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Strategic interaction in the market for charitable donations: The role of public funding

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Abstract

Government financing of charities influences their fundraising and private donations. To analyze competition between charities, we modify the model of fundraising introduced by Andreoni and Payne, where there are two groups of donors and two charities. We concentrate on warm-glow motivation for giving and highlight strategic interaction in the market for donations. The charities are output-maximizing, producing services with a purchased input and in-house managerial supervision. In the absence of public funding, fundraising by charities are strategic complement given fixed costs. We show that block grants can change the nature of the competition, making fundraising strategic substitutes if grants exceed fixed costs. A charity receiving a grant will optimally reduce its fundraising, but the level of service provision will also be affected by the fact that the competing charity will solicit more intensively. The competitor will deliver more services because it benefits from the reduction in solicitation by the grant recipient. In this setting, matching grants work much like block grants as charities in both cases will compete less intensively for donations. That is, incentives for fundraising are weaker with matching grants. However, if both instruments are used the impact of a matching grant depends on whether the block grant over- or undercompensates for fixed costs. An optimal funding policy must account for this interaction effect as well as the fungibility of support working through charity competition in the market for donations.

KEYWORDS
charities, crowding-out, fundraising, government grants, strategic interaction

1 | INTRODUCTION

The market for charitable donations is substantial and growing (List, 2011). Government financing affects this market on both sides. Our analysis deals with the strategic interaction between charities and how their behavior are affected by public funding. The main contribution is to establish how government grants can change the nature of the competition between charities in the market for donations.

A natural starting point is the seminal contribution of Andreoni and Payne (2003). In an analysis of fundraising, they formulate the behavioral responses of both charities and donors to government funding. They introduce two distinct groups of donors, each favoring the services produced by one of two charities. The essential aspect is fundraising by the charities, whereby they solicit contributions from individuals. Optimal fundraising depends on the objective function of the charity and how government funds enter the budget constraint. Their model predicts both direct and indirect crowding-out of unconditional public funding. The direct effect is the conventional one: donors contribute less when charities have more funds. The indirect effect is a novel one, however: government financing also causes significant reductions in fundraising, which adds to the drop in contributions. In the empirical part, Andreoni and Payne (2003) find support for this new mechanism.

We highlight how fundraising is affected by the interaction between charities. Though they mention the conditions for the existence of a unique subgame perfect equilibrium and illustrate it in a diagram, Andreoni and Payne (2003) were primarily interested in establishing indirect crowding-out theoretically and estimating it empirically. We find that reaction functions are non-linear, raising the possibility of there being more than one equilibrium. More importantly, we find that government grants can change the nature of the competition in the market for donations.

We modify and extend the model in three ways. First, regarding the motivation for giving, we shut down the classic crowding-out channel to zoom in on the indirect effect of government funding on donations via fundraising. In our setup donors only care about the "joy-of-giving" or "warm-glow." It turns out that this is not a limitation in the sense that we retain the two main effects of solicitation: it shifts donors from passive to active status and donations (partly) from one charity to its competitor. Thus, we demonstrate that these generalize not only to the case of impure altruism, as foreseen by Andreoni and Payne (2003), but also to an environment where potential donors are only motivated by the private benefits of giving.

Second, most analyses of crowding-out, including Andreoni and Payne (2003), deal with general economic support from the government to a charity, a so-called block grant. We also introduce matching grants, where public funding is conditional on other donations. The existing literature is oriented towards their impact on the behavior of donors. We compare the two types of government funding and focus on how they influence the fundraising of the charities competing for them. Our assumption of warm-glow donors, which are insensitive to incentives, facilitates this comparison.

Third, Andreoni and Payne (2003) assume that the production functions of NGOs are linear, that is, that output equals net revenues. According to them, empirical studies show that charities are not maximizing net revenues, so they postulate that charity managers incur a utility loss when engaging in the mundane task of fundraising. We instead follow Aldashev and Verdier (2010) in assuming that output-maximizing charities deliver services based on a production technology requiring two inputs, with strictly decreasing returns to both of them.[1] One input is purchased and the other, managerial supervision, is supplied in-house. Fundraising will allow a charity to buy more of the first input at the expense of the other as management devotes more time to chasing donations. This generates an endogenous nonmonetary cost of fundraising. In other words, the combination of a concave production function, arguably more realistic, and a limited resource (managerial time) generate similar effects as "fundraising aversion." Hence, the empirical pattern Andreoni and Payne (2003) refer to can arise even when the objective functions of charities are fully aligned with their missions.

The theoretical literature on charities and fundraising is limited. Mayo (2021) offers a review and concludes that "little is known about the ways in which nonprofits interact with each other." She modifies Andreoni and Payne (2003) to deal with the effect of large gifts to rival charities. She suggests that a large donor can change the game, leading to strategic complementarity. Another paper on the role of a large donor, Gong and Grundy (2014), address matching grants and seed money in a setting where the large donor influences a small donor and a charity. The focus is on how funding schemes affect the relationship between large and small donor. The behavior of the charity is limited to the transformation of donations to a public good. We concentrate on government funding and do not study the large donor case.

An alternative approach with results leaning towards crowding-in has emphasized asymmetric information and grants as signals of quality. The theoretical foundation for the handling of asymmetric information in organizations is developed by Hermalin (1998). Vesterlund (2003) applies the approach to donors and charities in a model of sequential fundraising. Khovrenkov (2019) supply empirical evidence that this mechanism may be of relevance in some settings. To avoid complicating our analysis of competition in the market for donations, we do not investigate it.

Another literature on strategic interaction in fundraising across nonprofits emphasizes entry, exit, and market structure. Castaneda (2008) address the effects of charity competition for donors on the behavior of nonprofit organizations. Competition affects the composition of spending on fundraising, service provision, and perquisites. Krasteva and Yildirim (2016) offer a more formal model of competition in a situation with information problems affecting quality heterogeneity among charities. We look at both sides of the market for donations in a partial equilibrium framework where there is neither misappropriation of funds by charities nor

[1]Scharf's (2014) characterization of "warm-glow charities:" organizations that place particular emphasis on their own activities to some extent.

quality differences between them. General equilibrium models with charities are few and far between. However, in Aldashev et al. (2018), individuals choose between running for-profit firms or charities. To study solicitation and public funding in more detail, we prefer to avoid this added layer of complexity. Moreover, we concentrate on the case of duopoly, while acknowledging that a larger space of possible effects of competition opens up under monopolistic competition.

While the empirical literature on donor funding is extensive, Meer (2017) stresses that neither the experimental literature nor observational studies provide clear-cut answers to the question of whether costly fundraising mainly induces an inefficient shifting of market shares or actually enlarges the market for donations and thus raises service provision. We address how public funds influence private donations, the "crowding-out-debate." The recent overview of by de Wit and Bekkers (2017) shows that the mechanisms and effects need clarification.[2] We take the evidence on crowding-out provided by Andreoni and Payne (2003, 2011) as a starting point—that reduced fundraising effort by charities is the most important channel.

Our model generates the following results. First, in the absence of government funding, fundraising by the charities are strategic complements as long as there are fixed costs of operations. As one of them solicits more intensively, the other receives fewer donations. This increases the marginal product of the input sourced from outside the organization and lowers the marginal product of managerial oversight. The fact that fundraising has a smaller impact on donations on the margin when the other charity is more aggressive in its marketing pulls in the other direction. Still, as long as a weak condition on the production technology is satisfied the net effect is to induce it to follow the example of its competitor. This contrasts with the strategic substitutability of fundraising in Andreoni and Payne (2003), where only the last effect is operative due to the assumed linearity of the production functions.

Second, however, the nature of the competition in the market for donations can change when the government provides block grants. If grants exceed fixed costs for both charities, fundraising will indeed be strategic substitutes. Moreover, public funding can introduce heterogeneity in the sense that one charity views competition differently from the other. This happens when the size of the grant relative to fixed costs differs between the two, for example, one being "overcompensated" while the other still having to cover a portion out of donations.

Third, this has the implication that while a charity receiving a grant will indeed reduce its fundraising, as in Andreoni and Payne (2003), the other charity might solicit more intensively. It also means that the net effect on the output of a charity receiving a higher grant is not necessarily the expected one. On the one hand, it is more generously funded by the government, but on the other it could be hurt by the response of its competitor. Surprisingly, the latter will for certain deliver more services because it benefits from the reduction in solicitation by the grant recipient. There are thus potentially important cross-organizational links through the market for donations that the government needs to take into account in its grant policy.

Fourth, and again contrary to expectation, on their own matching grants work like block grants. Charities will compete less intensively for donations as the public funds induce them to switch managerial attention from fundraising to operations. That is, charities have weaker incentives for fundraising. This is because a matching grant has the exact opposite effects of more intensive solicitation by the other charity.

[2]For a broader review of the literature on charitable giving, see Andreoni and Payne (2013).

Fifth, if both instruments are utilized, the impact of the matching grant depends on whether the block grant over- or undercompensates for the fixed costs. Only in the former case does it stimulate fundraising. An optimal funding policy thus have to factor in this interaction effect.

To our knowledge, these results are novel. In sum, they might explain why previous empirical studies have not delivered many general lessons. Strategic interaction between mission-oriented charities in the market for donations makes for complex responses to interventions and teasing them out requires quite detailed knowledge of both the workings of the market and government policies.

The rest of the paper is organized as follows. In the next section, we deduce the aggregate donation function facing the charities when contributors are motivated only by warm-glow. Section 3 is devoted to studying competition in this market in the absence of government intervention. We then introduce the two generic forms of grants that we study and investigate their effects both separately and jointly. Section 5 contains our conclusions.

2 | DONORS AND DONATIONS

2.1 | Individual donations

A well-known empirical regularity with regard to donative behavior is "the power of asking." Individuals tend to give to charitable causes only if they are actually asked to do so (Andreoni, 2006; Yörük, 2009). We model this in the following way. Potential donors do not give unless they are solicited by a charity. If individual i is approached by charity j, i chooses his donation balancing his private material interests against the gains flowing from the act of giving. These gains could in general be the utility from the resulting quantity of the collective good provided by the charity and/or the warm-glow generated by i's own contribution. We focus on the latter.

A potential application of our model is to the market for private foreign aid. Werker and Ahmed (2008) document the tremendous growth of the private aid industry in recent decades. Donor country governments, which have both outsourced tasks to development NGOs and funded their activities, have played a significant role in this expansion. A greater understanding of the interplay between public and private aid agencies could thus help inform policymaking, with potential impacts on both the efficiency and volume of total aid.

The purported beneficiaries of private aid live far away from those who give. Hansmann (1980) argues that the resulting information problem with respect to the spending of the funds is a major reason why service delivery in this sector is usually a nonprofit undertaking. The argument is that intrinsically motivated individuals can be trusted to spend for the intended purposes, in contrast to for-profit providers, who will take advantage of the information asymmetry to siphon off some of the funds for their own private use. This is of course not a fail-proof mechanism, as the many instances of charity fraud attests to. More generally, nothing stops management and workers from enjoying excessive on-the-job consumption within the nondistribution constraint. Still, because a dollar's worth of fringe benefits is worth less than a dollar in cash, nonprofit providers could be expected to plunge a larger share of donations into activities (Glaeser & Shleifer, 2001).

Another difficulty facing private aid donors is that their contributions will have an almost imperceptively small impact on the vast problem of global poverty. Relatedly, around the world, there is a large number of potential contributors and official aid is sizeable. As is well-known from the theoretical literature on the private provision of public goods (Andreoni, 1988; Bergstrom et al., 1986), this should induce outcome-oriented donors to free-ride. In turn, we can suppose that private foreign aid is almost exclusively driven by the warm-glow flowing from the act of giving itself. This is indeed the conclusion of Ribar and Wilhelm (2002)[3]:

> The estimates show little evidence of crowd-out from either direct public or related private sources. Thus, at the margin, donations to these [international relief and development] organizations appear to be motivated solely by joy-of-giving preferences.

More generally, Andreoni and Payne (2011) find that crowding-out is almost exclusively due to less fundraising, indicating that contributors are mainly motivated by warm-glow. In this spirit, we assume that a potential donor i has Cobb-Douglas preferences defined over private consumption C_i and donations to two different service-providing organizations, d_{i1} and d_{i2}:

$$U_i = \beta \ln C_i + F_{i1}\gamma_{i1} \ln d_{i1} + F_{i2}\gamma_{i2} \ln d_{i2,} \tag{1}$$

where β, γ_{i1}, and γ_{i2} are positive parameters summing to 1. C_i is material consumption. In line with the power of asking hypothesis, F_{ij} is an indicator function that takes on a value of zero if individual i is not reached by the fundraising effort of charity j and 1 if he is. In essence, individuals have latent warm-glow preferences that are triggered whenever they are solicited by j.[4]

As in Andreoni and Payne (2003), there are two distinct groups of donors, 1 and 2, each favouring the services produced by one of two charities. Accordingly, we assume $\gamma_{11} > \gamma_{12}$ and $\gamma_{22} > \gamma_{21}$. These weights could stem from an intrinsic preference for one type of charitable services over others or reflect ideas about the usefulness of the approach to service delivery espoused by a charity. We assume within-group homogeneity, implying that there are only two types of donors in this world. Letting the subscript i refer to groups from now on, the number of individuals in group i is N_i.

The budget constraint of individual i is

$$C_i + d_{i1} + d_{i2} = Y. \tag{2}$$

If an individual is not subjected to the fundraising effort of one of the charities, all income is spent on private consumption. In other words, there is no decision problem. However,

[3]Echazu and Nocetti (2015) show that the standard limit result—with an infinite number of potential donors, only warm-glow can sustain giving—does not apply when "the object of altruism is a large number of potential recipients of a good for which there is a target level of provision (e.g. an acute malnutrition treatment, an insecticide-treated bed net)." As the examples show, their approach could be of relevance for some types of private aid. Since our interest is mainly in the competition between NGOs for funds, we prefer to use a more standard warm-glow set-up.

[4]This is a strong version of the power of asking as there are obviously individuals who are able to say no when charities "come knocking." However, nothing is gained by introducing an exogenous nondegenerate probability that people give in to the power of the ask.

fundraising can induce three different situations where i must maximize the applicable version of (1) subject to (2). Using the notation $d_{ij}(F_{i1}, F_{i2})$ to underscore the dependence of individual donations on fundraising, the optimal levels are

$$d_{i1}(1,0) = \left(\frac{\gamma_{i1}}{\beta + \gamma_{i1}}\right)Y; \tag{3}$$

$$d_{i1}(1,1) = \gamma_{i1}Y, d_{i2}(1,1) = \gamma_{i2}Y; \tag{4}$$

$$d_{i2}(0,1) = \left(\frac{\gamma_{i2}}{\beta + \gamma_{i2}}\right)Y. \tag{5}$$

As already noted, $d_{i1}(0, F_{i2}) = d_{i2}(F_{i1}, 0) = 0$.

These results have a number of interesting implications. First, as long as your are solicited, you give more to your favorite charity than to the other one. For example, $d_{11}(1,0) > d_{12}(0,1)$ and $d_{11}(1,1) > d_{12}(1,1)$ because $\gamma_{11} > \gamma_{12}$. Individuals in group 1 gets more warm-glow from donating to charity 1 and this translates into a higher "willingness-to-donate" if they are solicited by it.

Second, this willingness is stronger when only charity 1 is requesting donations ($d_{11}(1,0) > d_{11}(1,1)$). In fact, you donate more to a charity if it is the only one soliciting you, regardless of its identity. Conversely, donors who already donate to one charity will decrease their donations to it somewhat if they are approached by the other. This means that for each charity there is an effect on the intensive margin from the fundraising effort of its competitor even though its own solicitation has no impact on the amount it receives from those who are already contributing.

Third, as long as the groups do not consist of "high demanders" and "low demanders," contributions to a charity is higher from solicited individuals in the "in-group" than in the "out-group" (e.g., $d_{11}(1,0) > d_{21}(1,0)$).[5]

Fourth, individuals who are reached by the fundraising efforts of both charities donate more in total than those only solicited by one of them. For someone in group 1, for instance, $d_{11}(1,1) + d_{12}(1,1) > d_{11}(1,0)$.

2.2 | Total donations

When individuals are motivated only by warm-glow, fundraising by charities can have no effect beyond triggering these preferences through the power of asking. We therefore assume that fundraising is "random" in the sense of Andreoni and Payne (2003), that is, takes the form of mass mail or television advertisements reaching some fraction of the population, with no individual being contacted more than once. Given the optimal response of individuals in the two groups, the total donations received by the two organizations are

[5]Formally, this holds as long as $Min\{\gamma_{11}, \gamma_{22}\} > Max\{\gamma_{12}, \gamma_{21}\}$.

$$\begin{aligned} D_1(f_1; f_2) = & f_1\{N_1[(1-f_2)d_{11}(1,0) + f_2 d_{11}(1,1)] \\ & + N_2[(1-f_2)d_{21}(1,0) + f_2 d_{21}(1,1)]\}; \end{aligned} \tag{6}$$

$$\begin{aligned} D_2(f_2; f_2) = & f_2\{N_1[(1-f_1)d_{12}(0,1) + f_1 d_{12}(1,1)] \\ & + N_2[(1-f_1)d_{22}(0,1) + f_1 d_{22}(1,1)]\}. \end{aligned} \tag{7}$$

f_j is the intensity of fundraising by charity j, measured as the share of the population reached. In each group, there will be some individuals who are not solicited by the other charity and some who are. The former give more than the latter. As already noted, this compositional effect means that the competitor's effort affects the amount of funds collected.

In the following, we will simplify notation somewhat by writing $d_{11}^{10} \equiv d_{11}(1, 0)$, and so on. Considering the case of charity 1 for simplicity, the properties of the donation functions are

$$\begin{aligned} \frac{\partial D_1}{\partial f_1} &= \left\{N_1\left[(1-f_2)d_{11}^{10} + f_2 d_{11}^{11}\right] + N_2\left[(1-f_2)d_{21}^{10} + f_2 d_{21}^{11}\right]\right\} \\ &\equiv \bar{\delta}_1 + \hat{\delta}_1 f_2 > 0; \end{aligned} \tag{8}$$

$$\frac{\partial D_1}{\partial f_2} = \hat{\delta}_1 f_1 \leq 0; \tag{9}$$

$$\frac{\partial^2 D_1}{\partial f_1^2} = \frac{\partial^2 D_1}{\partial f_2^2} = 0; \tag{10}$$

$$\frac{\partial D_1}{\partial f_1 \partial f_2} = \hat{\delta}_1 < 0. \tag{11}$$

Intensifying fundraising, you reach a larger share of the population, which is induced to give. More fundraising therefore generates higher donations (8).[6] Moreover, the marginal effect is independent of the level of the effort (10) as the additional fraction you reach is always composed of the same four subgroups: those in each preference group who are not solicited by the other charity and those in each group who are; and the amount given by each of the four "types" of individuals is independent of the intensity of solicitation. Note that it follows from this that total donations might be written as $D_1(f_1, f_2) = \frac{\partial D_1}{\partial f_1} f_1$.

Fundraising by the other charity impacts not only the total donations a charity receives (9), it also reduces the marginal effectiveness of its own effort (11). This is because individuals give less to each charity when they are contacted by both compared to the case where only one of them asks for contributions. For example, $d_{11}^{11} - d_{11}^{10} < 0$, as shown above.

[6]The first line of (8) may be rewritten as $N_1\left(d_{11}^{10} + f_2\Delta_{11}\right) + N_2\left(d_{21}^{10} + f_2\Delta_{21}\right)$, where $\Delta_{11} = d_{11}^{11} - d_{11}^{10}$ and $\Delta_{21} = d_{21}^{11} - d_{21}^{10}$ are both negative because donors give more to a charity if it is the only one soliciting them. Hence, $\bar{\delta}_1 = N_1 d_{11}^{10} + N_2 d_{21}^{10} > 0$ and $\hat{\delta}_1 = N_1\Delta_{11} + N_2\Delta_{21} < 0$.

The literature on competition between charities has studied the claim by Rose-Ackerman (1982) that competitive pressures may lead to excessive fundraising. Meer (2017) stresses that neither the experimental literature nor observational studies provide clear-cut answers to the question of whether costly fundraising mainly induces an inefficient shifting of market shares as opposed to enlarging the total market for donations, thus raising service provision. The results we just derived demonstrate that in our universe, fundraising in general entails both market expansion and business stealing. As long as the other charity is not covering the market, more fundraising expands it along both the extensive and the intensive margins. There will then be some unsolicited individuals in the pool of potential donors and when they are contacted they will donate. Moreover, there is an intensive margin effect on those who are already supporting the other charity: donors increase their total giving when both charities reach them. The business stealing that goes on is thus not zero sum; the new contribution is only partly financed by a reduction in the original donation to the other charity. The net effect on total donations $D_1 + D_2$ from a marginal increase in f_1 is $\bar{\delta}_1 + \widehat{\delta}_1 f_2 + \widehat{\delta}_2 f_2 = \bar{\delta}_1 + (\widehat{\delta}_1 + \widehat{\delta}_2) f_2$. This is obviously positive even if charity 2 covers the market since donors solicited by both are more generous.[7] However, this effect is calculated holding fundraising by charity 2 constant. For a complete picture, we need to study optimal fundraising, taking into account the strategic interaction in the market for donations.

3 | CHARITIES

3.1 | Goals and resources

Charities do not pursue profits. Even so, maximizing their activity level would seem to entail maximizing their financial surplus. Andreoni and Payne (2003) claim that this is not a realistic description and assume that charity managers bear a psychic cost of fundraising that makes it optimal for them to stop short of this point. We instead follow Aldashev and Verdier (2010) and Glazer et al. (2018) in assuming that the organizations maximize service levels. However, their output is not simply a linear function of the net surplus. As in the former paper, both managerial time and an input that has to be purchased are necessary for production. If the management spends more time doing fundraising, there will be less time to oversee operations.[8] The former increases the financial surplus, allowing the charity to buy more input from the market, but simultaneously less supervision will have a negative effect on output. In essence, we have a nonmonetary cost of fundraising, but it is endogenous to the model.

We assume the following production function for organization j:

$$Q_j = L_j^{\alpha_j} M_j^{1-\alpha_j}, \tag{12}$$

[7]See Appendix A for further discussion of market expansion and business stealing.

[8]A slightly different interpretation, which is equivalent, is that L is labor hired in the market and M is the time management devotes to production, and that these two types of labor are slightly different (e.g., have different skills or experience). The former could, for example, be social workers or nurses whereas M could be provided by someone with a degree in administration and/or experience in management.

where L_j is the input bought from the market (at a price normalized to unity) and M_j is mangerial supervision. Charity managers have a unit of time that can be allocated to supervision or fundraising:

$$M_j + \tau_j f_j = 1. \tag{13}$$

τ_j is a positive parameter that converts fundraising effort in terms of degree of coverage of potential donors into time-units.

The nondistribution constraint is

$$D_j = K_j + L_j. \tag{14}$$

The left-hand side is total revenues, which equals total donations in our benchmark case of no government support. The right-hand side shows total costs: K_j, the fixed costs of operations, and the cost of purchasing L_j. An equivalent formulation is to say that the amount of L a charity can procure is limited by the excess of donations over the fixed costs. Equation (8) implies that as long as less than 100% of the donors have been solicited, this surplus can always be increased.

3.2 | Optimal fundraising

Substituting for L in the production function using (14) and for M using (13), the decision problem of charity j is

$$Max_f\, Q_j = \left(\frac{\partial D_j}{\partial f_j} f_j - K_j\right)^{\alpha_j} (1 - \tau_j f_j)^{1-\alpha_j},$$

where we also have applied the fact that $D_j = \frac{\partial D_j}{\partial f_j} f_j$.

We assume that charities make their decisions simultaneously and noncooperatively and so the solicitation effort of its competitor is taken as given when charity j solves this problem.[9] The first-order condition for an interior optimum is

$$\frac{\partial Q_j}{\partial L_j}\frac{\partial L_j}{\partial f_j} + \frac{\partial Q_j}{\partial M_j}\frac{\partial M_j}{\partial f_j} = \frac{\partial Q_j}{\partial L_j}\frac{\partial D_j}{\partial f_j} - \frac{\partial Q_j}{\partial M_j}\tau_j = 0. \tag{15}$$

Note that the second-order conditions for an optimum holds, which implies that the reaction function is unique.[10] Before stating it, however, a few general remarks are in order. First of all, as you would expect for an output-maximizing entity, the marginal products of the inputs play an important role. This in turn implies that size of the fixed costs is crucial. When K is high, funds for buying L are in short supply, increasing its

[9]For a cooperative approach to fundraising, see Aldashev et al. (2014).

[10]The formal proof is in Appendix A.

marginal product and reducing the marginal product of M (as long as the two inputs are not substitutes, i.e., for $\frac{\partial^2 Q_j}{\partial L_j \partial M_j} \geq 0$). Soliciting donations is then a very important activity in terms of raising service provision by charity j. Similarly, if the competing charity is very active in the market for donations D_j goes down, pushing charity j towards doing more fundraising since the marginal gain from having more L is high and the opportunity cost from reducing M somewhat is low. However, here there is an additional effect pulling in the opposite direction: more fundraising by the competitor makes j's fundraising less productive on the margin (c.f. 11). Note that beyond the weak restriction $\frac{\partial^2 Q_j}{\partial L_j \partial M_j} \geq 0$, these effects do not hinge on the exact form of the production function. Hence, they are more general than the Cobb–Douglas formulation suggests.

In Appendix A, we show that when the production function is of the CES variety, reaction functions have a nonnegative slope as long as $K \geq \rho D$, where $\rho \leq 1$ is a parameter of the production function determining the elasticity of substitution. In other words, as long as fixed costs are above a critical value a charity will respond to increased competition in the market for donations by fundraising more intensively. In this case, the two positive effects just mentioned outweigh the negative one stemming from solicitation being less effective at the margin when the competitor is very active in the market for donations. Since ρ can be negative, our choice of a Cobb–Douglas production function ($\rho = 0$) is a fairly mild restriction. It is thus a quite general result that in the absence of government support, fundraising efforts will be *strategic complements*. This contrasts with Andreoni and Payne (2003), where they are strategic substitutes. This is due to charities having linear production functions in their model (i.e., $\rho = 1$). Then the only effect of more solicitation by one of them is to lower the marginal fundraising effectiveness of the other. The charities in our model face more a complex trade-off in maximizing their service provision.

There are addtional conditions that have to be met for (15) to hold, which relates to the requirement that, being a share, $f_j \in [0, 1]$. When these conditions are fullfilled, the reaction function that can be derived from the first-order condition constitutes the best response of charity k to the fundraising of charity l:

$$f_k^*(f_l) = \frac{\alpha_k}{\tau_k} + \frac{(1-\alpha_k)K_k}{\frac{\partial D_k}{\partial f_k}}. \tag{16}$$

In the absence of fixed costs of operations, $f_k^*(f_l) = \frac{\alpha_k}{\tau_k}$. To have an interior optimum in this case too, we assume $\alpha_k < \tau_k$. It is readily observable that when $K = 0$, there is no strategic interaction between the charities. In this knife-edge case, fundraising by the other organization lowers your revenues and reduces the productivity of your own effort in terms of generating more output, but does not affect your marginal incentive to chase donations. This result already points to potentially important effects of government support on the nature of strategic interaction in the market for donations. Block grants work like reductions in fixed costs and if a charity is overcompensated for them, it is equivalent to having $K < 0$.

As foreshadowed in the discussion above, for $K > 0$ fundraising is increasing in both the intensity with which your competitor solicits for donations and the magnitude of the fixed costs:

$$\frac{\partial f_k^*}{\partial f_l} = -\frac{(1-\alpha_k)K_k}{\left(\frac{\partial D_k}{\partial f_k}\right)^2}\widehat{\delta}_k > 0, \tag{17}$$

$$\frac{\partial f_k^*}{\partial K} = \frac{(1-\alpha_k)}{\frac{\partial D_k}{\partial f_k}} > 0, \tag{18}$$

$$\frac{\partial^2 f_k^*}{\partial f_l^2} = \frac{2(1-\alpha_k)K_k}{\left(\frac{\partial D_k}{\partial f_k}\right)^3}\widehat{\delta}_k^2 > 0. \tag{19}$$

Note that for a given level of solicitation by the competitor f_k^* is decreasing in marginal donations. This is not surprising as an upward shift in $\frac{\partial D_k}{\partial f_k}$ is equivalent to a reduction in f_l.[11] Thus, in this case the sum of the three effects discussed above are working in reverse. The direct effect visible in (15) is of course positive, but it is outweighed by the two indirect effects working through the marginal products of the two inputs as more L is purchased when total donations go up with $\frac{\partial D_k}{\partial f_k}$. This is why we in Section 4 obtain the surprising result that matching grants disincentivises fundraising when it is the only policy instrument. A matching grant has the same effects as an upward shift in the marginal impact of fundraising.

It is also easily seen from (16) that for positive fixed costs f_k^* is decreasing in τ_k When τ_k is higher fundraising is a more time-consuming activity. In other words, the charity has a less effective technology, perhaps because its staff has less experience with this task. This raises the marginal cost of fundraising and thus makes it optimal to do less of it.

One particularly important implication of these comparative statics results is the need for an upper bound on the fixed cost, to ensure that $f_k^*(f_l) \leq 1$ regardless of the intensity of fundraising by the other organization. Setting $f_l \equiv 1$, we obtain

$$K_k \leq \left(\frac{1}{1-\alpha_k}\right)\left(1-\frac{\alpha_k}{\tau_k}\right)(\overline{\delta}_k + \widehat{\delta}_k) \equiv \overline{K}_k.$$

Finally, note that the reaction function is strictly convex when there are fixed costs, c.f. (19). Nonlinear reduction functions in general imply that there could be more than one equilibrium in fundraising strategies. However, the restriction $K_k < \overline{K}_k$ actually rules this out, as will be demonstrated in Figure 2 below.

[11]Recall that by (8), $\frac{\partial D_k}{\partial f_k}$ may be written as $\overline{\delta}_k + \widehat{\delta}_k f_l$. Hence, it can shift upward with $\overline{\delta}_k$, which reflects the willingness to donate of individuals who are only solicited by k (c.f footnote 6).

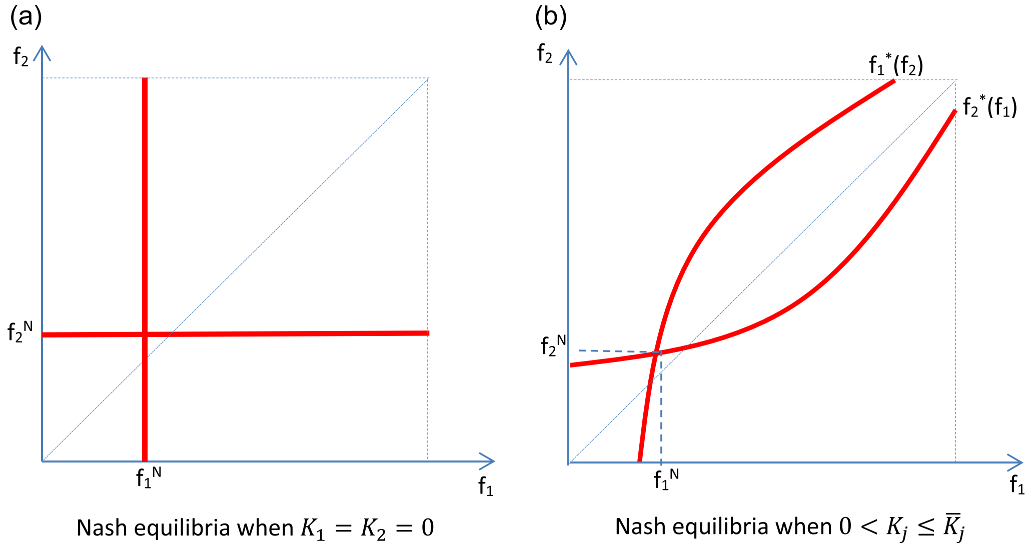

FIGURE 1 (a) Nash equilibria when $K_1 = K_2 = 0$, and (b) Nash equilibria when $0 < K_j \leq \bar{K}_j$.

3.3 | Nash-equilibrium in the market for fundraising

As just noted, there could be more than one Nash-equilibrium in the market for donations when $K > 0$ for both charities. However, the fact that the reaction functions are continuous and monotonically increasing means that the restrictions we impose generate a unique interior equilibrium as $0 < f_k^*(0) < f_k^*(1) < 1$.[12] In this equilibrium, both charities supply a positive quantity of output.

Figure 1 depicts the Nash-equilibrium in two separate instances. In the left panel, the case of $K_1 = K_2 = 0$ is shown. In the right, the equilibrium when both organizations have positive fixed costs of operations is exemplified.

In the general case, the nonlinearity complicates the solution to system consisting of the two reaction functions. We will therefore focus on comparative statics in the rest of the paper. However, imposing symmetry simplifies quite a bit. The second-order equation that follows from the first-order conditions then has the following solutions

$$f_1^N, = f_2^N \equiv f^N = \frac{1}{2\hat{\delta}}\left[\frac{\alpha}{\tau}\hat{\delta} - \bar{\delta}\right] \pm \frac{1}{2\hat{\delta}}\sqrt{\left[\frac{\alpha}{\tau}\hat{\delta} + \bar{\delta}\right]^2 + 4\hat{\delta}(1-\alpha)K}.$$

As $\hat{\delta} < 0$, the first term is positive. The negative effect solicitation by the competitor has on the marginal surplus also implies that the low-level equilibrium that we focus on is found by adding the second term. The high-level equilibrium that we rule out is of course, the second solution, which follows when subtracting the second term from the first.

[12]For $K_j > \overline{K}_j$, (i) there is a kink in best-responses for high levels of effort by the other charity as the restriction $f_j \leq 1$ binds in the interior of $[0, 1]$; (ii) there is a second, unstable interior equilibrium and a third where both charities cover the market (i.e., a corner solution); (iii) for large enough K, no equilibria exist. Our assumptions rule out all these complications.

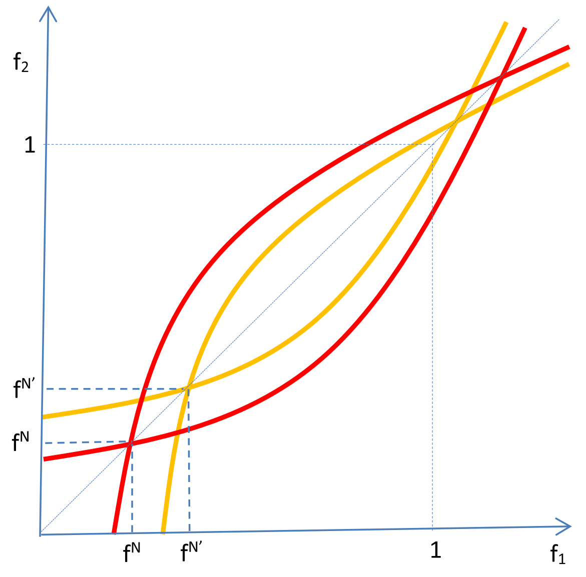

FIGURE 2 Symmetry: stable Nash equilibria with low fundraising, infeasible unstable equilibrium with high fundraising, $0 < K_j \leq \bar{K}_j$.

Symmetry locates the equilibria on the 45° line. As may be seen in Figure 2, the low-level equilibrium is stable.[13] The high-level equilibrium, which is shown to illustrate the possibility of its existence, is unstable. However, as it is outside the feasible space for fundraising effort given our restrictions on parameter values, the low-level equilibrium is the only relevant Nash-equilibrium.

Because higher fixed costs shift the reaction functions up, fundraising increases in the equilibrium with low levels of fundraising (and falls in the other); there will be a stronger fundraising effort by both charities if either of them experiences such a cost increase. This has implications for the effects of government block grants, as we will now demonstrate.

4 | GOVERNMENT SUPPORT FOR CHARITIES

4.1 | Public funding schemes

Government funds to NGOs have shifted over time. Before the 1980s, most grants were distributed as block grants. More recently, governments have shifted their approach towards contractual, tied funding programmes. Ali and Gull (2016) discuss how this has changed the relationship between governments and nonprofits. The emergence of matching grants as a funding strategy can be seen as a simplification of the contractual approach with explicit rules for cofinancing. Aldashev and Verdier (2009) observe and explain how this has stimulated the development of multinational NGOs.

[13]As is standard, stability of the equilibrium in general requires $\frac{\partial^2 Q_1}{\partial f_1^2}\frac{\partial^2 Q_2}{\partial f_2^2} - \frac{\partial^2 Q_1}{\partial f_1 \partial f_2}\frac{\partial^2 Q_2}{\partial f_1 \partial f_2} > 0$, which can be shown to be equivalent to $1 - \frac{\partial f_k^*}{\partial f_l}\frac{\partial f_l^*}{\partial f_k} > 0$.

Government financing of charities typically aims to increase the supply of a public good. The starting point of the theoretical literature is the influential model of private provision of public goods by Bergstrom et al. (1986). In this setup of government funding based on taxation, government financing reduces private donations dollar for dollar. Introducing charities influencing donations through fundraising and broader motivation of individual giving create richer effects. We concentrate on government subsidies to the budget of charities. The standard format is a block grant, an amount given to each charity based on its characteristics. In economic analysis the amount is assumed to be exogenous and independent of the (short term) actions of the charities. The crowding out result implies that a higher block-grant reduces private contributions, possibly the effect of both reduced fundraising and smaller individual donations.

The alternative type of government subsidy, matching grants, is designed to stimulate fundraising and private donations. In this case, the government's contribution is conditional on the donations of individuals. Public funds matching private donations is a design with wide application in most areas where charities are active. de Wit and Bekkers (2017) offer a broad overview of empirical studies and results. The diverse effects of government funding depending on grant design and institutional aspects of the market for donations motivate our theoretical analysis of funding instruments. Our contribution is to study how the effects of the two types of instruments are both a function of and influence the strategic interaction among charities.

In the model, we assume that the government wants to support the activities of the charities through a block-grant G_j and/or a matching rate for donations μ_j. We allow for the possibility that both instruments are organization-specific since the two charities are assumed to be differentiated in some way that matters to donors. Their differences could matter to the government too. For example, it might want to support activities in separate sectors to different degrees.

Since donors only care about their own contributions and not the supply of services by the charities, public support to boost provision does not directly change donative behavior. However, government funding changes the nondistribution constraint to

$$G_j + (1 + \mu_j)D_j = K_j + L_j. \tag{20}$$

Optimal fundraising for charity k is therefore now

$$f_k^*(f_l; \mu_k, G_k) = \frac{\alpha_k}{\tau_k} + \frac{(1 - \alpha_k)(K_k - G_k)}{(1 + \mu_k)\frac{\partial D_k}{\partial f_k}}. \tag{21}$$

The introduction of policy instruments necessitates not only an adjustment to our previous assumptions, but also requires us to impose a new one to ensure that we have a unique interior equilibrium. As is apparent from (21), the block grant works as an offset to fixed costs. A large enough grant will therefore reduce fundraising and could actually drive it to zero. Hence, we now place the following constraints on the cost structure of the charities:

$$K_k \leq G_k + \left(\frac{\tau_k - \alpha_k}{1 - \alpha_k}\right)\frac{(1 + \mu_k)(\bar{\delta}_k + \hat{\delta}_k)}{\tau_k} \equiv \overline{K}_k(G_k; \mu_k);$$
$$K_k \geq G_k - \left(\frac{\alpha_k}{1 - \alpha_k}\right)\frac{(1 + \mu_k)(\bar{\delta}_k + \hat{\delta}_k)}{\tau_k} \equiv \underline{K}_k(G_k; \mu_k).$$

The first restriction show that public support for charities enlarges the parameter space for which a unique interior equilibrium in the market for donations exists. Charities can tolerate higher fixed costs without hitting the constraint that no more than 100% of potential donors can be solicited. However, the second inequality—derived from $f_k^*(f_l; \mu_k, G_k) \geq 0$—demonstrates that unless fixed costs are substantial relative to the block grant, charities could find it optimal to rely solely on government funding.

Notice that $\overline{K}_k(G_k; \mu_k) > G_k > \underline{K}_k(G_k; \mu_k)$. Which of these constraints that matter thus depends on the relative sizes of K_k and G_k.

We first look at the impacts of the two policy instruments on fundraising effort. We subsequently proceed to analyze comparative statics effects in equilibrium. In the final part of this section, we study how block grants and matching grants interact.

4.2 | The impact of grants on fundraising effort

From (21), with $\mu_k = 0$, we see that the block grant serves to reduce the effective fixed cost of operations, shifting the reaction function downwards. This type of support thus weakens the incentive to do fundraising, c.f. (22). In effect, G_k is a subsidy for purchases of the market-sourced input, allowing charities to increase management supervision of operations as well. This is similar to the result derived by Andreoni and Payne (2003), who find that block grants lead to additional crowding-out by reducing optimal fundraising. That is, there is a disincentive to solicitation that reduces charity output beyond the standard, direct effect of government funding on the supply of the collective goods charities provide working through smaller private contributions. As already noted, their result is driven by an exogenous "psychological cost" of doing fundraising experienced by charity managers, whereas here the opportunity cost of fundraising is the endogenous reduction in mangerial supervision. Hence, we highlight a different disincentive effect with similar consequences.

$$\frac{\partial f_k^*}{\partial G_k} = -\frac{(1-\alpha_k)}{\frac{\partial D_k}{\partial f_k}} < 0; \tag{22}$$

$$\frac{\partial f_k^*}{\partial f_l} = -\frac{(1-\alpha_k)(K_k - G_k)}{\left(\frac{\partial D_k}{\partial f_k}\right)^2}\hat{\delta}_k \lesseqgtr 0 \Leftrightarrow K_k - G_k \lesseqgtr 0; \tag{23}$$

$$\frac{\partial^2 f_k^*}{\partial f_l^2} = \frac{2(1-\alpha_k)(K_k - G_k)}{\left(\frac{\partial D_k}{\partial f_k}\right)^3}\hat{\delta}_k^2 \lesseqgtr 0 \Leftrightarrow K_k - G_k \lesseqgtr 0. \tag{24}$$

Moreover, in our model block grants might alter the nature of the competition for funds. The slope of the reaction function now depends on fixed costs net of the block grant.[14] If $K_k - G_k \geq 0$, the properties of the reaction function are the same as in the case of no government intervention: (at least weakly) increasing and convex, c.f. (23) and (24). However, when $K_k - G_k < 0$, the

[14]It is easily demonstrated that for CES-production functions the general condition is now $K_k - G_k \lesseqgtr \rho D_k$, which reduces to $K_k - G_k \lesseqgtr 0$ in the Cobb–Douglas case.

reaction function of charity k is decreasing and concave in f_l. Assuming this holds for both charities, their fundraising efforts are then *strategic substitutes*. In this case, the direct negative effect on the incentives to do fundraising that stronger competition causes—that fewer donations are induced on the margin—outweighs the positive effects working through the marginal products of the two inputs when total donations simultaneously become more scarce.

Hence, government support can completely change the character of the interaction between the two charities. Furthermore, allowing for the possibility that $K_k > G_k$ and $K_l < G_l$ or vice versa, one of the organizations could respond positively to its competitor's fundraising while the other one responds negatively.[15] There are also knife-edge cases where one charity, having its fixed costs just covered by the government, optimally ignores the effort of its competitor, but the latter takes note of what the former does and adjusts its fundraising either up or down. Figure 3 illustrates three of the configurations that are now possible in addition to those shown in Figure 1.[16]

We now switch to a situation, where $G_j = 0$, but $\mu_j > 0$. The donations charity j receive are then magnified by a matching grant so that its revenues are $(1 + \mu_j)D_j$.

We obtain the following comparative statics results when it comes to the reaction functions:

$$\frac{\partial f_k^*}{\partial \mu_k} = -\frac{(1 - \alpha_k)K_k}{(1 + \mu_k)^2 \frac{\partial D_k}{\partial f_k}} < 0. \tag{25}$$

$$\frac{\partial f_k^*}{\partial f_l} = -\frac{(1 - \alpha_k)K_k}{(1 + \mu_k)\left(\frac{\partial D_k}{\partial f_k}\right)^2} \widehat{\delta}_k > 0. \tag{26}$$

Perhaps counterintuitively, the effect of the matching grant is *negative*. As explained in Section 3.2, the logic is similar to that explaining the response to more intense solicitation by the other charity, only with the sign reversed.[17] The matching grant means that fundraising generates more revenues on the margin, but this effect is dominated by the fact that more funds available in total reduces the marginal product of L (lowering the marginal gain from fundraising) and increases that of M (raising the marginal opportunity cost). To put it differently, as the charity has a higher surplus over fixed costs for any given solicitation effort it is possible to have more of both inputs by fundraising less. And this is in fact optimal even though matching also makes fundraising a more powerful tool for raising revenues. Once again, we see that the behavior of a nonprofit organization can be radically different from that of a profit-maximizing firm, which would of course respond to stronger incentives in the expected way.

[15]Note that this does not hinge on the grant being charity-specific as we could have $K_k > G > K_l$ or the reverse.

[16]Note that the case in Figure 3b creates a cobweb type of adjustment towards the equilibrium, while "the process" is instantaneous when one of the charities has a dominant fundraising strategy (c.f. Figure 3c). When the signs of the reaction functions are the same, as is the case in panel a as well as when $K_j > G_j$, $j = 1, 2$ (c.f. Figure 1b), out-of-equilibrium adjustment follows the standard stepwise pattern.

[17]In fact, it can be shown that the sign of the derivative is negative for CES production functions as long as $\rho(1 + \mu)D < K$, which in the Cobb-Douglas case holds as long as there are fixed costs. In other words, only for $\rho \in (0, 1)$ and K "low enough" would it be possible to get the expected positive incentive effect of matching.

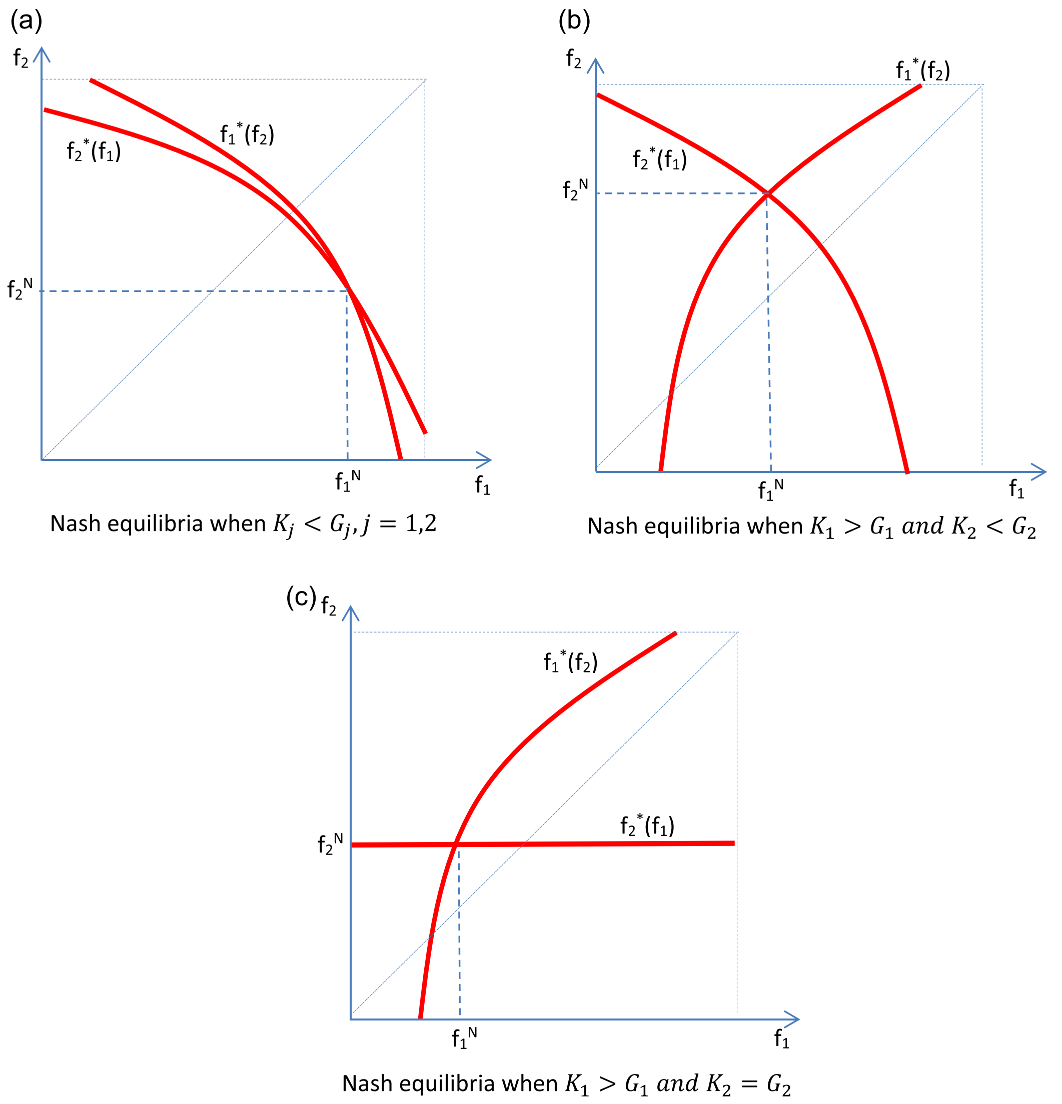

FIGURE 3 (a) Nash equilibria when $K_j < G_j, j = 1, 2$, (b) Nash equilibria when $K_1 > G_1$ and $K_2 < G_2$, (c) Nash equilibria when $K_1 > G_1$ and $K_2 < G_2$.

As is apparent from (26), in this case, the strategic competition between the charities retains its intrinsic complementarity.

4.3 | Policy effects in equilibrium

What do the responses to the policy instruments imply in equilibrium? To find out, we differentiate the system defined by the reaction functions at the Nash-equilibrium, $f_k^N\left(f_l^N\right)$, $k, l = 1, 2$, where the superscript N designates equilibrium values.[18]

[18]See Appendix A for more detail.

Starting with block grants, since G only has a direct impact on the reaction function of the organization that receives the grant, its response is fully determined by this effect whereas the response of its competitor depends on the nature of their strategic interaction. More specifically, the latter does more fundraising if it views the competition for donations in terms of strategic complementarity and less in the opposite case. In other words, there is a shift in the reaction function of the charity which is subsidized more generously (as well as a change in its slope) that generates a movement along the reaction function of the competitor, c.f. (27) and (28).

$$\frac{df_k^N}{dG_k} = \frac{1}{1 - \frac{\partial f_k^*}{\partial f_l}\frac{\partial f_l^*}{\partial f_k}}\frac{\partial f_k^*}{\partial G_k} < 0; \tag{27}$$

$$\frac{df_l^N}{dG_k} = \frac{1}{1 - \frac{\partial f_k^*}{\partial f_l}\frac{\partial f_l^*}{\partial f_k}}\frac{\partial f_l^*}{\partial f_k}\frac{\partial f_k^*}{\partial G_k} \lesseqgtr 0 \Leftrightarrow K_l - G_l \gtreqless 0. \tag{28}$$

Thus, more generous government support for one charity naturally influences both as they compete for contributions from the same pool of donors. Whereas Andreoni and Payne (2003) foresaw the first result,[19] they did not study the cross-organizational effect in (28). Consequently, they had nothing to say on the impact of greater public funding for one charity on the combined solicitation efforts of the two charities either. If charity l considers the effort of charity k to be complementary to or independent from its own fundraising, total fundraising in equilibrium $F^N = f_1^N + f_2^N$ will surely decrease as k receives more unconditional public funding. However, if charity l thinks the solicitation campaigns are strongly substitutable—that is, it increases its own fundraising more than one for one when f_k^* goes down with the grant $\left(\frac{\partial f_l^*}{\partial f_k} < -1\right)$—the sum total will actually increase as we have

$$\frac{dF^N}{dG_k} = \frac{df_k^N}{dG_k} + \frac{df_l^N}{dG_k} = \frac{1}{1 - \frac{\partial f_k^*}{\partial f_l}\frac{\partial f_l^*}{\partial f_k}}\left[1 + \frac{\partial f_l^*}{\partial f_k}\right]\frac{\partial f_k^*}{\partial G_k}.$$

In the symmetric case, this possibility is ruled out by the fact that the equilibrium is stable: $1 - \frac{\partial f_1^*}{\partial f_2}\frac{\partial f_2^*}{\partial f_1} > 0 \Leftrightarrow \left|\frac{\partial f_1^*}{\partial f_2}\right| = \left|\frac{\partial f_2^*}{\partial f_1}\right| < 1$. When there are asymmetries, a combination of a quite flat reaction function for the charity receiving more government funding and a steep (negatively sloped) one for its competitor could create the conditions necessary for total fundraising to rise in the stable equilibrium. It is notable that this can only happen if the latter is generously funded from the outset, c.f. (23). That is, it can only happen if $G_l > K_l$ and $G_k \approx K_k$ to begin with.

What is the effect on service delivery? This is of course what the government wants to influence with a grant. Using the fact that $D_k^N = \left(\bar{\delta}_k + \hat{\delta}_k f_l^N\right)f_k^N$, the equilibrium output of charity k is

[19]C.f. their footnote 10, p. 796.

$$Q_k^N = \left(\left(\bar{\delta}_k + \hat{\delta}_k f_l^N\right) f_k^N - K_k + G_k\right)^{\alpha_k} \left(1 - \tau_k f_k^N\right)^{1-\alpha_k}.$$

By the envelope theorem, the effect on output from the change in the charity's own fundraising induced by a change in the block grant vanishes. Thus, the production response that an adjustment in the grant creates comes from a combination of the direct effect of having more funds that can be used to buy L and the equilibrium response of the other charity to the change in fundraising competition. When we consider the effect of l being more or less heavily subsidized by the government, the output of charity k is only affected because there is less competition in the market for fundraising (recall that l will solicit less intensively if it gets a more generous grant). In sum, we have

$$\frac{dQ_k^N}{dG_k} = \frac{\partial Q_k^N}{\partial f_l}\frac{df_l^N}{dG_k} + \frac{\partial Q_k^N}{\partial G_k} = \frac{\partial Q_k^N}{\partial L_k}\left(\frac{\partial L_k}{\partial f_l}\frac{df_l^N}{dG_k} + 1\right); \tag{29}$$

$$\frac{dQ_k^N}{dG_l} = \frac{\partial Q_k^N}{\partial f_l}\frac{df_l^N}{dG_l} = \frac{\partial Q_k^N}{\partial L_k}\frac{\partial L_k}{\partial f_l}\frac{df_l^N}{dG_l} > 0. \tag{30}$$

When l gets a higher grant, it solicits less. In turn, this means that the marginal surplus of k is higher, allowing it to purchase more L. Hence, it will produce more (30).

On the other hand, what happens to the solicitation efforts of l when G_k goes up depends on the nature of the competition for donations. If l does not fundraise more, the marginal surplus of k does not decline and the financial impact of a higher grant might even be reinforced. If f_l^N rises with G_k, the direct effect is counteracted to some extent. A perverse total effect—a decline in production by k—cannot be ruled out a priori when l views fundraising by k as a strategic substitute, c.f. (29). Thus, perhaps surprisingly, the impact on the output of a charity from a higher block grant might be ambiguous whereas it clearly benefits if the government funds its competitor more generously.

It follows that to predict the total effect on charity service provision, the government needs quite detailed knowledge of the market for donations. In particular, it has to take into account the fungibility of the support between charities that follows because they are linked through the market for donations. These cross-organizational effects of block grants are to our knowledge new. They are not mentioned by Andreoni and Payne (2003), for example.

Moving on to matching, simple manipulations yield the following equilibrium responses to an increase in μ_k:

$$\frac{df_k^N}{d\mu_k} = \frac{1}{1 - \frac{\partial f_k^*}{\partial f_l}\frac{\partial f_l^*}{\partial f_k}}\frac{\partial f_k^*}{\partial \mu_k} < 0; \tag{31}$$

$$\frac{df_l^N}{d\mu_k} = \frac{1}{1 - \frac{\partial f_k^*}{\partial f_l}\frac{\partial f_l^*}{\partial f_k}}\frac{\partial f_l^*}{\partial f_k}\frac{\partial f_k^*}{\partial \mu_k} < 0. \tag{32}$$

As was the case for G, the impact on the charity that is directly affected is determined by this effect only, while the other charity adapts optimally to this response. Since fundraising has a complementary character when matching grants are the only instruments applied by the government, this implies that the intensity of the solicitation campaigns of both organizations soften when the government hikes the matching rate for one of them. Needless to say, total fundraising goes down too.

As for the output of k, the fact that fundraising is chosen optimally means that there is no impact of μ_k through the change in f_k^N. There is a direct effect, enhancing both the marginal and the total surplus from fundraising. And there is an indirect effect that works in the same direction. A higher matching rate for k makes l solicit less intensely, raising D_k^N. The latter is also the reason why k benefits from a hike in μ_l, as its fundraising becomes more productive when l is less aggressive in the market for donations.

$$\begin{aligned} \frac{dQ_k^N}{d\mu_k} &= \frac{\partial Q_k^N}{\partial f_l}\frac{df_l^N}{d\mu_k} + \frac{\partial Q_k^N}{\partial \mu_k} \\ &= \frac{\partial Q_k^N}{\partial L_k}\left[\frac{\partial L_k}{\partial f_l}\frac{df_l^N}{d\mu_k} + \frac{\partial L_k}{\partial \mu_k}\right] > 0; \end{aligned} \tag{33}$$

$$\frac{dQ_k^N}{d\mu_l} = \frac{\partial Q_k^N}{\partial f_l}\frac{df_l^N}{d\mu_l} = \frac{\partial Q_k^N}{\partial L_k}\frac{\partial L_k}{\partial f_l}\frac{df_l^N}{d\mu_l} > 0. \tag{34}$$

Thus, in contrast to a block grant, the effect of a matching grant on the recipient is unambiguous. A higher matching rate for the competitor is also good for k. The resulting reduction in l's fundraising makes the solicitation of k more productive, boosting its purchasing power in the market for L.

In sum, incentives for collecting donations provided by the government are powerful as they generate higher levels of service provision by both charities even if only one of them is targeted. Paradoxically, this happens because both optimally reduce their efforts in the market for donations. In other words, matching grants, which usually are conceived of as tools for providing high-powered incentives, actually lower solicitation levels and thereby the private financing of charities through donations. They are still effective in raising service provision. We have yet another illustration of the fact that nonprofits are quite different from profit-maximizing firms.

4.4 | Interactions between the policy instruments

Does it matter if both instruments are used, so that total public support for charity k is $G_k + (1 + \mu_k)D_k(f_k; f_l)$? When both matching and block-grants possibly are given to both organizations, we have[20]

$$\frac{\partial f_k^*}{\partial G_k} = -\frac{(1 - \alpha_k)}{(1 + \mu_k)\frac{\partial D_k}{\partial f_k}} < 0; \tag{35}$$

[20]For the sake of brevity, we only show the direct effects on fundraising effort here. As demonstrated in the preceding sections, the equilibrium effects follow straightforwardly.

$$\frac{\partial f_k^*}{\partial \mu_k} = -\frac{(1-\alpha_k)(K_k - G_k)}{(1+\mu_k)^2 \frac{\partial D_k}{\partial f_k}} \lesseqgtr 0 \Leftrightarrow K_k - G_k \gtreqless 0; \tag{36}$$

$$\frac{\partial f_k^*}{\partial f_l} = -\frac{(1-\alpha_k)(K_k - G_k)}{(1+\mu_k)\left(\frac{\partial D_k}{\partial f_k}\right)^2} \hat{\delta}_k \lesseqgtr 0 \Leftrightarrow K_k - G_k \lesseqgtr 0; \tag{37}$$

$$\frac{\partial^2 f_k^*}{\partial f_l^2} = \frac{2(1-\alpha_k)(K_k - G_k)}{(1+\mu_k)\left(\frac{\partial D_k}{\partial f_k}\right)^3} \hat{\delta}_k^2 \lesseqgtr 0 \Leftrightarrow K_k - G_k \lesseqgtr 0. \tag{38}$$

Equation (35) demonstrates that the sign of the derivative of the reaction functions with respect to G is unchanged by matching. The only impact the matching rate has on the effect of the block grant is to mute it. The marginal surplus is larger for any level of fundraising by the other charity when $\mu_k > 0$. As the marginal products of the inputs are decreasing, a small increase in the block grant produces a smaller increase in L in this case, in turn necessitating only a minor hike in M to restore the optimal input mix. Since adjustments in managerial oversight can only be brought about by changing fundraising effort, the optimal response is muted.

Suprisingly, the effect of the matching grant depends on the size of the block grant (36). If the latter is not large enough to cover the fixed cost of operations, the matching grant *weakens* the incentives to do fundraising in this case too.

However, If $G_k = K_k$, we see from (21) that the optimal level of fundraising is constant. Given what we already know about charity behavior in the absence of government support, this is not surprising as having your fixed costs covered is equivalent to having none. Still, the rate of matching does matter for the level of output as then $L_k = D_k = \frac{\partial D_k}{\partial f_k} f_k = (1+\mu_k)(\bar{\delta}_k + \hat{\delta}_k f_l)\frac{\alpha_k}{\tau_k}$. In a sense the matching grant works a bit like a block grant in this special case, boosting output even though marginal incentives for generating funds are not affected. Here $Q_k = [(1+\mu_k)(\bar{\delta}_k + \hat{\delta}_k f_l)]^\alpha f_k^\alpha (1 - \tau_k f_k)^{1-\alpha}$. Hence, the other charity's fund-raising has only a "level effect" on output and does not affect the trade-off between the two inputs. In other words, it only changes the "total factor productivity" of charity k. The same applies to μ_k.

Only in the case where the block grant overcompensates for the fixed cost, do we get the intuitive effect of the matching rate: higher levels of effort at attracting donations. Thus, there are important interaction effects between the two policy instruments that a policy-maker seeking to optimize support needs to take into account. However, considering the trade-offs involved, including the cost of public funds, is beyond the scope of this paper.

Finally, note from (37) that it remains the case that it is the extent to which the government compensates for the fixed costs that matter for the slope of the reaction functions and thus for the nature of competition in the market for donations. Reaction functions are increasing (and convex, c.f. 38) whenever a charity has to cover at least a portion of fixed costs out of the net surplus from fundraising and decreasing (and concave) when the government provides unconditional funding above and beyond these costs.

In sum, public support for charities have complex effects. Predicting them require detailed information about not only the organizations but also of their interaction in the market for donations. Our results illustrate the importance of understanding how this market works.

5 | CONCLUSION

Government financing affects charities and the market for donations. We contribute to the "crowding-out-debate" by studying how public funds influence private donations by changing the incentives for fundraising. A theory model of the behavior of charities is developed including both the direct effect of government funding on the revenues of charities and the indirect effects via their fundraising activity. The main contribution is to compare different public grant schemes, taking into account strategic interaction between charities in the market for donations.

The natural starting point is the Andreoni-Payne (2003) model. They introduce two distinct groups of donors each favoring the services produced by one of two charities. The essential aspect here is solicitation of contributions from individuals. Optimal fundraising depends on the objective function of the charity and how government funds enter the budget constraint. We modify and extend their model by assuming warm-glow motivation for giving; studying the effects of matching grants; and using a production structure creating an endogenous nonmonetary cost of fundraising.

Given fixed costs of operations, solicitation by the charities are shown to be strategic complements in the absence of government funding. Block grants can change the nature of the competition in the market for donations and fundraising efforts will be strategic substitutes if grants exceed fixed costs. A charity receiving a grant will indeed reduce its fundraising, a basic result of the Andreoni-Payne model, but the competing charity may solicit more intensively thereby affecting the net output effect of the one receiving the grant. The competitor will deliver more services because it benefits from the reduction in solicitation by the grant recipient. In this setting, matching grants work like block grants as charities in both cases will compete less intensively for donations. However, there will be important interaction effects between the two instruments—the effect of the matching grant depends on whether the block-grant over—or undercompensates for fixed costs. An optimal funding policy thus has to be comprehensive to account for strategic interaction.

The broad implication is that prediction of the effects of government funding requires knowledge of strategic interaction between charities. The empirical literature does not offer much information about the underlying mechanisms, only broad relationships between government grants, fundraising and service production. Understanding the channels through which public funding impacts charities in general and the role of strategic interaction in particular is important for policy but demanding both in terms of data and identification strategies. To develop the framework applied here into a work-horse model of charities, better empirical foundations for the model would be desirable. Interesting areas include the motivations of private donors, the goals of charities, and the structure of the market for donations.

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DATA AVAILABILITY STATEMENT

This is a theoretical paper, so there is no data to share.

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APPENDIX A: PROOFS AND ELABORATIONS

A.1. Fundraising, market expansion, and business stealing

Consider the effect of an increase in f_1 on total donations

$$\frac{\partial D_1(f_1,f_2)}{\partial f_1}+\frac{\partial D_2(f_1,f_2)}{\partial f_1}=\left\{N_1\left[(1-f_2)d_{11}^{10}+f_2d_{11}^{11}\right]+N_2\left[(1-f_2)d_{21}^{10}+f_2d_{21}^{11}\right]\right\}$$
$$+f_2\left[N_1\left(d_{12}^{11}-d_{12}^{01}\right)+N_2\left(d_{22}^{11}-d_{22}^{01}\right)\right].$$

The first term (in curly brackets) is positive because charities always reach more donors by fundraising more intensely, and all donors give something if they are asked. $(1-f_2)\left(N_1d_{11}^{10}+N_2d_{21}^{10}\right)$ comes from individuals who were not previously solicited by charity 2. This is the pure *m*arket expanding effect, operating on the extensive margin whether viewed from the market perspective or more narrowly from the headquarters of charity 1. The rest $\left(f_2\left(N_1d_{11}^{11}+N_2d_{21}^{11}\right)\right)$ is made up by donations from those already reached by the fundraising of charity 2. This sum is thus part market expansion, part business stealing. While this is an extensive margin effect for charity 1, as these donors are new to it, it is an intensive margin effect at the market level. The total effect on D_1 can be rewritten as $\bar{\delta}_1+\hat{\delta}_1f_2$, as shown in Equation (8) in the main text.

The second term can be expressed as $\widehat{\delta}_2 f_2$, c.f. Equation (9). It is negative because charity 2 lose when those who previously were its exclusive donors are solicited by charity 1 and therefore switch some of their giving to its competitor. Added to $f_2\left(N_1 d_{11}^{11} + N_2 d_{21}^{11}\right)$, this is the net *business stealing effect*: $f_2\left[N_1\left(d_{11}^{11} + d_{12}^{11} - d_{12}^{01}\right) + N_2\left(d_{21}^{11} + d_{22}^{11} - d_{22}^{01}\right)\right]$.

The change in total donations is $\overline{\delta}_1 + (\widehat{\delta}_1 + \widehat{\delta}_2)f_2$. As both terms in parenthesis are negative, it is minimized for $f_2 = 1$. If charity 2 covers the market, no completely new donors are drawn in when charity 1 solicits more intensely. The total effect is still positive because individual donors donate more of their incomes when approached by both organizations:

$$\begin{aligned}\frac{\partial D_1(f_1,1)}{\partial f_1} + \frac{\partial D_2(f_1,1)}{\partial f_1} &= N_1\left(d_{11}^{11} + d_{12}^{11} - d_{12}^{01}\right) + N_2\left(d_{21}^{11} + d_{22}^{11} - d_{22}^{01}\right)\\ &= \left[N_1\frac{\beta\gamma_{11}}{\beta+\gamma_{12}} + N_2\frac{\beta\gamma_{21}}{\beta+\gamma_{22}}\right]Y > 0.\end{aligned}$$

A.2. Optimal fundraising without policy

The first- and second-order conditions for an interior optimum for optimal fundraising are

$$\frac{\partial Q_j}{\partial f_j} = \frac{\partial Q_j}{\partial L_j}\frac{\partial L_j}{\partial f_j} + \frac{\partial Q_j}{\partial M_j}\frac{\partial M_j}{\partial f_j} = \frac{\partial Q_j}{\partial L_j}\frac{\partial D_j}{\partial f_j} - \frac{\partial Q_j}{\partial M_j}\tau_j = 0; \tag{A1a}$$

$$\frac{\partial^2 Q_j}{\partial f_j^2} = \frac{\partial^2 Q_j}{\partial L_j^2}\left(\frac{\partial L_j}{\partial f_j}\right)^2 + 2\frac{\partial^2 Q_j}{\partial L_j \partial M_j}\frac{\partial L_j}{\partial f_j}\frac{\partial M_j}{\partial f_j} + \frac{\partial^2 Q_j}{\partial M_j^2}\left(\frac{\partial M_j}{\partial f_j}\right)^2 < 0. \tag{A1b}$$

The second-order derivative is strictly negative because $\alpha_j \in (0,1)$, $\frac{\partial M_j}{\partial f_j} = -\tau_j < 0$, and $\frac{\partial L_j}{\partial f_j} = \frac{\partial D_j}{\partial f_j} > 0$. Hence, f_j^* exists and is unique.

Differentiating the first-order condition for charity k, we get

$$\frac{\partial^2 Q_k}{\partial f_k^2} d f_k^* + \frac{\partial^2 Q_j}{\partial f_k \partial f_l} d f_l + \frac{\partial^2 Q_j}{\partial f_k \partial K} dK = 0. \tag{A2}$$

Thus,

$$\frac{d f_k^*}{dK} = \frac{1}{\frac{\partial^2 Q_k}{\partial f_k^2}}\left[\frac{\partial^2 Q_k}{\partial L_k^2}\frac{\partial D_k}{\partial f_k} - \frac{\partial^2 Q_k}{\partial L_k \partial M_k}\tau_k\right] > 0. \tag{A3}$$

Here we have utilized $\frac{\partial L_k}{\partial K} = -1$ as well as $\frac{\partial L_k}{\partial f_k} = \frac{\partial D_k}{\partial f_k}$ and $\frac{\partial M_k}{\partial f_k} = -\tau_k$. Higher fixed costs make more fundraising optimal because the marginal product of L, which has to be purchased, is higher when charity k has a lower surplus and the marginal product of M, and hence the opportunity cost of fundraising, is not higher as long as $\frac{\partial^2 Q_k}{\partial L_k \partial M_k} \geq 0$, which is a standard assumption.

More intensive fundraising by k's competitor generates the following optimal response:

$$\begin{aligned}\frac{df_k^*}{df_l} &= \frac{-1}{\frac{\partial^2 Q_k}{\partial f_k^2}}\left[\frac{\partial^2 Q_k}{\partial L_k^2}\frac{\partial D_k}{\partial f_k}\frac{\partial D_k}{\partial f_l} + \frac{\partial Q_k}{\partial L_k}\frac{\partial^2 D_k}{\partial f_k \partial f_l} - \frac{\partial^2 Q_k}{\partial L_k \partial M_k}\tau_k\frac{\partial D_k}{\partial f_l}\right]\\ &= \frac{-1}{\frac{\partial^2 Q_k}{\partial f_k^2}}\frac{\partial^2 D_k}{\partial f_k \partial f_l}\left[\frac{\partial^2 Q_k}{\partial L_k^2}D_k + \frac{\partial Q_k}{\partial L_k} - \frac{\partial^2 Q_k}{\partial L_k \partial M_k}\tau_k f_k^*\right]\\ &= \frac{-1}{\frac{\partial^2 Q_k}{\partial f_k^2}}\frac{\partial^2 D_k}{\partial f_k \partial f_l}\left[\epsilon_{L_k}^{\frac{\partial Q_k}{\partial L_k}}\left(\frac{D_k}{D_k - K_k}\right) + 1 - \epsilon_{L_k}^{\frac{\partial Q_k}{\partial M_k}}\left(\frac{D_k}{D_k - K_k}\right)\right].\end{aligned} \tag{A4}$$

In the first line, we have already made the substitutions $\frac{\partial L_k}{\partial f_l} = \frac{\partial D_k}{\partial f_l}$, $\frac{\partial^2 L_k}{\partial f_k \partial f_l} = \frac{\partial^2 D_k}{\partial f_k \partial f_l}$, and $\frac{\partial M_k}{\partial f_k} = -\tau_k$. We see that there are three effects of more intense solicitation by the competing charity. Two of them—the first and the last—pull in the direction of a positive response by k as $\frac{\partial D_k}{\partial f_k} > 0$ and $\frac{\partial D_k}{\partial f_l} < 0$. More fundraising by the competitor means smaller donations and hence less funds to buy L. As was the case for higher fixed costs, this imples a larger marginal product of L, raising the marginal gain from fundraising. As $\frac{\partial^2 Q_k}{\partial L_k \partial M_k} \geq 0$, lower donations also at worst keep the marginal cost of fundraising constant, but will reduce it when L and M are complements, making a higher level og fundraising optimal. Against this, more intense solicitation by the other charity also means that at the margin your own fundraising becomes less effective since there are fewer donors who are only solicited by you (the second effect): $\frac{\partial^2 D_k}{\partial f_k \partial f_l} < 0$, c.f. (11) in the main text. This of course tends to make fundraising less attractive. To say something about the net effect, we hence need to delve deeper.

To get to the second line, we use the following properties of the donations function: $\frac{\partial D_k}{\partial f_l} = \frac{\partial^2 D_k}{\partial f_k \partial f_l}f_k$ and $\frac{\partial D_k}{\partial fk}f_k = D_k$. To get to the third line, we use the first-order condition to substitute for τ_k and then define the elasticities shown in the standard way. Hence, we can say that

$$\frac{df_k^*}{df_l} \lesseqgtr 0 \Leftrightarrow K_k \lesseqgtr \left[1 - \left(-\epsilon_{L_k}^{\frac{\partial Q_k}{\partial L_k}} + \epsilon_{L_k}^{\frac{\partial Q_k}{\partial M_k}}\right)\right]D_k. \tag{A5}$$

So far we have not used any of the properties of the production function beyond the weak assumption $\frac{\partial^2 Q_k}{\partial L_k \partial M_k} \geq 0$. If it is of the CES type, it is easy to show that the sum of the elasticities in the expression on the right-hand side is $1 - \rho$, where $\rho \leq 1$ is a parameter of the production function determining the elasticity of substitution (which equals $\frac{1}{1-\rho}$). Hence, the condition boils down to $K_k \lesseqgtr \rho D_k$, i.e., sign of the derivative depends on the size of the fixed costs relative to total donations. As is well known, Cobb-Douglas is a special case of CES with $\rho = 0$, which is why we get $\frac{df_k^*}{df_l} \geq 0$ for $K_k \geq 0$ in the main text. It is noteworthy that although it is possible to have the opposite sign for positive, but low fixed costs when $\rho \in (0, 1)$, this is is a small part of the parameter space (due to the linearity of the donations function and the time constraint, our model requires a strictly concave production function and hence $\rho = 1$ is not applicable). A positive relationship between fundraising efforts in the absence of government support is therefore a quite general relationship.

There are other conditions that have to be satisfied for (15) to generate an interior equilibrium that makes economic sense. In particular, because the decision variable is the share of the population covered by fundraising, $f_k \in [0, 1]$. If the solution to (15) lies outside this interval, there are no permissible interior equilibria. Since the reaction functions are monotonically increasing in both K_k and f_l, we thus also need to ensure that $f_k^*(1) \leq 1$ when $K_k > 0$. This can be achieved by placing the following restriction on the size of K:

$$K_k \leq \left(\frac{1}{1-\alpha_k}\right)\left(1-\frac{\alpha_k}{\tau_k}\right)\frac{\partial D_k(f_l=1)}{\partial f_k} \equiv \overline{K}_k.$$

$\tau_k < 1$ would ensure that even if the charity decides to cover the whole population of potential donors in its fundraising campaign, management is still able to devote some time to supervising operations. However, we will make the slightly stronger assumption that $\alpha_k < \tau_k < 1$ to avoid a corner solution for fundraising when fixed costs are zero.

A.3. Comparative statics effects of policy instruments on fundraising in Nash-equilibrium

When the government's only instrument is G, we have

$$f_k^*(f_l; G_k) = \frac{\alpha_k}{\tau_k} + \frac{(1-\alpha_k)(K_k - G_k)}{\frac{\partial D_k}{\partial f_k}}$$

Differentiating the reaction functions of charity k and l with respect to G_k at the Nash-equilibrium, we have

$$\frac{df_k^N}{dG_k} = \frac{\partial f_k^*}{\partial G_k} + \frac{\partial f_k^*}{\partial f_l}\frac{df_l^N}{dG_k};$$
$$\frac{df_l^N}{dG_k} = \frac{\partial f_l^*}{\partial G_k} + \frac{\partial f_l^*}{\partial f_k}\frac{df_k^N}{dG_k}.$$

Noting that $\frac{\partial f_l^*}{\partial G_k} = 0$, substituting for $\frac{df_l^N}{dG_k}$ in the expression for $\frac{df_k^N}{dG_k}$, and then using the result to replace $\frac{df_k^N}{dG_k}$ in the second equation, we obtain (27) and (28) in the main text.

$\Phi = \frac{\partial^2 Q_1}{\partial f_1^2}\frac{\partial^2 Q_2}{\partial f_2^2} - \frac{\partial^2 Q_1}{\partial f_1 \partial f_2}\frac{\partial^2 Q_2}{\partial f_1 \partial f_2} = 1 - \frac{\partial f_k^*}{\partial f_l}\frac{\partial f_l^*}{\partial f_k}$ is the determinant of the system and standard stability considerations implies $\Phi > 0$. Visual inspection of Figure 3 demonstrates that this holds in the equilibrium we focus on, no matter the character of the competition between the charities. Equations (31) and (32) are derived in the same fashion, starting from (21) with $G_k \equiv 0$.