donations given is affected by such signals is an increasing function of the amount the individual would have donated in the absence of the signal, then marginal donors are less affected by the signal than are individuals who would have donated more even in the absence of the signal. As a consequence, the signaling treatment may have quantitatively larger effects on the intensive rather than extensive margins of giving. The empirical analysis sheds light on which of these hypotheses is supported by the data.

In all remaining treatments potential donors are, as in T2, aware of the existence of a lead donor. Hence, in order to isolate the effect of variations in the budget set on behavior, the relevant comparison group throughout is the signaling treatment T2. The linear matching schemes in treatments T3 and T4 vary the price of donations relative to own consumption so that with the 50% match rate in T3, $\lambda = 1.5$, and with the 100% match rate in T4, $\lambda = 2$. In both cases the budget set pivots out with the same vertical intercept.

A comparison of treatments T2, T3, and T4 then provides a series of estimates of the own price elasticity of charitable donations received as the match rate varies. Consider an increase in the match rate from λ to λ'. As the price of consumption is normalized to one, the relative price of donations received, p, falls from $\frac{1}{\lambda}$ to $\frac{1}{\lambda'}$ so the own price elasticity of donations received is,

$$\epsilon_{d_r,p} = \left(\frac{\Delta d_r}{\Delta p}\right) / \left(\frac{d_r}{p}\right) = \left(\frac{\Delta d_r}{\frac{1}{\lambda} - \frac{1}{\lambda'}}\right) / \left(\frac{d_r}{\frac{1}{\lambda}}\right). \tag{2}$$

where d_r is the average donation received in the baseline treatment with match rate λ, and Δd_r is the change in donations received as the match rate increases from λ to λ'.[10] As the price of own

[10] Charitable donations are tax-deductible in Germany which implies the actual price of the donation received will always be marginally lower than assumed here. Any such differences will wash out in the treatment comparisons due to random assignment.

consumption is normalized to one, the price of donations *given* is always equal to one independent of the match rate. While we focus attention on the own price elasticity of donations received, we later also calculate the implied cross price elasticity of donations given with respect to the price of giving, in order to directly compare our results to those in Karlan and List [2007].

Two point predictions on this own price elasticity of donations received warrant special attention. First, if recipients are engaged in pure donation targeting—where preferences are such that individuals choose a particular d_r independent of the price of donations received—then moving from a match rate of λ to λ' implies $\Delta d_r = 0$ and $\Delta d_g = \frac{\lambda-\lambda'}{\lambda'} d_g < 0$. Hence the own price elasticity of donations received is $\epsilon_{d_r,p} = 0$ so the increased match rate leads to full crowding out of donations given.

Second, suppose preferences are characterized by *pure* warm glow—where individuals *only* care about the donation given rather than that actually received. If the match rate then increases from λ to λ' this leads to $\Delta d_g = 0$ and $\Delta d_r = (\lambda' - \lambda) d_g > 0$ so the own price elasticity of donations *received* is $\epsilon_{d_r,p} = -\frac{\lambda'}{\lambda}$.[11]

The non-linear matching scheme in treatment T5 causes recipients to face a non-convex budget constraint that partly overlaps with those in T2 and T4. In this treatment, as the match rate λ is a function of d_g, there are kinks in the budget line that might lead to an interior corner solution in the individual optimization problem above. This raises the possibility of donations given being crowded in by such schemes.

As our research design does not restrict the behavior of individuals in any way, it is possible for them to display behavior consistent with there being crowding out or crowding in of donations given, or even of donations received being a Giffen good. Figure 2A summarizes the possible inferences that can be made about individual preferences at different values of the estimated own price elasticity of donations received.

For each budget set considered, individuals may optimally locate at an exterior corner. Note however that every individual with preferences that satisfy $\left.\frac{\partial u}{\partial d_r}\right|_{d_r=0} > 0$ should make a small positive donation in the leveraged matching scheme T6. This treatment should then have the highest response rates, and allows us to bound the share of recipients for whom $\left.\frac{\partial u}{\partial d_r}\right|_{d_r=0} \not> 0$ and so are unlikely to contribute to the project under any realistic circumstances.[12]

[11] The *pure warm glow* model, a special case of the preferences described in Andreoni [1990], implies donors actually care only about their own consumption $(y - d_g)$ and their donation given (d_g) but not about the donation received (d_r). In this special case the representation in Figure 1 is slightly misleading as all budget sets would be materially identical for donors. However, as documented later, the data rejects the hypothesis that donors behave according to the pure warm glow hypothesis.

[12] To be precise, when we state an individual would never contribute to the project it is always implied that giving involves some small transaction costs. If such costs, that relate to reading the solicitation letter and making the actual donation for example, could be eliminated, more recipients might be willing to donate. To keep clear the exposition, the theoretical framework abstracts from such costs.

As documented in more detail later, the opera database contains information on individual expenditures on opera tickets in the twelve months preceding the mail out, denoted x. We exploit this information to estimate the expenditure elasticity of charitable giving from a comparison of treatments T6 and T2. This sheds light on how much of the pure income transfer in T6 is passed on to the opera and how much is retained for own consumption. More precisely, assuming individuals have a fixed budget for the opera that can be divided between attendance and charitable donations, the expenditure elasticity of donations received is,

$$\epsilon_{d_r,x} = \left(\frac{\Delta d_r}{\Delta x}\right) / \left(\frac{d_r}{x}\right) = \left(\frac{\Delta d_r}{20}\right) / \left(\frac{d_r}{x}\right), \tag{3}$$

where x denotes the annual expenditure on the opera in the baseline treatment T2, d_r is the average donation received in treatment T2, and Δd_r is the change in donations received between T6 and T2. Finally, we use treatments T2 and T6 to estimate the income elasticity of own consumption,

$$\epsilon_{c,y} = \left(\frac{\Delta(y - d_g)}{\Delta y}\right) / \left(\frac{y - d_g}{y}\right) \approx 1 - \frac{\Delta d_g}{20}, \tag{4}$$

where Δd_g is the change in donations given between T6 and T2, and as the budget share of donations given is small, $(y - d_g/y)$ is approximately equal to one. As summarized in Figure 2B, if recipients retain all the additional income with no increase in donations given then $\epsilon_{c,y} = 1$. Alternatively, if there is full crowding out of donations given then $\epsilon_{c,y} = 2$.[13]

3 Descriptive Evidence

3.1 Sample Characteristics and Treatment Assignment

Individuals that purchase a ticket are automatically assigned a customer number and placed on the database. The original mail out was sent to 25,000 recipients. We remove non-German residents, corporate donors, formally titled donors, and recipients to whom we cannot assign a gender—typically couples. The working sample is based on the remaining 22,512 individuals and the analysis throughout refers to this sample.

Individuals were randomly assigned to one of the six treatments. Table 1 tests whether individuals differ across treatments in the individual characteristics obtained from the opera's database. For each observable, Table 1 reports the p-values on the null hypothesis that the mean character-

[13] With convex preferences, individuals that contribute to T6 but not to T2 should only donate incrementally above €0. Hence in order to avoid confounding the effects of a change in the composition of donors, we later show how the estimated expenditure and income elasticities vary as we restrict the sample to recipients that are expected to donate higher than average amounts conditional on their observables.

istics of individuals in the treatment group are the same as in the control group T1. There are almost no significant differences along any dimension between recipients in each treatments, so that individuals are indeed randomly assigned into treatments.[14]

Columns 1 and 2 show that there is an almost equal split of recipients across treatments, and that close to 47% of all recipients are female. Columns 3 to 7 provide information on individuals' attendance at the opera. This is measured by the number of tickets the individual has ordered in the twelve months prior to the mail out, the number of separate ticket orders that were placed over the same period, the average price paid per ticket, and the total amount spent. Individuals in the sample typically purchase around six tickets in the year prior to the mail out in two separate orders. The average price per ticket is just under €86 with the annual total spent on attendance averaging over €400. We use information on the zip code of residence of individuals to identify that 40% of recipients reside within Munich, where the opera house is located. Finally, we note that the majority of individuals have attended the opera in the six months prior to the mail out.

Three further points are of note. First, the number of tickets bought, the number of orders placed, and whether or not a person lives in Munich, can proxy an individual's affinity to the opera. This may in turn relate to how they trade-off utility from consumption for utility from donations received by the opera for the "Stück für Stück" project. In contrast, the average price per ticket bought might better proxy individual income. We later exploit this information to shed light on whether on the extensive margin, donors differ from non-donors predominantly in terms of their affinity to the opera, or in terms of their incomes. Of course, we cannot rule out the existence of 'opera buffs' whose expenditures on opera tickets are beyond their means. Insofar as such individuals exist, average ticket price might also reflect an element of affinity.

Second, there is a wide degree of dispersion across individuals in each of the ticket purchase related characteristics. For example, the average price per ticket ranges from €36 at the 10th percentile to €134 at the 90th percentile. This underlying variation in observables allows us to explore whether treatment responses vary with such characteristics.

Third, recipients are not representative of the population—they attend the opera more frequently than the average citizen and are likely to have higher disposable incomes. Our analysis therefore sheds light on how such selected individuals donate towards a project that is being directly promoted by the opera house. To the extent that other organizations target charitable projects towards those with high affinity to the organization as well as those who are likely to have high income, the results have external validity in other settings. Moreover, while the non-representativeness of the sample may imply the observed *levels* of response or donations likely

[14] The one exception is that there are slightly more females in T6 relative to T1. However we note that there are no significant gender differences between those in T6 and T2, which forms a more natural group from which to identify the causal effect of the specific matching scheme in T6. In the econometric analysis we condition on individual characteristics throughout.

overstate the response among the general population, we focus attention on *differences* in behavior across treatments that purge the analysis of the common characteristics of sample individuals.

3.2 Recipient Behavior: Extensive Margin

Table 2 provides evidence on the observable characteristics of donors and non-donors overall, and split within each treatment. We report the mean and standard error of each characteristic, as well as the p-value on the null hypothesis that the characteristic is the same among donors and non-donors in the same treatment. Three points are of note.

First, Columns 1 and 2 show that response rates vary from 3.5% to 4.7% across treatments, which are almost double those in comparable large-scale natural field experiments on charitable giving [Eckel and Grossman 2006, Karlan and List 2007].[15]

Second, individuals that have purchased more tickets in the year prior to the mail out, have placed more separate orders over the same time period, and have last attended the opera more recently are significantly more likely to donate in *each and every* treatment. In contrast, the average price per ticket does not differ significantly between donors and non-donors in five out of the six treatments, the exception being T5 where donors have paid on average, a few euros more. Munich residents are not more likely to respond in each treatment.

As a further check, we exploit additional information on average house rents in Munich by zip code, measured in Euros per square meter. For the subset of recipients in Munich, Table 1 shows that individuals were randomly assigned to treatments along this dimension. Table 2 then shows that in each and every treatment, the rental rate of donors and non donors is not significantly different, again suggesting that income proxies are not much correlated with behavior on the extensive margin of giving.

Taken together these results suggest that affinity to the opera house—as measured by the number of ticket purchases, separate ticket orders, and time of last attendance—is more strongly correlated to behavior along the extensive margin of whether to donate or not. In contrast, characteristics that more closely proxy individual income are less correlated with whether the individual responds to the mail out. In short, there are differences in observables between individuals with—(i) flat indifference curves and who, hence, are unlikely to give in any treatment; (ii) relatively steep indifference curves and so find it optimal to give.

Third, despite there being large variations in the budget sets individuals face in treatments T1 to T5, there are no significant differences in response rates. Neither quality signaling nor changes in price significantly affect behavior along the extensive margin. However, as made clear earlier,

[15] One explanation for the high response rates we obtain may be that the Bavarian State Opera has not previously engaged in fundraising activities through mail outs, nor is the practice as common in Germany as it is in the US.

treatment T6—that introduces a leveraged matching scheme by causing a parallel shift out of the budget set for any positive donation—is the treatment that should induce the largest change in the number of donors relative to the control group. The data supports this—the response rate is significantly higher in T6 relative to the other treatments. However, the fact that the response rate in T6 is 4.7% highlights that even among this targeted population, 95% of individuals cannot be induced to donate. These individuals either do not value the project at all or must face transactions costs that are sufficiently high to offset any warm glow they feel from giving to this particular cause, and so optimally locate at the corner solution given by the vertical intercept in Figure 1.

3.3 Recipient Behavior: Intensive Margin

Table 3 provides descriptive evidence on donations given and received by treatment. For each statistic we report its mean, its standard error in parentheses, and whether it is significantly different from that in the control and signaling treatments, T1 and T2 respectively. Figure 1 provides a graphical representation of the outcomes of each treatment.

Columns 1 to 3 show that, despite the response rates being not significantly different from each other in the first four treatments, the total amounts donated vary considerably across treatments. Among the full sample of 25,000 recipients more than €120,000 were donated, fully exhausting the €60,000 of the lead donor. In our working sample of 22,512 individual recipients, from a total of 922 donors, €85,900 was donated overall, which corresponds to €127,039 actually raised for the project, with a mean donation given of €93.2.[16]

Column 4 shows that in the control treatment T1, the average donation given is €74.3. In the signaling treatment T2, this rises significantly to €132. The near doubling of donations given can only be a response to the presence of a lead donor—the relative price of donations received by the opera house vis-à-vis own consumption is unchanged. The result is not driven by outliers—Column 5 shows the median donation is also significantly higher in T2 than in T1.

This suggests the marginal rate of substitution between consumption and donations received is altered when individuals are aware of the existence of an anonymous lead donor who has already pledged a substantial monetary amount to the project. While such a quality signal does not induce new donors to enter, recipients who like the project to begin with like it even more when they observe that somebody else is already strongly committed to it. We provide more formal econometric evidence on this in Section 4.2.

In terms of linear matching schemes, we see that as the relative price of donations received falls moving from treatment T2 to the linear matching treatments T3 and T4, the average donation

[16] This exceeded the expectations of the Bavarian State Opera which were that €22,000 would be donated overall on the basis of a 1% response rate and mean donation of €100.

received, d_r, continues to rise. The average donation received increases to €151 in T3 with a 50% match rate, and to €185 in T4 with a 100% match rate. Importantly, as shown in Figure 1 and Column 6 of Table 3, as the match rate increases, the donations *given*, d_g, fall. The average donation given falls from €132 in the signaling treatment T2 to to €101 in T3 with a 50% match rate, and to €92.3 in T4 with a 100% match rate. Column 7 reiterates that these differences are not driven by outliers—the median donation given is significantly lower in treatments T3 and T4 than the signaling treatment T2.

Therefore, linear matching does not crowd in donations—rather there is partial crowding out of donations given to an extent that, although donations received increase, they do so less than proportionately to the fall in the relative price of the charitable good. An immediate consequence is that straight linear matching schemes as in treatments T3 and T4 do not pay for the fundraiser. As in Karlan and List [2007], we conclude the charitable organization is better off simply announcing the lead gift as quality signal.[17,18]

The final two treatments involve non-linear matching schemes. Treatment T5 induces recipients to face a non-convex budget set. For donations below €50 the budget line is coincident with that of the signaling treatment T2, for donations at or above €50 it coincides with that of the 100% matching treatment T4. Figure 1 shows that the average outcome in terms of donations given and received in T5 replicate almost exactly those in the 100% matching treatment T4—the average donation received in T5 is €194, as opposed to €185 in T4, and the average donation given is €97.9, as opposed to €92.3 in T4. To understand why this is so, note that in the pure signaling treatment T2 the average donation received is €132. This suggests that the portion of the budget line in T5 that lies to the left of €100 on the x-axis of donations received is irrelevant for many recipients. In essence, treatments T4 and T5 present the average recipient with an almost identical choice. Hence response rates and donations should not differ markedly between the two.

Finally, we compare the leveraged matching scheme T6 in which recipients are informed of the existence of a lead donor and that *any* positive donation will be matched with €20, and the signaling treatment T2 in which recipients are only informed of the existence of the lead donor. As previously discussed, response rates are significantly higher in T6 than in T2, in line with standard consumer theory. Theory also suggests these additional donors should be willing to

[17] If the lead donor were to only offer their gift conditional on such a matching scheme being implemented, then the relevant comparison is with treatment T1. Clearly, the fundraiser is then better off taking the lead donation and implementing a linear matching scheme rather than not accepting the lead donation at all.

[18] This result is unlikely to be driven by the precise monetary value committed to by the lead donor, or the precise match rates utilized in the treatments. On the one hand, recipients are informed the lead donor is willing to contribute 60,000 to the project, a substantial sum that may well substantially alter individual perceptions on the quality of the project. On the other hand, the relative price variation in treatments T3 and T4 are also not trivial—the instances in which market prices are observed to halve in consumer panel data, for example, are rare. Yet the magnitude of the price responses are small relative to those induced by the signaling treatment.

contribute relatively low amounts to the project. This is strongly supported in the data, as best illustrated in Figure 1—there is a decrease in both the donations given and received in treatment T6 relative to the signaling treatment T2. Column 3 of Table 3 shows the average donation received in T6 is €89.2—relative to T2, donations given fall by significantly more than €20. This result is not driven by outliers. Column 4 shows the median donations received is also significantly lower (by €30) in T6 than T2. These effects remain even in Columns 6 and 7 when differences in the mean and median amounts *given* are considered.

At face value this suggests pure income transfers lead to more than full crowding out of donations given so that charitable giving is an inferior good. However, this interpretation is misleading. To understand more precisely how small changes in individual wealth affect charitable giving, the later econometric analysis takes account of the change in composition of donors in treatment T6 relative to treatment T2.

4 Econometric Evidence

In this section we present more formal evidence to estimate price, expenditure, and income elasticities of charitable giving, to check precisely for whether recipient's behavior is driven by particular motives such as pure warm glow or donation targeting, and to explore whether treatment effects vary by the observable characteristics of recipients.

4.1 Empirical Method

To begin with we define a dummy variable, D_i, equal to one if individual i donates to the charitable project, and equal to zero otherwise. To shed light on the extensive margin of charitable giving, we estimate the following equation using a probit model for whether any donation is given or not,

$$\mathbf{prob}\left(D_i = 1\right) = \mathbf{prob}\left(u_i > -\left(\beta_1 T_i + \gamma_1 X_i\right)\right). \tag{5}$$

Whether i donates or not depends on the budget set she faces as embodied in the treatment she is assigned to, T_i. Given random assignment this is orthogonal to the error term u_i so that $\widehat{\beta}_1$ provides a consistent estimate of the treatment effect on the extensive margin of giving of being assigned to treatment T_i relative to whichever is the omitted treatment. We control for individual characteristics X_i, to reduce the sampling errors of the treatment effect estimates. We report marginal effects and calculate robust standard errors throughout.

On the intensive margin of charitable giving, the central econometric concern is that even with random assignment into treatments, we cannot in general make valid causal inferences conditional on donations being positive because those that choose to donate are likely to differ from those that choose not to donate. Table 2 already highlights the observable dimensions along which donors differ to non donors.

We address this sample selection issue in two ways. First, we estimate for the entire sample of recipients the following OLS specification for the donation received by the opera house from recipient i, d_{ri},

$$d_{ri} = \beta_2 T_i + \gamma_2 X_i + v_i, \quad (6)$$

so that $d_{ri} = 0$ for non donors, v_i is a disturbance term and all other controls are as previously defined. We calculate robust standard errors throughout. Under the assumption of no spillover effects between treatments, the parameter of interest β_2 then measures the average treatment effect on the donation received of individual i being assigned to treatment T_i relative to whichever is the omitted treatment.[19]

Inference can be made on positive donations only under the condition that $E[v_i|T_i, X_i, D_i = 1] = 0$ [Angrist 1997]. Intuitively, we require unobserved determinants of the amount donated, conditional on giving, treatment assignment and observable characteristics, to be orthogonal to unobserved determinants of the decision to donate. We provide some suggestive evidence in support of this assumption utilizing results from a follow-up experiment with the same Opera house.

In particular, a month after the original mail outs, recipients that did not respond were sent a reminder letter. This stated that the original matching scheme, if any, was no longer in place, but still encouraged individuals to donate to the project. We then consider the response to the reminder letter of those individuals that did not respond to the original mail out letter, to shed light on the nature of selection into response.

First, we find there are individuals that donate following the reminder even though they did not respond to the original mail out. The response rate to the reminder was 1.8%. If only individuals with the highest valuation of the charitable good ever respond to mail outs, then the response to the reminder ought to be zero. This suggests individuals face transaction costs to responding.

Second, the average donation under the reminders was €78.7. This is not significantly different from the €74.3 that was donated in the original control treatment T1. This suggests the transactions costs faced by recipients are orthogonal to their valuation of the charitable good, so that unobserved determinants of how much to donate may be less correlated to the underlying transactions costs faced that determine whether to give or not. While not conclusive, the data is suggestive of decisions to donate being driven by the existence of transactions costs that are unrelated to how much individuals would like to donate.

[19] The disturbance term v_i may in part capture determinants of charitable giving such as guilt or shame. We are implicitly assuming that such motives do not interact with the treatments so that comparisons of the change in behavior between treatments is informative.

In order to estimate the treatment effects conditional on a positive donation being made, we specify a hurdle model which takes explicit account of the fact that the initial decision to donate ($D_i = 0$ or 1) may be separated from the decision of how much to donate, namely, the choice over d_r conditional on $D_i = 1$. A simple two-tiered model for charitable giving has, as a first stage, the probit model above in (5). At the second stage, we assume donations received are log normally distributed conditional on any donation being given, namely, $\log(d_{ri})|(T_i, X_i, D_i = 1) \sim N(\beta_3 T_i + \gamma_2 X_i, \sigma^2)$. The maximum likelihood estimator of the second stage parameters, (β_3, γ_2), is then simply the OLS estimator from the following regression,

$$\log(d_{ri}) = \beta_3 T_i + \gamma_3 X_i + z_i \text{ for } d_{ri} > 0, \tag{7}$$

where we calculate robust standard errors throughout [Wooldridge 2002]. For each treatment, we therefore present both the OLS and hurdle model estimates, with the caveats associated with each set of results.

In all specifications, when estimating the response to the presence of a lead donor, we compare the data from treatments T1 and T2 where the former is the reference group; when estimating the response to linear matching schemes we compare the data from treatments T2, T3, and T4, where T2 is the reference group, and we include two dummies for whether recipient i is assigned to treatment T3 or to T4; when estimating the response to the non-linear matching scheme we compare the data from treatments T2 and T5 and from T4 and T5 where, in each case the former is the reference group; and when estimating the response to the leveraged matching scheme, we compare the data from treatments T2 and T6 where T2 is the reference group.

For some pairwise treatment comparisons, it will also be useful to consider how the distribution of donations changes. To do so we use quantile regression methods to characterize changes in the shape and spread of the conditional distribution of donations received, not just the change in the mean as estimated in (7). We therefore estimate the following quantile regression specification at each quantile $\theta \in [0, 1]$,

$$Quant_\theta(\log(d_{ri})|.) = \beta_\theta T_i + \gamma_\theta X_i \text{ for } d_{ri} > 0. \tag{8}$$

The parameter of interest, β_θ, measures the difference at the θth conditional quantile of log donations received between the treatment group T_i and whichever is the baseline treatment considered.

The individual characteristics controlled for in X_i are whether recipient i is female, the number of ticket orders placed in the 12 months prior to mail out, the average price of these tickets, whether i resides in Munich, and a dummy for whether the year of the last ticket purchase was 2006.[20]

[20] We also experimented with alternative controls in X_i. For example, the number of tickets bought may serve as an alternative proxy for affinity rather than the number of orders placed. However, we prefer the latter measure

4.2 Signaling Effects

We first compare recipient behavior in the control treatment T1 and the signaling treatment T2 to estimate the effect of the presence of a lead donor on the extensive and intensive margins of charitable giving. The results are presented in Table 4. Column 1 shows that, in line with the descriptive evidence in Table 3, recipients are no more likely to respond in the signaling treatment T2 than they are to respond in the control group T1. This suggests the marginal donor does not much change in response to being informed about the presence of a substantial lead donor. However, on the intensive margin, Column 2 shows that recipients in the signaling treatment T2 donate significantly more than those in the control treatment, a result confirmed in the hurdle model estimate in Column 3. The magnitude of this effect implies that donations increase by around $\exp \widehat{\beta}_2 - 1 = 44\%$ moving from the control group T1 to the signaling treatment T2.

A priori, it could certainly have been the case that the signaling treatment increased the number of donors. The evidence however suggests that the response rate is not much changed relative to the control group. One explanation is that the extent to which the MRS between consumption and donations given is affected by such signals is an increasing function of the amount the individual would have donated in the absence of the signal. In other words, the valuation of the charitable good and the signal are complements. Hence marginal donors are less affected by the signal than are individuals who would have donated more even in the absence of the signal. As a consequence, the signaling treatment may have quantitatively larger effects on the intensive rather than extensive margins of giving. To present direct evidence on such heterogeneous treatment effects, Figure 3 graphs estimates of β_θ from (8) and the associated 95% confidence interval at each quantile when the comparison treatment is T1.

Figure 3 shows that the effect of the signal is more pronounced on those individuals that would have given more under the control treatment. Donations in the lowest quantiles of the conditional distribution of donations given are not much affected by the signal, suggesting the MRS for marginal donors is not affected by the signal. In contrast, more generous donors are more affected by quality signals, all else equal, causing the overall distribution of donations given to become more dispersed as it is stretched rightward at higher donation amounts.

To provide further evidence of such heterogeneous treatment effects of the presence of a lead donor, we repeat the analysis focusing on donors that, *a priori*, are expected to donate larger amounts. To define such donors we use data only from the control treatment to run an OLS regression of donations given on the individual characteristics in X_i described above, and to therefore form a predicted donation for each and every recipient in the data base. We then define high valuation donors to be those predicted to give more than the mean donation based on these

as the former may be confounded by recipients attending the opera with their friends and family. In any case, the main results are robust to slight alterations in the controls.

observables.

Columns 4 to 6 then repeat the analysis on high valuation donors. We see that, consistent with the quantile regression results, such individuals – (i) are not more likely to give to the signaling treatment than to the control treatment (Column 4); and, (ii) are more sensitive to the signaling treatment as estimated either using the OLS or the hurdle model specification (Columns 5 and 6), than the analogous specifications using all recipients in Columns 2 and 3. If the analysis is repeated on analogously defined low value donors, namely those that are predicted to give lower than the mean donation, then there is no significant treatment effect on the intensive margin using either the OLS or hurdle specification.

Taken together the evidence suggests that the extent to which the MRS between consumption and donations given is affected by such signals is an increasing function of the amount the individual would have donated in the absence of the signal. Marginal donors are less affected by the signal than are individuals who would have donated more even in the absence of the signal, so that the signaling treatment, predominantly has effects on the intensive rather than extensive margin of charitable giving.[21]

Finally, we find little evidence that the effect of the quality signal on individual's propensity to donate varies by their observable characteristics. In particular, individuals that attend the opera more frequently or purchase more expensive tickets are not differentially sensitive on the extensive margin to the signal. The only robust evidence of such heterogeneous responses to the presence of a lead donor are that men are 1% *less* likely to respond to the presence of a lead donor, and women are .9% *more* likely to respond to such information. However there is no differential effect by gender on the intensive margin. We are unaware of other studies that document whether women are more responsive to quality signals in the marketplace, or whether in the specific context of charitable giving, women are more sensitive on the extensive margin to the presence of lead donors. As a point of comparison, we note that men and women donate similar amounts in T1—the mean donation of men (women) is €76 (€72) and the median donation for both is €50.

[21] Although not the focus of our study, the coefficients on the other controls in Columns 1, 2, and 3 of Table 4 show that recipients who are generally more likely to donate some positive amount, under either treatment, are those that have—(i) placed more ticket orders in the 12 months prior to the mail out; (ii) paid a higher average price per ticket over the same period; (ii) last attended in the opera in the six months prior to the mail out. However, the magnitude of the first two effects is relatively small, while the last effect is considerable—those that attended the opera more recently are 2% more likely to respond than those that have not attended recently, other things equal. This is a quantitatively large effect given the response rate in the treatments is 3.6%. Recipients that have placed more ticket orders in the 12 months prior to the mail out, and have paid a higher average price per ticket over the same period, donate significantly more regardless of whichever treatment they are assigned to.

4.3 Linear Matching

Table 5 presents evidence of the behavioral response of recipients to linear matching schemes. We compare responses on the extensive and intensive margin of recipients in treatments T3, which introduces a 50% match rate, and T4, which introduces a 100% match rate, relative to treatment T2 that involves no match rate. In all treatments, recipients are aware of the existence of a lead donor, and so comparisons to behavior in T2 isolate the pure price effects of the schemes.

Column 1 shows that, in line with the descriptive evidence, recipients are no more likely to respond to either price matching treatment than to the baseline treatment, T2. This suggests there are few individuals who are just on the margin of donating in treatment T2, namely those for whom the marginal rate of substitution between own consumption and donations received, is such that $-\frac{1}{2} < MRS_{c,d_r}|_{d_r=0} < -1$.

On the intensive margin, the OLS estimates in Column 2 show that relative to recipients in the signaling treatment T2 which involves no match rate—(i) larger donations are received in treatment T3, although this is not quite significantly different from zero at conventional levels; (ii) significantly larger donations are received in treatment T4. These results are confirmed using the hurdle model specification in Column 3 which takes account only of positive donations.

At the foot of Column 3 we report the implied own price elasticity of donations received, $\epsilon_{d_r,p}$. This varies from $-.534$ when we consider the behavioral response in T3 vis-à-vis T2, to -1.12 when we consider the behavioral response in T4 vis-à-vis T3. We also use these estimated own price elasticities to shed light on whether individuals behave as if they are motivated by pure warm glow ($\epsilon_{d_r,p} = -\frac{\lambda'}{\lambda}$) or by donation targeting ($\epsilon_{d_r,p} = 0$). Both forms of behavior are rejected by the data—in five out of six tests the implied price elasticities differ significantly from these values at conventional levels of significance, as reported at the foot of Column 3.[22]

Overall, the data from the price matching treatments therefore supports the demand for donations received to be decreasing in their own price, and there being *partial* crowding out of donations given $\frac{\lambda-\lambda'}{\lambda'}d_g < \Delta d_g < 0$ and $\Delta d_r > 0$. Hence, despite their ubiquitous prevalence in fundraising campaigns, linear matching schemes harm the fundraiser because they reduce donations given. The fundraiser would be better off to use a large donation as a simple lead gift instead of offering extra leverage through matching.

Previous studies have varied in the empirical method used to estimate price elasticities, which is reflected in the wide range of estimates proposed. Studies using cross sectional survey data on giving or tax returns, typically find a price elasticity between -1.1 and -1.3 [Andreoni 2006b].

[22] The fact that individuals respond to price changes also rules out the hypothesis that recipients believe their donation contributes little to the charitable project. This occurs in any model of giving where consumer preferences are concave in total project size and there are a large number of consumers, as in the impure altruism model [Andreoni 1990]. However, this is unlikely to be a good representation of the project in this setting because the project is of a linearly expandable nature such that recipients know that marginal contributions matter.

Panel data studies [Randolph 1995, Auten *et al* 2002] using US data on tax returns over a period spanning two tax reforms, provide potentially exogenous sources of variation from which to identify price elasticities. Randolph [1995] finds short run elasticities to be higher than cross sectional estimates at -1.55, although Auten *et al* [2002] find the reverse, with elasticities ranging from $-.40$ to $-.61$ depending on the empirical method used.

Own price elasticities of charitable giving have also been estimated in earlier natural field experiments. Eckel and Grossman [2006] estimate a higher price elasticity of -1.07 as match rates vary from 125 to 133%, and find this to be significantly larger in absolute value than consumer responses to the equivalent rebate. In comparison to Karlan and List [2007], there are two important differences between the elasticities they report and those we calculate. First, they calculate elasticities from a comparison of treatments with a lead donor and a matching scheme relative to a control in which neither is offered. Second, they calculate how donations given respond to the relative price of giving, while we focus on the how donations received respond to the price of giving. Our conceptual framework makes clear the former measures the cross price elasticity of consumption with respect to the price of giving, while the latter measures the own price elasticity of charitable giving.

In Column 4 we estimate (6) and (7) using the donation given to calculate the implied cross price elasticity of consumption with respect to the price of charitable giving. In Column 5 we replicate the methodology of Karlan and List [2007] using the control treatment T1 as the base category, not the signaling treatment T2. Reassuringly, we then find cross price elasticities that are not significantly different to the baseline elasticity reported in Karlan and List [2007], $-.225$, as shown in the final column of Table 5.

An alternative interpretation of the results might be that recipient's behavior is driven by the inferences they make about the lead donor over these treatments rather than any changes in relative prices. For example, in T2 the lead donor effectively commits to provide €60,000 irrespective of the behavior of others. In T3 the lead donor commits to providing € 60,000 only if other donors provide €120,000 given the match rate. Similarly, in T4 the lead donor commits to providing €60,000 only if other donors provide €60,000. In other words, the level of commitment of the lead donor that recipients may infer is greatest in T2, second highest in T4, and lowest in T3. Three pieces of evidence contradict such an interpretation—(i) donations received monotonically decrease in their relative price—moving from T2 to T3 to T4; (ii) donations given fall as the strength of the commitment rises moving from T3 to T4; (iii) in actuality, the lead donation of €60,000 was exhausted by the donations from the original 25,000 mail out recipients.

Finally, we again found no robust evidence that these treatment effects varied by observable characteristics along either the extensive and intensive margins. In other words, recipients with more affinity to the opera, or those that pay a higher price per ticket on average, are no more sensitive to the price of charitable giving than other individuals.

4.4 Non-linear Matching

We now focus attention on the behavioral response of recipients to the non-linear matching scheme T5 that induces a non-convex budget set. While the natural reference group is the signaling treatment T2, we also use the data from the 100% linear matching treatment T4 because the budget lines in T4 and T5 coincide for donations given greater than or equal to €50. The results are reported in Table 6 where T2 is the omitted treatment in each column. At the foot of the table in each column we report p-values on the null hypothesis that the coefficients on the T_4 and T_5 dummy variables are equal. Columns 1 to 3 report specifications (5) to (7) for behavioral responses on the extensive and intensive margins respectively.

On the extensive margin, Column 1 shows that recipients are significantly more likely to respond to the non-linear matching scheme than to the baseline signaling treatment T2. This is in line with revealed preference theory, because as the budget set expands in T5 relative to T2, recipients who found it optimal not to donate in T2 might now optimally choose the interior corner solution. On the intensive margin, significantly larger donations are received in T5, consistent with there being an interior corner solution. In contrast, there is no evidence of response rates being higher in T5 than T4.

On the intensive margin and in line with all the earlier treatment comparisons, Columns 2 and 3 show the results from the OLS estimates and the hurdle model are qualitatively similar, suggesting that selection into giving takes place on unobservables that are largely orthogonal to how much is donated. The hurdle model estimates show that conditional on a donation being made, donations received are significantly higher in T5 than treatment T4.

As both treatments present the average recipient with an almost identical choice if they choose to donate more than €50, Columns 4 to 6 repeat the exercise for the subset of recipients that are predicted to be high valuation donors, as defined earlier. In this subsample response rates and donations given are not significantly different in T5 than T4—this is as expected given these recipients face essentially the same budget set.

The wording in which treatment T5 is described in the mail out letter might lead to $d_g =$ €50 becoming focal in recipient's minds. If so, then relative to T4 there ought to be bunching in the distribution of donations given *from above* at $d_g =$ €50 in T5. No such bunching above $d_g =$ €50 is predicted in the standard model of consumer choice—this segment of the budget line is available under both T4 and T5.

To check for any such detrimental effects on non-linear fundraising schemes, Figure 4 focuses attention on the difference in the proportion of donations given in €10 bins from €0 and €199, between treatments T5 and T4. There is no evidence of consumers being swayed by a focal point effect as there is no bunching from above at d_g = €50 in T5 relative to T4. Indeed, the distribution of donations given is little changed above €70 between T4 and T5. However, in line with the earlier results using T2 as the comparison group, we again find that a greater proportion of individuals choose to donate between €51 and €60 in treatment T5 relative to T4—in T5 20.6% of respondents give in this range whereas there are zero contributions in this range under T4. This suggests donors prefer to give incrementally above €50 when faced with the non-convex budget set which might reflect that donors do not want to 'exploit' the generous lead donor by giving the minimum amount required for the match to be implemented.

The analysis highlights that by removing a portion of the budget set for donations given less than €50 in T5 relative to T4, most small donors optimally move to the interior corner solution rather than the exterior solution, while large donors are unaffected—the response rates are almost identical in treatments T4 and T5. This is in contrast to some findings in the psychology literature, where consumers are sometimes observed forgoing a decision altogether in the presence of an expanded choice set [Iyengar and Lepper 2000].

These results have important implications for fundraisers. On the one hand, non-linear schemes that demand a minimum donation before the match kicks in, have beneficial effects from the fundraiser's point of view in that they—(i) sway those who would have given less than the threshold amount to increase their donation to the threshold level or incrementally above it; (ii) there are no adverse effects on response rates, nor of focal points. On the other hand, for those that would have donated more than the threshold amount of €50, these donors effectively face a reduced relative price of charitable giving, which should lead to a partial crowding out of donations as found in the straight linear matching schemes.

The optimal fundraising scheme would balance these effects. As shown in Table 3, in our design T5 raised less money overall than T2 suggesting the threshold amount was not chosen optimally. As stated previously, this is because most donors would have given above this threshold in any case—in T2 the mean donation given was €132. We therefore conjecture that a higher threshold, set somewhere above this amount would have further increased the total donations given. Hence the fundraiser might be better off by considering sending out tailor-made letters to potential donors, where the matching thresholds are individually adjusted on the basis of predicted donations in the absence of any matching.

4.5 Leveraged Matching

Table 7 presents evidence on the behavioral response of recipients to our second non-linear matching scheme, the leveraged match where recipients are informed that all donations will be matched by an additional €20. The relevant comparison is again with treatment T2. On the extensive margin Column 1 shows that, in line with the descriptive evidence in Table 3, recipients are significantly more likely to respond to the leveraged matching scheme.

On the intensive margin, Column 2 shows the value of donations received is however no different to that under the signaling treatment T2 that involves no matching. This result is replicated using the hurdle model estimate in Column 3. At the foot of Column 3 we report the implied expenditure elasticity of donations received, $\epsilon_{d_r,x}$—this is .006, which although significantly different from zero, is a quantitatively small effect.

Column 4 estimates a specification analogous to (7) for donations given rather than received. The result shows that donations given are significantly *lower* in the leverage treatment T6. The magnitude of this effect suggests donations given fall by around 37% moving from the signaling treatment T2 to the leverage treatment T6. While the results suggest the leveraged matching scheme increases the proportion of recipients that are willing to donate, for those that do, the offered match leads individuals to reduce their donation given to such an extent that the donations actually received by the project are left unchanged overall. At the foot of Column 4 we report the implied income elasticity of own consumption $\epsilon_{c,y}$—this is 1.92, which is significantly different from zero. Moreover, we cannot reject the null hypothesis that $\epsilon_{c,y} = 2$ so there is full crowding out of donations given by the €20 match.[23]

One issue with the comparison of these treatments is that there may be a drawing in of new donors in T6 with very flat indifference curves. These individuals give small amounts in the leverage treatment T6 and would not have given at all had they been assigned to the counterfactual treatment T2. To explore this further, in Columns 5 to 8 we therefore repeat the analysis restricting attention to 'high valuation' donors, namely those that are predicted to donate higher than the average amount. This helps purge our estimates of donors that are likely to have contributed to T6 and would not have contributed in treatment T2.

As expected, on the extensive margin, Column 5 shows there is no longer any difference in response rates across the treatments once more marginal donors are removed. However, even among these recipients who are likely to have donated under both treatments, there is no significant change in donations received (Columns 6 and 7) and a significant reduction in donations given (Column 8). As expected, the estimated coefficient on the donation given is smaller in absolute value than reported in Column 4 when all donors were considered. The implied income elasticity of donations given is 3.08, which is significantly different from two. Hence the evidence suggests there is more than full crowding out of donations given for recipients that would have donated at

[23] As the expenditure elasticity of donations received is close to zero, this suggests that donations given are likely to have a weak, but positive, relationship with income. The fact that the income effect is found to be so weak in turn implies, that the observed price effects in treatments T3 and T4 are nearly all attributable to substitution rather than income effects.

least €20 in the benchmark treatment T2.

Studies using cross sectional data have typically reported income elasticities in the range .4 to .8 [Andreoni 2006a]. Panel data estimates include those of Randolph [1995], who finds short run income elasticities to be considerably smaller at .09. Auten *et al* [2002] use a similar panel of tax payers and find short run elasticities of .29. In the field, Eckel and Grossman [2006] report a far higher income elasticity of 1.07. These estimates are in sharp contrast to our findings.

The core econometric issue with all these studies is, however, that they do not exploit variation in income—either experimental or natural—that is exogenous to other determinants of charitable giving, such as the marginal tax rate faced. To the best of our knowledge, we provide the first estimates of income elasticities for charitable giving that are based on experimental variation in incomes induced by a parallel shift out of the budget set faced by recipients in treatment T6, although this variation of €20 is of course very small relative to total income.[24]

One final remark is in order. Earlier, we have noted the optimal non-linear fundraising scheme might offer matching that kicks in above the response an individual would have chosen in the pure signaling treatment T2. In some sense, this is precisely what the leveraged matching scheme in T6 does for those recipients whose T2 response would have been to donate zero. From that perspective, the crowding in of small donations in T6 vis-à-vis T2 mirrors perfectly the choice of the interior corner solution of small donors in treatment T5 vis-à-vis T2. This again suggests that an optimal fundraising scheme would entail tailor-made non-linear matching based on what the individual would have offered in T2. What remains for future research is understanding the optimal location of the threshold at which matching should kick in, and the magnitude of the match.

5 Conclusions

We have presented evidence from a natural field experiment designed to shed light on the efficacy of alternative charitable fundraising schemes. The key insights that relate directly to such comparisons, and that are of practical use from any fundraiser's point of view, are as follows.

First, the presence of large lead gifts—that might serve as a signal of project quality as in Andreoni [2006b]—significantly and substantially increase donations given with no reduction in the response rate. Second, straight linear matching schemes are not profitable—although donations

[24] To benchmark our data more closely with the income elasticity estimates from the existing literature, we restricted attention to donors in the control group T1 and estimated a specification analogous to (7) except that no treatment dummy needs to be included as the sample is restricted to donors in T1. For this specification, if we interpret the price per ticket bought in the 12 months prior to the mail out as a proxy for income, we find an implied income elasticity of donations received of .42, all else equal, which is significantly different from both zero and one at the 1% significance level.

received rise in response to a fall in the price of giving, donations given fall. In short, despite the common usage of linear matching schemes, our results imply fundraisers would be better off simply announcing the presence of a substantial lead donation. Third, non-linear matching schemes—that require a minimum donation to be given before they are matched—can be profitable in that they cause donations received to be crowded in with little or no change in the overall proportion of recipients that donate in the first place. Fourth, leveraged matching schemes—which match donations by a fixed amount irrespective of the donation given—are ineffective as they lead to an almost full crowding out of donations given so that the project overall receives the same net contribution.

Our finding on the effectiveness of quality signals relative to linear matching schemes naturally begs the question of why fundraisers are typically observed employing the latter type of fundraising scheme. One explanation for the limited use of purely signaling the presence of a lead donor is that for projects with a specific target to be raised, the announcement of significant lead donors might discourage additional contributions [List and Lucking-Reiley 2002]. This is not the case in this empirical setting because the project has no target in mind and because of the linearly expandable nature of the project being funded.

An alternative explanation for the prevalence of linear matching schemes might stem from the fact that the same organization is typically not observed experimenting with different fundraising schemes and thus receives little feedback on alternatives. In line with recent evidence on for-profit firms [Levitt 2006], absent informative feedback on alternative schemes, systematic deviations from optimal fundraising methods might be more likely.

In terms of external validity, two points are of note. First, our analysis throughout is based on a sample of opera attendees. However, while the non-representativeness of the sample may imply the observed *levels* of response or donations likely overstate the response among the general population, the results we have emphasized throughout are identified from *differences* in behavior across treatments that purge the analysis of the common characteristics of sample individuals. Second, our results have external validity for other organizations that also target charitable fundraising towards those with high affinity to the organization.

At the core of the design of our natural field experiment lies the fact that we observe, otherwise similar individuals, making choices on whether and how much to donate when faced with randomly induced variations in their budget set. Viewed through the lens of consumer theory, our results deliver a remarkably positive message for orthodox economic theory. Consumer behavior, on both the extensive and intensive margins, can be rationalized within a standard model of consumer choice in which individuals have preferences defined over own consumption and charitable donations received by the project. In particular—(i) the non-linear matching scheme where potentially focal point effects could have distorted behavior the actual behavioral responses are just as predicted by standard theory; (ii) we find no evidence of particular behaviors such that choices are motivated either *purely* by warm glow, or that individuals target a certain amount of donations to give irrespective of the budget set faced.[25]

Finally, as the provision of information on a lead gift has quantitatively such large effects, our analysis raises the question of what precisely is being signaled by lead donors, and why are individuals so responsive to this? To address these issues, we have designed a new large-scale experiment with the Bavarian State Opera to reveal how responsive individuals are to lead donors as—(i) the amount the lead donor commits to provide varies; (ii) the characteristics of the charitable good change, so the project involves fundraising for a less altruistic cause and one that the lead donor as well as other donors potentially directly benefit from, such as specific operatic productions; (iii) information is provided on the identity of the lead donor.

These variations define a broad research agenda on understanding the role of quality signals for the economics of charitable giving specifically, and in terms of providing a richer framework for understanding behavior in markets with quality signaling more generally.

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[25] In a companion paper we exploit this aspect of the data further by analyzing whether individual behaviors are consistent with the predictions of revealed preference theory. As our treatments induce intersecting budget sets, revealed preference theory generates a large set of predictions if preferences indeed satisfy GARP. While this analysis requires a paper on its own, the bottom line is very simple—we find very few individual violations of revealed preference theory and those that are observed, stem from a small minority of recipients. The analysis highlights that in a real world setting where consumers make simple decisions they are familiar with, standard microeconomic theory works well in explaining observed individual choices.

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Table 1: Characteristics of Recipients by Matching Treatment

Mean, standard error in parentheses

P-value on test of equality of means with control group in brackets

Treatment Number	Treatment Description	Number of Individuals	Female [Yes=1]	Number of Tickets Bought in Last 12 Months	Number of Ticket Orders in Last 12 Months	Average Price of Tickets Bought in Last 12 Months	Total Value of All Tickets Bought in Last 12 Months	Munich Resident [Yes=1]	Year of Last Ticket Purchase [2006=1]	Land Prices 2006
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Control	3787	.466	6.30	2.23	86.6	416	.416	.565	11.2
			(.008)	(.178)	(.047)	(.666)	(7.88)	(.008)	(.008)	(.021)
2	Lead donor	3770	.478	6.27	2.22	86.3	423	.416	.574	11.2
			(.008)	(.153)	(.046)	(.650)	(7.73)	(.008)	(.008)	(.021)
			[.269]	[.886]	[.838]	[.722]	[.541]	[.980]	[.420]	[.979]
3	Lead donor + 1:.5 match	3745	.481	6.39	2.20	86.8	432	.416	.576	11.2
			(.008)	(.184)	(.049)	(.660)	(9.63)	(.008)	(.008)	(.021)
			[.182]	[.737]	[.700]	[.873]	[.197]	[.991]	[.329]	[.905]
4	Lead donor + 1:1 match	3718	.477	6.46	2.28	85.8	435	.419	.576	11.2
			(.008)	(.148)	(.050)	(.667)	(9.78)	(.008)	(.008)	(.021)
			[.314]	[.496]	[.439]	[.397]	[.124]	[.819]	[.347]	[.785]
5	Lead donor + 1:1 match for donations greater than €50	3746	.476	6.31	2.21	85.2	419	.426	.567	11.2
			(.008)	(.145)	(.046)	(.657)	(7.39)	(.008)	(.008)	(.021)
			[.377]	[.977]	[.788]	[.132]	[.781]	[.385]	[.849]	[.447]
6	Lead donor + €20 match for any donation	3746	.486	6.09	2.20	86.5	416	.428	.556	11.2
			(.008)	(.132)	(.047)	(.657)	(8.05)	(.008)	(.008)	(.021)
			[.082]	[.353]	[.616]	[.861]	[.962]	[.270]	[.416]	[.428]

Notes: All figures refer to the mail out recipients in each treatment excluding non-German residents, corporate donors, formally titled donors, and recipients to whom no gender can be assigned. The tests of equality are based on an OLS regression allowing for robust standard errors. All monetary amounts are measured in Euros. In Columns 3 to 6 the "last twelve months" refers to the year prior to the mail out from June 2005 to June 2006. In Column 9, the "land price" measure is the price of renting a flat measured in Euros per month per square meter

Table 2: Characteristics of Donors and Non Donors by Treatment

Mean, standard error in parentheses

P-value on test of equality of means with comparison group in brackets

	Treatment Number and Description	Comparison Group	Number (Proportion) of Responses	Response Rate	Female [Yes=1]	Number of Tickets Bought in Last 12 Months	Number of Ticket Orders in Last 12 Months	Average Price of Tickets Bought in Last 12 Months	Total Value of All Tickets Bought in Last 12 Months	Munich Resident [Yes=1]	Year of Last Ticket Purchase [2006=1]	Land Prices 2006
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All Donors		922	.041	.475	8.71	2.91	87.6	642	.421	.702	11.2
				(.001)	(.016)	(.353)	(.105)	(1.45)	(24.9)	(.016)	(.015)	(.021)
	All Non Donors				.477	6.20	2.19	86.2	414	.420	.563	11.2
					(.003)	(.065)	(.020)	(.274)	(3.42)	(.003)	(.003)	(.021)
		Donors equal to non donors			[.896]	[.000]	[.000]	[.341]	[.000]	[.965]	[.000]	[.657]
1	**Control**		142	.037	.394	8.55	2.87	87.1	585	.380	.697	11.2
			(15.4)	(.003)	(.041)	(.970)	(.245)	(3.65)	(47.0)	(.041)	(.039)	(.108)
		Non Donors in Same Treatment			[.080]	[.019]	[.009]	[.901]	[.000]	[.376]	[.000]	[.855]
2	**Lead donor**		132	.035	.530	9.52	3.36	88.1	666	.394	.742	11.3
			(14.3)	(.003)	(.044)	(.954)	(.374)	(4.21)	(66.1)	(.043)	(.038)	(.114)
		Non Donors in Same Treatment			[.226]	[.000]	[.002]	[.669]	[.000]	[.600]	[.000]	[.386]
3	**Lead donor + 1:.5 match**		156	.042	.449	9.67	2.88	87.3	662	.365	.654	11.2
			(16.9)	(.003)	(.040)	(1.09)	(.235)	(3.33)	(55.1)	(.039)	(.038)	(.113)
		Non Donors in Same Treatment			[.412]	[.002]	[.004]	[.874]	[.000]	[.183]	[.040]	[.673]
4	**Lead donor + 1:1 match**		155	.042	.426	7.96	2.75	88.9	619	.413	.748	11.2
			(16.8)	(.003)	(.040)	(.746)	(.274)	(4.13)	(58.2)	(.040)	(.035)	(.108)
		Non Donors in Same Treatment			[.190]	[.041]	[.083]	[.452]	[.001]	[.886]	[.000]	[.957]
5	**Lead donor + 1:1 match for donations greater than €50**		160	.043	.563	8.11	2.60	90.7	698	.475	.694	11.2
			(17.4)	(.003)	(.039)	(.703)	(.177)	(3.14)	(69.7)	(.040)	(.037)	(.097)
		Non Donors in Same Treatment			[.025]	[.010]	[.028]	[.079]	[.000]	[.206]	[.000]	[.887]
6	**Lead donor + €20 match for any donation**		177	.047	.486	8.58	3.07	83.8	623	.480	.684	11.2
			(19.2)	(.003)	(.038)	(.719)	(.243)	(2.98)	(63.9)	(.038)	(.035)	(.086)
		Non Donors in Same Treatment			[.994]	[.000]	[.000]	[.367]	[.001]	[.160]	[.003]	[.992]

Notes: All figures refer to the mail out recipients in each treatment excluding non-German residents, corporate donors, formally titled donors, and recipients to whom no gender can be assigned. The tests of equality are based on an OLS regression allowing for robust standard errors. All monetary amounts are measured in Euros. In Column 1, the proportion refers to the proportion of all donors that were in the given treatment. In Columns 4 to 7 the "last twelve months" refers to the year prior to the mail out from June 2005 to June 2006. In Column 10, the "land price" measure is the price of renting a flat measured in Euros per month per square meter.

Table 3: Outcomes by Treatment

Mean, standard error in parentheses
P-values on tests of equalities on means with comparison group in brackets

Treatment Number	Treatment Description	Comparison Group	Response Rate (1)	Total Amount Donated (2)	Total Amount Raised (3)	Average Donation Received (4)	Median Donation Received (5)	Average Donation Given (6)	Median Donation Given (7)
1	Control		.037	10550	10550	74.3	50	74.3	50
			(.003)			(6.19)		(6.19)	
2	Lead donor		.035	17416	17416	132	100	132	100
			(.003)			(14.3)		(14.3)	
		T1 Control	[.564]			[.000]	[.000]	[.000]	[.000]
3	Lead donor + 1:.5 matching		.042	15705	23558	151	75	101	50
			(.003)			(18.9)		(12.6)	
		T1 Control	[.355]			[.000]	[.005]	[.061]	[.999]
		T2 Lead donor	[.134]			[.421]	[.131]	[.102]	[.000]
4	Lead donor + 1:1 matching		.042	14310	28620	185	100	92.3	50
			(.003)			(20.7)		(10.4)	
		T1 Control	[.352]			[.000]	[.000]	[.136]	[.999]
		T2 Lead donor	[.132]			[.037]	[.999]	[.025]	[.000]
5	Lead donor + 1:1 matching for donations greater than €50		.043	15671	31107	194	120	97.9	60
			(.003)			(19.3)		(9.59)	
		T1 Control	[.249]			[.000]	[.000]	[.039]	[.138]
		T2 Lead donor	[.084]			[.010]	[.102]	[.049]	[.000]
6	Lead donor + €20 match for any donation		.047	12248	15788	89.2	70	69.2	50
			(.003)			(5.51)		(5.51)	
		T1 Control	[.036]			[.073]	[.024]	[.539]	[.999]
		T2 Lead donor	[.008]			[.006]	[.065]	[.000]	[.002]

Notes: All figures are based on the total sample of recipients of the mail outs excluding non-German residents, corporate donors, formally titled donors, and recipients to whom no gender can be assigned. The test of equality of means is based on an OLS regression allowing for robust standard errors. The test of equality of medians is based on a quantile regression. The response rate is the proportion of recipients that donate some positive amount, as reported in the donation amount column. The actual donation then received by the opera house in each treatment is reported in the donation received column. All monetary amounts are measured in Euros.

Table 4: Signaling Effects of a Lead Donor

Marginal effects reported in probit regressions

Robust standard errors in parentheses

Dependent variable:	**Match Response**	**Donation Received**	**Log (Donation Received)**	**Match Response**	**Donation Received**	**Log (Donation Received)**
	(1) Probit	**(2) OLS**	**(3) Hurdle Model**	**(4) Probit: Predicted High Donors**	**(5) OLS: Predicted High Donors**	**(6) Hurdle Model: Predicted High Donors**
Signaling Treatment T2	-.003	1.83***	.366***	-.002	3.18**	.425**
	(.004)	(.711)	(.122)	(.007)	(1.42)	(.169)
Mean of Dependent Variable (€)	.036	3.70	102	.044	5.59	128
Observations	7557	7557	274	3306	3306	145

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. Robust standard errors estimated throughout. In Columns 1 and 4 a probit regression is estimated where the dependent variable is equal to one if the recipient responds to the matching treatment with any positive donation, and zero otherwise. Marginal effects are reported. In Columns 3 and 6 the second stage of a hurdle model is estimated assuming the donation amounts follow a log normal distribution. The dependent variable is the log of the donation received. The reference treatment group throughout is the control treatment (T1). The sample in Columns 4 to 6 is restricted to those recipients that are predicted to donate higher than average amounts. All specifications control for the recipient's gender, the number of ticket orders placed in the 12 months prior to mail out, the average price of these tickets, whether the recipient is a Munich resident, and a dummy variable for whether the year of the last ticket purchase was 2006 or not.

Table 5: Linear Matching Schemes

Marginal effects reported in probit regressions

Robust standard errors in parentheses

Dependent variable:	Match Response	Donation Received	Log (Donation Received)	Log (Donation Given)	
	(1) Probit	(2) OLS	(3) Hurdle Model	(4) Cross Price Elasticity of Own Consumption	(5) Karlan-List [2007] Replication
50% Linear Match Treatment T3	.007	1.61	.178	-.301**	.076
	(.005)	(1.12)	(.128)	(.127)	(.109)
100% Linear Match Treatment T4	.007	3.07**	.457***	-.354***	.040
	(.005)	(1.22)	(.124)	(.125)	(.108)
Mean of Dependent Variable (€)	.039	6.20	157	107	89.5
Implied Own Price Elasticity [T2 - T3]			-.534 (.385)		
t-test: pure warm glow			[.013]		
t-test: donation targeting			[.167]		
Implied Own Price Elasticity [T3 - T4]			-1.12 (.444)		
t-test: pure warm glow			[.047]		
t-test: donation targeting			[.012]		
Implied Own Price Elasticity [T2 - T4]			-.915 (.249)		
t-test: pure warm glow			[.093]		
t-test: donation targeting			[.000]		
Implied Cross Price Elasticity [T2 - T3]				.903 (.381)	
Implied Cross Price Elasticity [T2 - T4]				.211 (.469)	
Implied Cross Price Elasticity [T2 - T4]				.708 (.251)	
Implied Cross Price Elasticity [T1 - T3]					-.227 (.328)
Implied Cross Price Elasticity [T1 - T4]					.144 (.454)
Implied Cross Price Elasticity [T1 - T4]					-.080 (.217)
Observations	11233	11233	443	443	453

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. Robust standard errors estimated throughout. In Column 1 a probit regression is estimated where the dependent variable is equal to one if the recipient responds to the matching treatment with any positive donation, and zero otherwise. Marginal effects are reported. In Columns 3 to 5 the second stage of a hurdle model is estimated assuming the donation amounts and received follow a log normal distribution. The dependent variable in Column 3 is the log of the donation received, and the dependent variable in Columns 4 and 5 is the log of the donation given. The reference treatment group in Columns 1 to 4 is the signalling treatment (T2), and in Column 5 the reference treatment group is the control treatment (T1). In Columns 3 to 5 the implied own and cross price elasticities are reported and the standard error of each estimate is reported in parentheses. All specifications control for the recipient's gender, the number of ticket orders placed in the 12 months prior to mail out, the average price of these tickets, whether the recipient is a Munich resident, and a dummy variable for whether the year of the last ticket purchase was 2006 or no

Table 6: Non-linear Matching

Marginal effects reported in probit regressions

Robust standard errors in parentheses

Dependent variable:	**Match Response**	**Donation Received**	**Log (Donation Received)**	**Match Response**	**Donation Received**	**Log (Donation Received)**
	(1) Probit	**(2) OLS**	**(3) Hurdle Model**	**(4) Probit: Predicted High Donors**	**(5) OLS: Predicted High Donors**	**(6) Hurdle Model: Predicted High Donors**
100% Linear Match Treatment T4	.007	3.08**	.377***	.003	4.56*	.445***
	(.005)	(1.22)	(.105)	(.007)	(2.51)	(.147)
Non-linear Matching Treatment T5	.008*	3.85***	.560***	.006	4.10*	.437***
	(.005)	(1.22)	(.099)	(.007)	(2.30)	(.141)
Mean of Dependent Variable (€)	.040	6.87	173	.046	10.1	218
Equality of Treatments T4 and T5	[.730]	[.594]	[.035]	[.725]	[.874]	[.945]
Observations	11234	11234	447	4892	4892	227

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. Robust standard errors estimated throughout. In Columns 1 and 4 a probit regression is estimated where the dependent variable is equal to one if the recipient responds to the matching treatment with any positive donation, and zero otherwise. Marginal effects are reported. In Columns 3 and 6 the second stage of a hurdle model is estimated assuming the donation amounts follow a log normal distribution. The dependent variable is the log of the donation received. The reference treatment group throughout is the signalling treatment (T2). The sample in Columns 4 to 6 is restricted to those recipients that are predicted to donate higher than average amounts. In each column we also report the p-value on the null hypothesis that the coefficients on the dummy variables for treatments T4 and T5 are equal. All specifications control for the recipient's gender, the number of ticket orders placed in the 12 months prior to mail out, the average price of these tickets, whether the recipient is a Munich resident, and a dummy variable for whether the year of the last ticket purchase was 2006 or not.

Table 7: Leveraged Matching

Marginal effects reported in probit regressions

Robust standard errors in parentheses

Dependent variable:	Match Response	Donation Received	Log (Donation Received)	Log (Donation Given)
	(1) Probit	(2) OLS	(3) Hurdle Model	(4) Hurdle Model
Leveraged Matching Treatment T6	.013***	-.372	.012	-.456***
	(.004)	(.750)	(.112)	(.104)
Mean of Dependent Variable (€)	.041	4.42	107	96
Expenditure Elasticity (donations received)			.006***	
			(.000)	
Income Elasticity (own consumption)				1.92***
				(.164)
t-test: full crowding out (income elasticity = 2)				[.608]
Observations	7516	7516	309	309

Dependent variable:	Match Response	Donation Received	Log (Donation Received)	Log (Donation Given)
	(5) Probit: Predicted High Donors	(6) OLS: Predicted High Donors	(7) Hurdle Model: Predicted High Donors	(8) Hurdle Model: Predicted High Donors
Leveraged Matching Treatment T6	.010	-1.43	-.193	-.572***
	(.007)	(1.49)	(.154)	(.149)
Mean of Dependent Variable (€)	.048	6.45	134	123
Expenditure Elasticity (donations received)			-.107***	
			(.012)	
Income Elasticity (own consumption)				3.18***
				(.421)
t-test: full crowding out (income elasticity = 2)				[.006]
Observations	3317	3317	160	160

Notes: *** denotes significance at 1%, ** at 5%, and * at 10%. Robust standard errors estimated throughout. In Columns 1 and 4 a probit regression is estimated where the dependent variable is equal to one if the recipient responds to the matching treatment with any positive donation, and zero otherwise. Marginal effects are reported. In Columns 3, 4, 7, and 8 the second stage of a hurdle model is estimated assuming the donation amounts follow a log normal distribution. The reference treatment group throughout is the signalling treatment (T2). The sample in Columns 5 to 8 is restricted to those recipients that are predicted to donate higher than average amounts. In Columns 3, 4, 7, and 8 the implied expenditure and income elasticities are reported and the standard error of each estimate is in parentheses. All specifications control for the recipient's gender, the number of ticket orders placed in the 12 months prior to mail out, the average price of these tickets, whether the recipient is a Munich resident, and a dummy variable for whether the year of the last ticket purchase was 2006 or not.

Figure 1: The Design of the Field Experiment and Outcomes

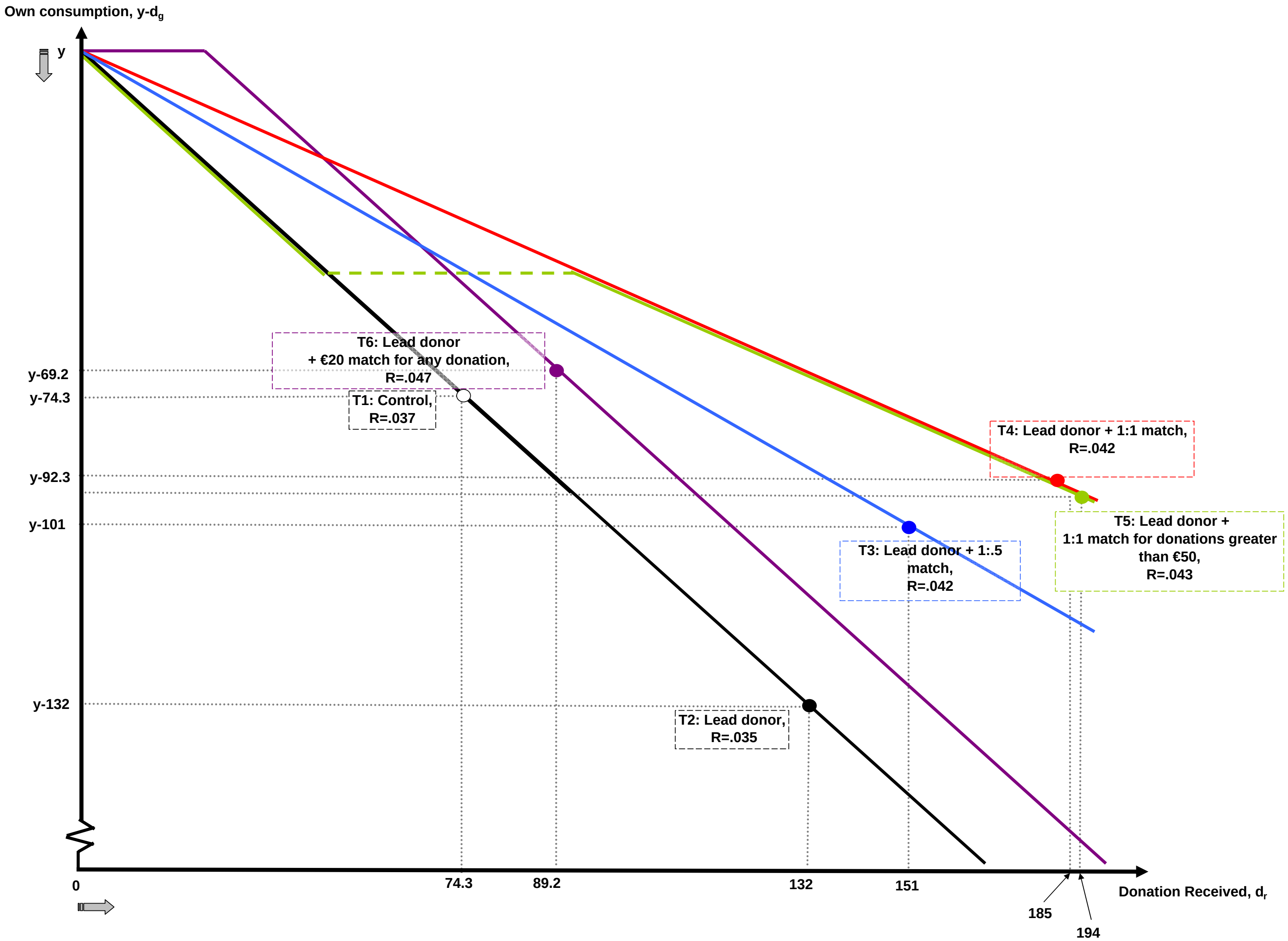


Figure 2: Predictions

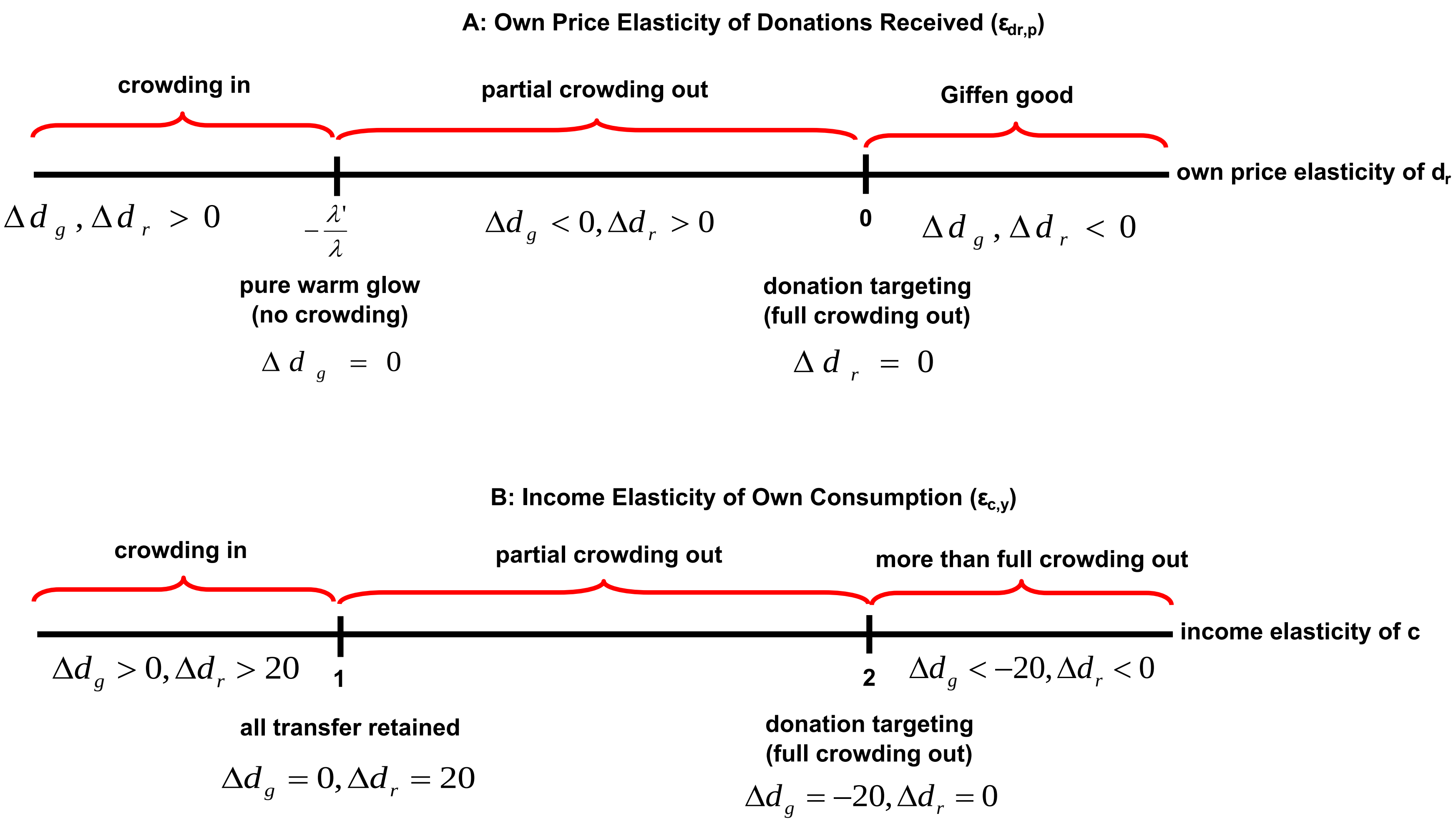


Figure 3: Quantile Regression Estimates of Signaling Treatment T2

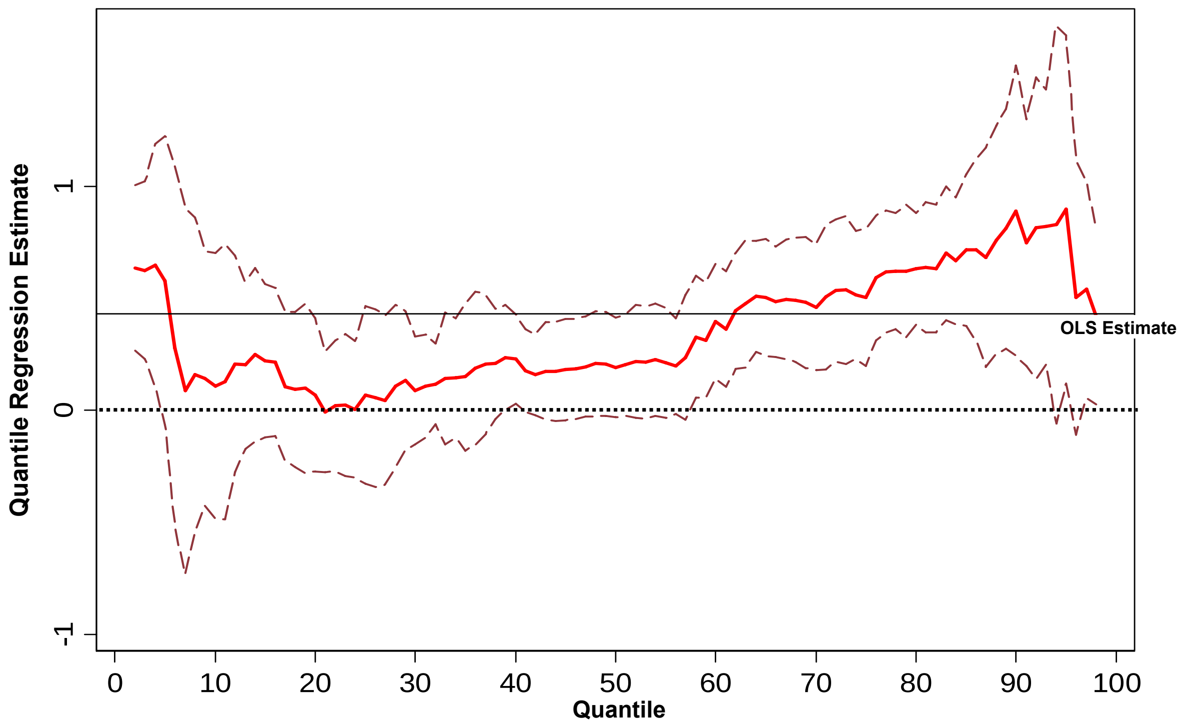
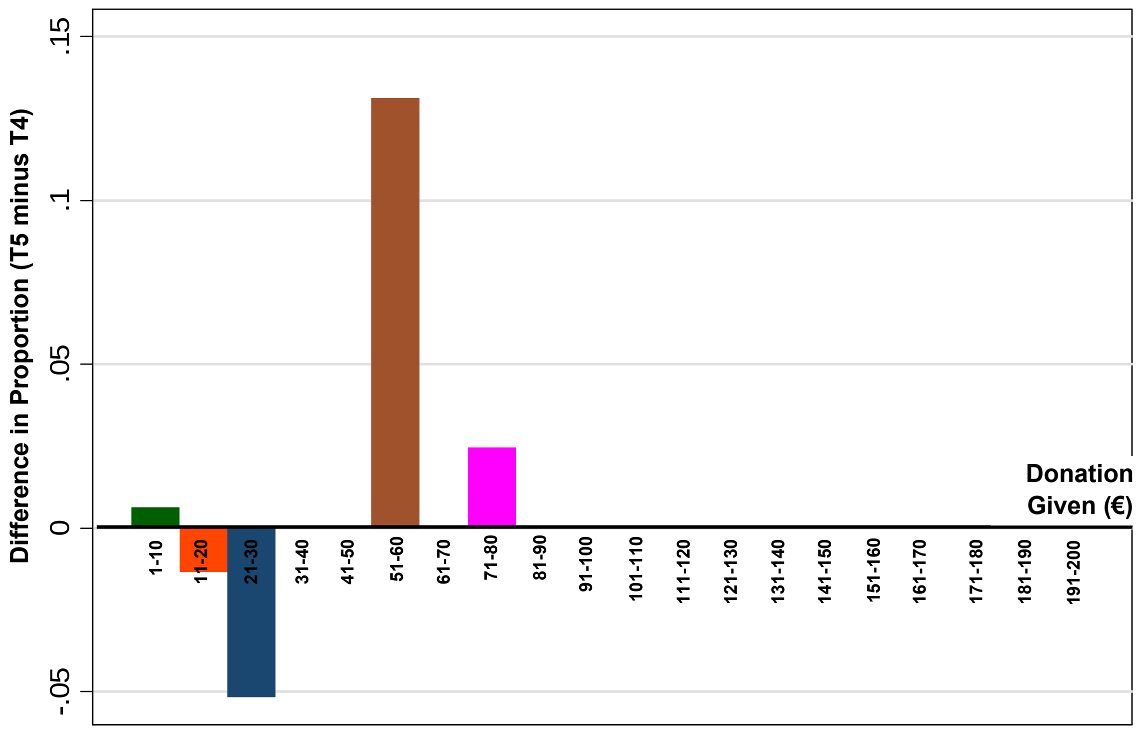


Figure 4: Proportion of Donations Given, T5 minus T4



Notes: Figure 3 shows the estimated quantile regression effect at each quantile of the conditional distribution of the log of donations received, and the associated 95% confidence interval. The figure also shows the coefficient on the treatment dummy variable from an OLS regression. The individual characteristics controlled for are whether the recipient is female, the number of ticket orders placed in the 12 months prior to mail out, the average price of these tickets, whether the recipient is a Munich resident, and a dummy variable for whether the year of the last ticket purchase was 2006 or not. Figure 4 plots the difference in the proportion of donations given by 10 Euro bins. A positive value indicates that proportionally more donations were given in the bin under T5 than T4, and negative values have the opposite interpretation.

Appendix: The Mail Out Letter (Translated)

Bayerische Staatsoper
Staatsintendant
Max-Joseph-Platz 2, D-80539 München
www.staatsoper.de

[ADDRESS OF RECIPIENT]

Dear [RECIPIENT],

The Bavarian State Opera House has been investing in the musical education of children and youths for several years now as the operatic the art form is in increasing danger of disappearing from the cultural memory of future generations.

Enthusiasm for music and opera is awakened in many different ways in our children and youth programme, “Erlebnis Oper” *[Experience Opera]*. In the forthcoming season 2006/7 we will enlarge the scope of this programme through a new project “Stück für Stück” that specifically invites children from schools in socially disadvantaged areas to a playful introduction into the world of opera. Since we have extremely limited own funds for this project, the school children will only be able to experience the value of opera with the help of private donations.

[This paragraph describes each matching scheme and is experimentally varied as described in the main text of the paper].

As a thank you we will give away a pair of opera tickets for Engelbert Humperdinck’s “Konigskinder” on Wednesday, 12 July 2006 in the music director’s box as well as fifty CDs signed by Maestro Zubin Mehta among all donors.

You can find all further information in the enclosed material. In case of any questions please give our Development team a ring on *[phone number]*. I would be very pleased if we could enable the project “Stück für Stück” through this appeal and, thus, make sure that the operatic experience is preserved for younger generations.

With many thanks for your support and best wishes,

Sir Peter Jonas, Staatsintendant

Appendix: The Mail Out Letter (Translated)

“Stück für Stück”

The project “Stück für Stück” has been developed specifically for school children from socially disadvantaged areas. Musical education serves many different functions in particular for children and youths with difficult backgrounds -- it strengthens social competence and own personality, improves children’s willingness to perform, and reduces social inequality. Since music education plays a lesser and lesser role in home and school education, the Bavarian State Opera has taken it on to contribute to it ourselves. The world of opera as a place of fascination is made attainable and accessible for young people.

In drama and music workshops, “Stück für Stück” will give insights into the world of opera for groups of around 30 children. They will be intensively and creatively prepared for a subsequent visit of an opera performance. These workshops encourage sensual perception – through ear and eye but also through scenic and physical play and intellectual comprehension – all of these are important elements for the workshops. How does Orpheus in “Orphee and Eurydice” manage to persuade the gods to let him save his wife from the realm of dead? Why does he fail? Why poses the opera “Cosi fan tutte” that girls can never be faithful? It is questions like these that are investigated on the workshops.

The workshops are also made special through the large number and variety of people who are involved in them: musicians, singers, directors, and people from many other departments, ranging from costumes and makeup to marketing. The participants in each workshop work through an opera’s storyline, and are introduced to the production and will meet singers in their costumes as well as musicians. This makes the workshops authentic. After the workshops the participants are invited to see the actual opera production.

Through your donation the project “Stück für Stück” will be made financially viable so that we can charge only a small symbolic fee to the participants. This makes it possible to offer our children and youth programme also to children from socially disadvantaged backgrounds that can, thus, learn about the fascination of opera.

Note: In German, Stück für Stück is a wordplay --- “Stück” meaning “play” as in drama and “Stück für Stück” being an expression for doing something bit by bit.