Online Appendix – Not for Publication

The model presented here is a simple static equilibrium model of the amount of private and public giving to a charity or public good. Consider an economy with N individuals indexed by i. Each individual has an exogenous income allocation y_i, is subject to a lump sum tax τ_i, and chooses a voluntary contribution g_i to the public good. The individual gets utility from consumption, c_i, and from the level of the public good, G.[1] The utility function is thus $U_i = U(c_i, G)$. Suppose that $U_x > 0$, $U_{xx} < 0$ for $x = c, G$, and $U_{cG} > 0$, where U_x represents the derivative of the utility function with respect to the variable x. Also suppose that $U_x \to \infty$ as $x \to 0$, assuring an interior solution. The level of the public good is $G = \sum_{i=1}^{N} g_i + \tau_i$, so that private and public contributions to the public good are perfect substitutes in production. The individual's budget constraint is $y_i \le c_i + g_i + \tau_i$, and this constraint must bind. The individual thus makes a single choice of g_i to maximize $U(y_i - g_i - \tau_i, \sum_{i=1}^{N} (g_i + \tau_i))$.

The government is benevolent, maximizing a weighted utilitarian social welfare function: $W = \sum_{i=1}^{N} \gamma_i U(c_i, G)$. The government chooses the tax structure $\{\tau_i\}$ to maximize social welfare.

As previous literature on crowding out has considered government action (the tax schedule τ_i) exogenous, I start by considering that case in the following section. Later, I consider how government responds to an exogenous change in the level of private donations, and how the two types of agents interact when both move endogenously.

Exogenous Government Action

First, suppose that the government sets its taxes exogenously and consider the response of individuals. Individual i's problem is: $\max_{g \ge 0_i} U(y_i - g_i - \tau_i, \sum_{j=1}^{N} (g_j + \tau_j))$. Individual i takes as given all other private contributions g_j. The first order condition for this maximization problem, assuming an interior solution, is $U_c = U_G$. The left hand side of the first order condition is the

[1] The public good G may also incorporate private goods provided by a charity to individuals (e.g. food, clothing) as long as donors are altruistic. In other words, the fact that donors feel altruistic towards recipients of charitable services means that the private consumption of those services becomes a public good.

marginal cost of an additional unit of private contribution, which is the foregone consumption from that unit of wealth, U_c. This is equated with the marginal benefit of an additional unit of private contribution, equal to the additional amount from the public good that is created from the individual's contribution, U_G. At a corner solution, where the individual optimizes by giving nothing to the public good, $U_c > U_G$, since the cost of giving the first dollar outweighs the benefit.

Crowding out is analyzed by evaluating $dg_i/d\tau_i$, or the change in private contribution resulting from a change in the forced level of government contribution from individual i. (This is a comparative static result for an agent's best-response function, not for a Nash equilibrium contribution.) This derivative is evaluated using the implicit function theorem on the first order condition for the interior solution:

$$\frac{dg_i}{d\tau_i} = -\frac{U_{cc} - 2U_{cG} + U_{GG}}{U_{cc} - 2U_{cG} + U_{GG}} = -1 .$$

Private contributions are perfectly crowded out by the government's contribution. This result is intuitive; individuals only care about the level of the public good and not about the source of its funding, so they are indifferent whether it is funded through their voluntary contributions or through their taxes.[2] Since g_i and τ_i appear together always summed in the individual's utility function, each individual can be seen as just maximizing this sum, so that any exogenous change in τ_i is offset perfectly by changing the choice of g_i.[3]

Exogenous Individual Action

The previous section assumes that the taxes are set exogenously and considers the response of individuals to a change in those taxes. This structure of the problem is most commonly seen in the empirical literature on crowding out. However, one may just as easily consider the government's response to a change in private donations to public goods. A large increase in private donations to a charity, due to perhaps a fundraising drive or a high-profile event highlighting the charity's need, may cause the government to reduce its giving to that

[2] Bergstrom et. al. (1986) show how considering corner solutions can make the crowding out less than one-for-one: those individuals who contribute nothing cannot respond to a tax increase by contributing even less.

[3] In the same model Ribar and Wilhelm (2002) find that as N approaches infinity, crowding out can become either partial, one-for-one, or zero, depending on the parameters of the model. However, this only holds in the case where government funding of the public good is exogenous and not subject to a budget constraint. When that constraint is added, crowding out can no longer be zero (see their Corollary 1.2).

charity compared to what it otherwise would have given under the same conditions but without the increased private contributions.

To capture this other direction of crowding out, suppose that the actions of each individual are treated as exogenous by the government, who then sets the taxes $\{\tau_i\}$ to maximize social welfare. The government's problem is

$$\max_{\{\tau_i \geq 0\}_{i=1}^N} \sum_{i=1}^N \gamma_i U[y_i - g_i - \tau_i, \sum_{j=1}^N (g_j + \tau_j)],$$

where private giving g_i is exogenous. Assume an interior solution for all τ_i. This yields N first order conditions $-\gamma_i U_c + \sum_{j=1}^N \gamma_j U_G = 0$ for $i = 1,\ldots,N$. The social marginal cost of increasing the tax on individual i is the foregone value of consumption for that person. This equals the marginal benefit of increasing the tax, which is the value of the increase in the public good. This benefit accrues to each person's utility function, and hence it is summed over each individual. To evaluate $d\tau_i/dg_i$ using the implicit function theorem, one must calculate the inverse of an $N \times N$ matrix (from the N first order conditions). Instead, one can look at the government's social welfare function and note that g_i and τ_i are perfect substitutes, appearing only as a sum, as they are in individual i's utility function in the section above. Thus the government can act as if maximizing their sum, and so any change in a g_i will be offset perfectly by a change in τ_i.

Formally, suppose at equilibrium the government chooses $\tau_1^*, \tau_2^*,\ldots, \tau_N^*$ in response to donations of $g_1^*, g_2^*, \ldots, g_N^*$ (all interior solutions). The value of social welfare is thus $\sum_{i=1}^N \gamma_i U(y_i - g_i^* - \tau_i^*, \sum_{j=1}^N (g_j^* - \tau_j^*)) \equiv W^*$. Consider an exogenous change in just one individual's donation level from g_k^* to g_k^{**}. By replacing $\tau_k^{**} = \tau_k^* - (g_k^{**} - g_k^*)$, and keeping all other tax levels the same, the government can achieve the same level of welfare W^*. Can the government do any better in this case? Suppose it can, so that some $\hat{\tau}_1, \hat{\tau}_2, ..., \hat{\tau}_N$ exist such that

$$\gamma_k U(y_k - g_k^{**} - \hat{\tau}_k, \sum_{j\neq k}(g_j^* + \hat{\tau}_j) + g_k^{**} + \hat{\tau}_k) + \sum_{i\neq k}\gamma_i U(y_i - g_i^* - \hat{\tau}_i, \sum_j (g_j^* + \hat{\tau}_j) + g_k^{**} + \hat{\tau}_k) > W^*.$$

If this inequality holds, then, given each $g_i = g_i^*$ (the initial equilibrium), the government can set all $\tau_i = \hat{\tau}_i$ except for $\tau_k = \hat{\tau}_k - (g_k^{**} - g_k^*)$ and get the same level of welfare as in the left-hand side of the above inequality. But then W^* is not the maximum level of welfare achievable given the initial equilibrium. This contradicts the initial assumption. Thus, the government cannot do any better in response to a change from g_k^* to g_k^{**} than replacing $\tau_k^{**} = \tau_k^* - (g_k^{**} - g_k^*)$, and keeping all other tax levels the same. By replacing these changes with infinitesimal changes, it follows that $d\tau_i/dg_i = -1$ and $d\tau_i/dg_j = 0$ for $i \neq j$. The government thus perfectly crowds out any change in private donations through individually based taxes.

Endogenous Government and Individual Action

The previous two sections have each considered a case where one side of the market acts exogenously; in the first section I followed the literature by assuming the government sets the tax rates exogenously, and in the following section I assumed that private donations were set exogenously. The next logical extension is assuming both private donations and government grants are endogenous.[4]

First, suppose that all of the individuals and the government move simultaneously, resulting in a Nash equilibrium. Since both the government and each individual act as though the other's action is fixed at the equilibrium level, the maximization problems and the first order conditions for each party are identical to those from before. Thus, the first order conditions for an interior solution are a system of $2N$ equations: $-\gamma_i U_c + \sum_{j=1}^{N} \gamma_j U_G = 0$ for $i = 1,\ldots,N$ for the government's problem and $U_c = U_G$ for each individual i. This is a large system of equations that is impossible to solve without parameterizing the utility function. By assuming homogeneity of individuals, though, an interesting result emerges. With identical individuals all making a contribution g, and the government setting an identical tax τ on each of them, the government's first order condition simplifies to $U_c = NU_G$. This is inconsistent with the individuals' first order condition for an interior solution. By considering corner solutions through the Kuhn-Tucker conditions, it can be shown that individuals give nothing in equilibrium: $g = 0$. The government sets a positive tax level to maximize social welfare. Why does this corner solution always hold? Under homogeneity of individuals, the same level of utility is achieved whether funding the public good through private donations g or through taxes

[4] This is similar to the contribution made by Knight (2002) to the federalism literature. He departs from the assumption of exogenous federal grants to states by supposing that they are determined in a political process, so that federal spending may help determine state spending, and vice versa.

τ. Thus, the government can set τ to achieve the first-best, totally compensating for the free rider problem. This is in general not possible when the two sources of funding for the public good are not perfect substitutes, for example, if a warm glow effect accrues from private donations.

A second equilibrium concept occurs when the government is the first mover, followed by all individuals moving simultaneously, resulting in a Stackelberg equilibrium.[5] The maximization problem and first order condition for each individual are the same as before, since individuals are second movers and take the government's and each other's actions as exogenous. The government, however, chooses both the tax and the individuals' private donations, subject to the individuals' maximizing behavior. The government's problem is thus

$$\max_{\tau\geq 0, g\geq 0_i} \sum_{i=1}^{N} \gamma_i U[y_i - g_i - \tau_i, \sum_{j=1}^{N} (g_j + \tau_j)] \text{ such that } -U_c + U_G + \mu_i = 0 \quad \forall i,$$

where μ_i is individual i's constraint that $g_i \geq 0$, coming from the first order conditions of the individual's maximization problem. Because of the inequality constraints on both g and τ, the first order conditions for this problem are complicated.

Another Stackelberg equilibrium occurs when the government sets the tax *after* all of the individuals have chosen their level of private contributions. In the first stage, all N individuals move simultaneously, and in the second stage the government moves. The government's maximization problem and first order condition are the same as in the case where individuals' actions are exogenous, since those actions are given at the time of the government decisions. The individuals must each choose a level of private contribution, factoring in how their contribution affects the government's choice of tax, holding constant all other individuals' contributions. Individual i's maximization problem is

$$\max_{g_i\geq 0, \tau\geq 0} U(y_i - g_i - \tau_i, \sum_{j=1}^{N} (g_j + \tau_j)) \text{ such that } \sum_{j=1}^{N} \gamma_j (-U_c + NU_G) = 0 .$$

The constraint is the first order condition of the government's optimization problem, assuming an interior solution. Individual i chooses τ subject to the constraint but can only affect τ insofar

[5] This is similar to Varian's (1994) modeling of sequential private contributions to public goods. That model has no government, though, and only two individuals. He shows that the level of public good provision is weakly lower under sequential contributions than under simultaneous contributions. Here, I allow the government to move either before or after individuals, but all individuals move simultaneously with each other.

as g_i is changed. Though the first order conditions are relatively easy to find, any further analysis of this equilibrium is impossible without assuming any form on the utility function.

Finally, I evaluate the social planner's problem, where each individual's level of private contribution and the tax are set simultaneously by one agent. The maximization problem is

$$\max_{\{g_i\}\geq 0, \tau\geq 0} \sum_{i=1}^{N} \gamma_i U(y_i - g_i - \tau, N\tau + \sum_{k=1}^{N} g_k)\,.$$

The first best solution thus depends on how each individual is weighted in the social welfare function, described by the γ_i parameters. In the special case where all individuals are identical, the problem becomes

$$\max_{g\geq 0, \tau\geq 0} U(y - g - \tau, N(\tau + g))\,.$$

Again, here g and τ are perfect substitutes, so government need only choose the sum $\tau + g$, or each individual's total contribution to G. This leads to the first order condition $U_c = NU_G$. The marginal cost to each individual, U_c, is set to equal the social marginal benefit, which accrues to all N individuals, NU_G.

Warm Glow

Next, consider extending individuals' preferences to allow for a warm glow effect, or impure altruism.[6] Ignoring impure altruism is contrary to much empirical evidence suggesting that individuals do in fact experience a warm glow when giving; neurological evidence is documented in Harbaugh et. al. (2007). As in Andreoni (1990), this is done by amending the individual's utility function to include the individual's level of voluntary contribution as an argument. Thus, the utility function is $U(c_i, g_i, G)$. Given an exogenous tax schedule, the individual's first order condition is now $-U_c + U_g + U_G = 0$. The middle term accounts for the fact that the individual earns warm glow utility from the level of giving g_i, separate from the benefit directly received by the public good G. The individual does not receive this warm glow from mandatory contributions to the public good (taxes).

The first order condition can be used to find the effect of a change in the individual's tax rate τ_i:

[6] An alternative extension, yet with similar effects, is to consider reputation effects, as in Benabou and Tirole (2006). See also Kotchen (2006).

$$\frac{dg_i}{d\tau_i} = \frac{-(U_{cc} - 2U_{cG} - U_{cg} + U_{gG} + U_{GG})}{U_{cc} - 2U_{cG} - 2U_{cg} + 2U_{gG} + +U_{gg} + U_{GG}}.$$

In general, this cannot be signed. The numerator is positive, and the denominator is equal to the negative of the numerator plus three additional terms: $U_{gg} + U_{gG} - U_{cg}$. If this additional sum is negative, then the total derivative above must be between –1 and 0. That is, crowding out exists but is less than one-for-one. The intuition is that government and private provision of the public good are no longer perfect substitutes in utility because of the warm glow effect, and thus we would not expect perfect crowding out. The sufficient condition for partial crowding out to hold is satisfied as long as U_{gG} is not too large (the other two terms are negative). That is, if U_{gG} is too big, then a decrease in government spending on the public good (G) reduces the marginal utility of the warm glow effect (U_g) enough so that the individual reduces his or her private giving.

Consider next the case where individuals' actions are exogenous and the government's tax structure is endogenous in the context of a warm glow effect. Suppose further that the government sets an identical tax τ on every individual.[7] The government's problem is $\max_{\tau}\sum_{i=1}^{N}\gamma_i U[y_i - g_i - \tau, g_i, \sum_{j=1}^{N}(g_j + \tau)]$. Assume an interior solution for τ.[8] This yields the first order condition $\sum_{i=1}^{N}\gamma_i(-U_c + \sum_{j=1}^{N}U_G) = 0$. The social marginal cost of increasing the tax on individual i is the foregone value of consumption for that person. This equals the marginal benefit of increasing the tax, which is the value of the increase in the public good. This benefit accrues to each person's utility function, and hence it is summed over N. Use the implicit function theorem to calculate the change in the optimal tax in response to a change in private donations:

[7] The most general form of the tax allows for the government to set a different tax for each individual. However, this generality makes the evaluation of derivatives difficult. To evaluate $d\tau_i/dg_i$ using the implicit function theorem, one must calculate the inverse of an $N \times N$ matrix (from the N first order conditions).

[8] The condition on the utility function, that $U_x \to \infty$ as $x \to 0$, ensures an interior solution for g_i in the individual's problem. This does not ensure an interior solution for τ, however, since τ is not an argument of the utility function.

$$\frac{d\tau}{dg_i} = \frac{\gamma_i(-U_{cc} + U_{cg} + U_{cG} - U_{Gg}) + \sum_{j=1}^{N}\gamma_j(U_{cG} - U_{GG})}{\sum_{j=1}^{N}\gamma_j(U_{cc} - 2U_{cG} + U_{GG})}.$$

The denominator of this expression is strictly negative. With no warm glow effect, the numerator is strictly positive, which implies that private donations crowd out public spending.[9] In fact, as long as $U_{gG} < U_{cG}$, crowding out must occur. This condition is similar to that in the last section. Again, crowding out must occur as long as the marginal utility from the public good (U_G) does not increase too much in the level of the warm glow effect (g). If so, then a reduction in private giving by individual i may reduce everyone's utility from the public good by enough so that the optimal tax decreases as well.

Non-benevolent Government

I next consider the case of a non-benevolent government, that is, a government whose maximand is not the social welfare function of the weighted sum of individuals' utility functions. One way in which the government's utility function could differ from the socially optimal is if the government uses weights different than those that are socially optimal. If the true social welfare function is $W = \sum_{i=1}^{N}\gamma_i U(c_i, G)$, suppose that the government actually maximizes $\sum_{i=1}^{N}\mu_i U(c_i, G)$, where the new weights may represent a government corrupted by influence from some interest groups. However, note that all of the results found in the paper are independent of the weights γ_i. Thus, this particular deviation from a benevolent government has no effect on the model's implications.

Consider instead an alternative formulation of a non-benevolent government. Suppose that the government's maximand is $\sum_{i=1}^{N}[\gamma_i U(c_i, G) + \xi_i \tau_i]$, so that the government directly receives utility from their tax levels τ_i. This could represent the outcome from lobbying by firms who contract for government services and who prefer government funding of public goods to

[9] Finding conditions for when crowding out is one-for-one is not appropriate in this context, since the tax rate applies to each individual. If individual i increases his or her private contribution by one dollar, then a decrease of one dollar in the tax τ would actually decrease the total amount of the public good by $(N-1)$ dollars.

private funding. Note that this specification is analogous to the warm glow specification in household utility; here government can receive a warm glow from their tax expenditures on the public good. The proof used in Section I to show that private donations perfectly crowd out government funding no longer applies, since government and private contributions to the public good are no longer perfect substitutes. The first order condition for the government's choice of τ_i is $-\gamma_i U_c + \sum_{j=1}^{N} \gamma_j U_G + \xi_i = 0$. One could use the implicit function theorem on this series of first order conditions, but this would involved a large N by N matrix, for each of the τ_i. Alternatively, one could assume a unified tax rate τ, as was done above for the impure altruism case. If that assumption is taken, then the derivative above remains the same, except that all of the warm glow terms are dropped. As described above, this still results in crowding out of private donations, though perhaps not at a one-for-one level.

Endogenous Charity Response

A final extension includes the behavior of charities in response to government grants or private donations. A growing literature examines charities' response, especially in their choices over fundraising expenditures (Andreoni and Payne 2003, 2010, Breman 2008).

Suppose that, in addition to a benevolent government and N private potential donors, there exists a charity who takes government grants and private donations and converts them into public goods. The charity has access to fundraising technology, and uses it to solicit donors. The charity can choose a level of fundraising effectiveness θ, which gives the fraction of individuals that are solicited by the charity. To reach this level of fundraising they must pay $F(\theta)$ in fundraising costs, where F is increasing and convex. A charity seeks to maximize the total payout to the public good less the amount that is being spent on fundraising; its maximand is $\sum_{i=1}^{N} (g_i + \tau_i) - F(\theta)$. An individual donor is not aware of the charity or the public good unless she is solicited by the charity. Let $z_i = 1$ if individual i is solicited and $z_i = 0$ if not. If $z_i = 0$, then $g_i = 0$. If $z_i = 1$, then individual i chooses g_i to maximize her utility given her tax rate τ_i as well as everyone else's tax rate and everyone else's level of contribution to the charity.

As shown in the models above, the order of movement among the government, the individuals, and here the charity is likely to matter. Suppose that the government sets its tax levels τ_i exogenously, and then the charity responds by choosing θ, followed by all N individuals simultaneously. A key difference between this model and the previous models is the stochastic element: the charity can choose θ, which gives the probability that any individual will be solicited. Once the charity chooses this probability, the actual solicitations are realized and individuals respond. Define the solicitation vector as $Z = (z_1, z_2, \ldots z_N)'$, where each z_i is defined as above. The value of θ gives the probability of any Z being drawn, let this be $\Pr(Z; \theta)$. Let the set of all possible solicitation vectors be Σ.

Begin by solving the individual's maximization problem, given the taxes, the solicitation vector Z, and all other individuals' levels of giving. As assumed, if $z_i = 0$, then $g_i = 0$. If $z_i = 1$, then individual i chooses g_i to maximize $U(y_i - g_i - \tau_i, \Sigma(g_i + \tau_i))$. The first order condition for this choice is $U_c = U_G$. Given a solicitation vector Z and a set of taxes $\{\tau_i\}$, each individual's choice of giving can be written as a deterministic function $g_i(y_i, \tau_i, \tau_{-i}, Z)$. It can be shown as in the text for the basic model in section 2 that $\delta g_i/\delta\tau_i = -1$ and $\delta g_i/\delta\tau_j = 0$ for $i \neq j$. These partial derivatives, though, are conditional on a fixed solicitation vector Z. In equilibrium, when the government's choice of taxes changes, the charity's choice of fundraising will change and thus so will Z.

The charity takes as given each individual's response to the tax levels and the solicitation vector and chooses θ to maximize its expected utility. For a given θ, its expected level of donations is

$$\sum_{Z \in \Sigma} \Pr(Z;\theta) \cdot (\sum_{i=1}^{N} g_i(y_i, \tau_i, \tau_{-i}, Z)) .$$

The charity sets θ so that its marginal cost of increasing θ, $F'(\theta)$, is equal to the marginal benefit of increasing θ. The charity's first order condition is thus

$$F'(\theta) = \sum_{Z \in \Sigma} \frac{d \Pr(Z;\theta)}{d\theta} \cdot (\sum_{i=1}^{N} g_i(y_i, \tau_i, \tau_{-i}, Z)) .$$

A charity cannot directly choose who it solicits for donations, it can only choose the probability that any individual is solicited. As it alters this probability, the probability of different draws of the solicitation vector is accordingly changed. To somewhat simplify the charity's first order condition, assume that individuals are homogeneous. Now, instead of dealing with a solicitation vector Z, the outcome of the random draw can be described with the number of individuals solicited z, where z is an integer between 0 and N. The binomial distribution gives

$\Pr(z;\theta) = \binom{N}{z}\theta^z(1-\theta)^{N-z}$. Furthermore, use symmetry to reduce each individual's $g_i(y_i, \tau_i, \tau_{-i}, Z)$ to merely $g(\tau,z)$, where this is defined as the amount that each individual who solicits chooses to contribute ($g = 0$ for those who are not solicited).

Then, the charity's first order condition can be written as

$$F'(\theta) = \sum_{z=0}^{N}\frac{d}{d\theta}\binom{N}{z}\theta^z(1-\theta)^{N-z}\cdot z\cdot g(\tau,z) = \sum_{z=0}^{N}\binom{N}{z}\theta^{z-1}(1-\theta)^{N-z-1}(z-\theta N)\cdot z\cdot g(\tau,z).$$

The derivative of the binomial probability expression with respect to θ is positive for values of z in the sum that are greater than θN, the expected value of z, and is negative for values lower. An higher θ makes it more likely that a higher value of z will be drawn and makes it less likely that a lower value of z will be drawn.

The right hand side of the first order condition above can be written in the form of an expectation over the binomial distribution. After simplifying, this becomes

$$F'(\theta) = E_\theta[\frac{1}{\theta(1-\theta)}(z-\theta N)\cdot z\cdot g(\tau,z)].$$

In general, this expectation cannot be evaluated without knowing the form of $g(\tau, z)$, and in particular how it depends on z. However, temporarily assume that g is independent of z. That is, the amount donated by an individual who is solicited is independent of the number of individuals solicited. For the charity, this means that the benefit of increasing θ lies only in its increasing the probability of soliciting a higher number of donors z, but not in changing the amount that each individual who donates will give g. This assumption is strong and unlikely to be true, but it is used here to make the charity's first order condition more interpretable. Under this assumption, $g(\tau, z)$ can be pulled out of the expectation operator. Thus,

$$F'(\theta) = \frac{1}{\theta(1-\theta)}g(\tau,z)E_\theta[(z-\theta N)\cdot z] = \frac{1}{\theta(1-\theta)}g(\tau,z)[E_\theta(z^2)-\theta NE_\theta(z)] = Ng(\tau,z).$$

The marginal cost of increasing θ, $F'(\theta)$, equals the marginal benefit. This benefit consists only in the increased expected number of people donating, the final expression on the right of the above equation.

The first order condition implicitly gives the charity's choice of θ as a function of the government's tax choice τ. The implicit function theorem can be used to show how θ changes with τ. In general, this expression cannot be signed. Making the same assumption as earlier that the level of an individual's giving $g(\tau, z)$ is independent of z, the derivative can be shown to equal

$$\frac{d\theta}{d\tau} = \frac{\partial g / \partial \tau \, N}{F''(\theta)}.$$

The denominator of this expression is strictly positive. The entire expression, then, is of the same sign as $\delta g/\delta\tau$, the change in an individual's giving in response to a change in the tax level, for a fixed z. Since this partial derivative is negative, as shown in the main text, the entire derivative above is negative. That is, under the given assumption, an increase in the government's tax level leads to a decrease in the charity's fundraising expenditures. This mimics the main finding of the theory in Andreoni and Payne (2003), which is that government grants crowd out fundraising expenditures.

One can consider then how private donations to the charity are affected by government grants taking into account the charity's endogenous response to those grants. Let total private donations $G_p = \Sigma g_i$. Then, $E_\theta[G_p] = E_\theta[z \cdot g(\tau, z)] = \sum_{z=0}^{N} \binom{N}{z} \theta^z (1-\theta)^{N-z} \cdot z \cdot g(\tau, z)$. How this expected value changes with τ depends on how g and θ change with τ. Thus,

$$\frac{dE_\theta[G_p]}{d\tau} = \sum_{z=0}^{N} \binom{N}{z} \{\theta^{z-1}(1-\theta)^{N-z-1}(z-\theta N) \cdot z \cdot g(\tau, z) \cdot \frac{\partial \theta}{\partial \tau} + \theta^z (1-\theta)^{N-z} \cdot z \cdot \frac{\partial g(\tau, z)}{\partial \tau}\}.$$

Taking the expectations over the binomial distribution, this simplifies to

$$\frac{dE_\theta[G_p]}{d\tau} = E_\theta[\frac{(z-\theta N)}{\theta(1-\theta)} z \cdot g(\tau, z) \cdot \frac{\partial \theta}{\partial \tau} + z \cdot \frac{\partial g(\tau, z)}{\partial \tau}].$$

The final term inside the bracket of the expectation operator represents the "classic" crowd out that results from an increase in government funding of the public good; individuals will reduce their giving. The first term arises from the response of the charity. This endogenous response can thus change the magnitude of the crowding out of private donations.

Quality Signaling

In the model in the prior sections, the government and all individuals have perfect information. It is likely, however, that some uncertainty exists about the quality of a public good and how it affects individuals' utility functions. Furthermore, asymmetries between the government and individuals may exist concerning this uncertainty. Governments may have access to more information about a charity or public good and consequently be more informed about its quality. Alternatively, some private donors, like large private foundations, may have more information about charity quality. I capture this information asymmetry in the model here and show that when the government has full information, it can use its tax policy to signal charity quality to individuals. This signaling can lead to a crowding in effect that works against the crowding out effect found earlier, if a higher tax rate signals a higher quality charity towards which individuals want to give more in donations. This model thus combines the crowding out literature with the literature on quality signaling of seed grants: government grants can provide the same quality signal as private seed grants.[10]

In the model that follows, I assume that it is the government that has the full information about charity quality and thus can use its tax policy to signal that quality. The prediction that government grants can crowd in private donations is based on this assumption about information asymmetry. What if the information asymmetry goes in the opposite direction; what if individuals observe the quality of the public good but the government does not? Clearly, the implication must be that crowding in can occur in the opposite direction. Although the model is not perfectly symmetric between individuals and the government, this result is attainable nonetheless, as long as the individuals are first movers (if the party that receives the private information does not move first, it cannot signal that information). Thus, a slightly extended model predicts that private donations may crowd in government grants, and the empirical work identifying the response of government grants to private donations is testing this prediction as well. I omit this extension, but it is straightforward. A justification for the assumption that governments have the private information is that governments tend to make large grants to organizations and so are likely to spend more time researching the effectiveness of the charity than individuals, who make smaller donations on average. This is true both absolutely and as a fraction of total government versus private expenditure.

To incorporate information asymmetries, suppose that the public good G can vary in quality, measured by the variable α. Following Andreoni (2006), let the individual's utility function be defined as $U(c_i,G;\alpha) = u(c_i) + v(G;\alpha)$ where, as before, utility is increasing in both

[10] The model is thus quite similar to the models in Payne (2001), Vesterlund (2003), and Andreoni (2006). Of those, only Payne (2001) explicitly considers the government acting as the "seed" grant maker or the signaler of quality. However, that model avoids dealing with Bayesian equilibria by supposing a reduced-form function for the signal, where the level of government grants directly affects individuals' beliefs about the quality.

consumption, c, and the level of the public good, G. Also suppose that $dv/d\alpha > 0$ and $d^2v/dGd\alpha > 0$; that is, both total utility and the marginal utility of the public good increase with α. The separability of the private and public good in utility ensures that, under full information (if the individual knows the level of α), an increase in α induces individuals to donate more to the public good.

Suppose that individuals do not know the value of α, but the government does. The government does not convey this information directly to individuals, but it sets taxes based on the value it observes. In the standard signaling model, the holder of private information is unable to directly convey that information, usually because such an announcement cannot be credible, and thus a signal is required. Why can the government in this case not merely announce the α it observes? First, this is not in fact observed; governments do not announce the quality of various charities. Second, the government will want to impose a tax and make contributions to the public good to overcome the free rider problem. Since the tax will end up acting as a signal, the value added of a direct announcement is zero, and none is made. Therefore, the government does not announce α because it does not need to after setting the tax rate.

For simplicity, assume that the government sets a single tax rate τ for all individuals.[11] Individuals choose their level of private donations, g_i, simultaneously in response to the government's tax level. Let the government be the first mover. The game can thus be characterized by the following steps:

1. Nature chooses a value of the quality of the public good, α.
2. Government observes α and sets a tax τ.
3. Individuals simultaneously choose their level of private donations to the charity, g_i, observing τ but not α.

This game lends itself to being analyzed in the framework of a perfect Bayesian equilibrium (PBE), in a manner similar to that of the signaling model of Spence (1973). A PBE is defined by a set of strategies of the individuals $g_i(\tau)$ and of the government $\tau(\alpha)$, and a belief function of the individuals $\mu(\alpha; \tau)$ that gives the individuals' common probability density function for α given τ, such that the government's strategy is optimal given the individuals' strategies, the belief function is derived from the government's strategy using Bayes's rule when possible, and

[11] By making the tax rate identical, this ensures that the signal is a scalar. Otherwise, the government has an N dimensional vector with which to signal the quality of the good. This assumption simplifies the analysis of the separating equilibrium, where each value of α is associated with a unique value of τ.

individuals' strategies constitute a Nash equilibrium of the simultaneous-move game in which the probability of α is given by $\mu(\alpha; \tau)$.

The model can be solved backwards, starting with the individuals' responses to government policy. Individual i chooses a non-negative contribution level g_i to maximize his utility, given τ and all other contributions g_{-i}, such that $y_i \leq c_i + g_i + \tau$ and $G = g_i + g_{-i} + N\tau$. Define $\mu(\alpha; \tau)$ as the individual's density function of beliefs about the value of α upon observing the signal τ. The individual's problem is

$$\max_{g_i} u(y_i - g_i - \tau) + \int_A v(g_i + g_{-i} + N\tau; \alpha)\mu(\alpha; \tau) d\alpha ,$$

where A is the support of α. The first order condition, assuming an interior solution, is

$$-u'(y_i - g_i - \tau) + \int_A v_G(g_i + g_{-i} + N\tau; \alpha)\mu(\alpha; \tau) d\alpha = 0 .$$

The key results of the model are found in this condition. Suppose there is a strictly separating equilibrium, so that for any value of α observed, the government sets a unique tax $\tau(\alpha)$. Then this function must be invertible to $\alpha(\tau)$. Since individuals' beliefs must be derived from Bayes' rule, it follows that $\mu(\alpha;\tau) = 1(\alpha = \alpha(\tau))$, where $1(\cdot)$ is the indicator function equal to 1 if the argument is true and 0 otherwise. In a PBE with a separating equilibrium, individuals are certain about the true value of α after observing the signal. The integral then falls out of the first order condition, which becomes

$$-u'(y_i - g_i - \tau) + v_G(g_i + g_{-i} + N\tau; \alpha(\tau)) = 0 .$$

This condition can be used to find the effect of the tax on private donations via the implicit function theorem:

$$\frac{dg_i}{d\tau} = \frac{u''(c_i) + Nv_{GG}(G; \alpha(\tau)) + v_{G\alpha}(G; \alpha(\tau)) \cdot \alpha'(\tau)}{-u''(c_i) - v_{GG}(G; \alpha(\tau))} .$$

The denominator is strictly positive. The numerator can be divided into two parts. The first two terms are strictly negative, and they represent the crowding out effect found in the last section.[12] With no uncertainty about the quality of the public good, $\alpha'(\tau) = 0$ and the final term in the numerator vanishes. With uncertainty, this last term, the signaling effect, can either intensify or oppose the crowding out effect. The first part of it, $v_{G\alpha}$, is positive by assumption. Suppose that the second part, $\alpha'(\tau)$, is also positive, that is, a higher tax is used to signal a higher quality

[12] The first two terms divided by the denominator do not equal -1, as in the prior section, since here the model has been simplified by assuming the government sets an identical tax on each individual.

charity. Then the signaling effect is positive: a higher tax rate increases the level of private donations. The two effects oppose each other. When the tax increases, individuals want give to less because more of the public good is provided for by the government, and they want to give more because the tax increase signals that the public good is high quality.[13]

The two effects oppose each other only when $\alpha'(\tau) > 0$. Otherwise, they go in the same direction. If a higher tax signals a lower quality public good, then individuals want to donate less to that good because of both the crowding out effect and the signaling effect. To find $\alpha(\tau)$, the government's problem must be solved. Upon observing α, the government maximizes social welfare, taking into account the individuals' responses to the tax it sets. It thus solves

$$\max_{\tau} \sum_{i=1}^{N} \gamma_i (u(y_i - g_i - \tau) + v(N\tau + \sum_{j=1}^{N} g_j; \alpha),$$

subject to the condition that g_i satisfies the individual's first order condition: $-u'(y_i - g_i - \tau) + v'(\sum_j g_j + N\tau; \alpha) = 0$. The government's first order condition for this problem, assuming an interior solution, is

$\sum_{i=1}^{N} \gamma_i (-u'(c_i) + Nv_G(G;\alpha)) + \sum_{i=1}^{N} \lambda_i (u''(c_i) + Nv_{GG}(G;\alpha)) = 0$, where λ_i is the Lagrange multiplier for the constraint from individual *i*'s optimization problem.

This first order condition implicitly defines $\tau(\alpha)$, though it is difficult to interpret without further assumptions. Two assumptions can separately be used to show that $d\tau/d\alpha > 0$. One is assuming that the third derivatives of both *u* and *v* are zero. Under that assumption, $\alpha'(\tau) > 0$, and the signaling effect opposes the crowding out effect.[14] A more intuitive assumption is the following. Assume that $v(G; 0) = 0$, so that when $\alpha = 0$ the public good provides no utility. Then, $\alpha'(\tau) > 0$.[15] However, even under either assumption the magnitudes of the two effects are unknown, as they depend on the utility function and parameters. It is possible that the signaling effect opposes and dominates the crowding out effect. In this case, government grants crowd in private donations. The conditions for that to hold are complex when the utility function

[13] Compare this equation to Equation 3 in Payne (2001).
[14] This can be seen from using the implicit function theorem on the first order condition of the government's problem. Dropping all of the third derivatives from the result yields a strictly negative derivative.
[15] When $v(G;0) = 0$, the individuals' response will always be to contribute nothing, and the government's response will be to set the tax at zero. Since, in a separating equilibrium, the tax must be different for different each value of α, as α increases from zero so must $\tau(\alpha)$.

is left this general, so this section merely demonstrates that crowding in is possible when government grants act as signals of charity quality.[16]

The above results hold under the assumption of interior solutions, for both the government's and the individuals' choices. At corner solutions, no interesting results are possible, since individuals are contributing nothing, and marginal changes in the level of the tax have no effect on private contributions. More realistic is the case where the tax is set so that some individuals are at a corner solution contributing nothing and others are at the interior with positive contributions. In that case, the above results hold for the subset of individuals at interior solutions, while those contributing nothing have a zero crowding out effect and signaling effect. Thus in the aggregate, the above results hold, though the magnitude of the crowding out or crowding in is reduced insofar as some individuals are not donors. This follows from the analysis of Bergstrom et. al. (1986).

References

Andreoni, James. 1990 "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving." *The Economic Journal*, 100(401): 464-477.

_________. 2006. "Leadership Giving in Charitable Fund-raising." *Journal of Public Economic Theory*, 8(1): 1-22.

_________, and Abigail Payne. 2003. "Do Government Grants to Private Charities Crowd Out Giving or Fund-Raising?" *American Economic Review*, 93(3): 792-812.

_________, and _________. 2010. "Is Crowding Out Due Entirely to Fundraising? Evidence from a Panel of Charities." National Bureau of Economic Research Working Paper #16372.

Benabou, Roland, and Jean Tirole. 2006. "Incentives and Prosocial Behavior." *American Economic Review*, 96(5): 1652-1678.

Bergstrom, Theodore, Larwrence Blume, and Hal Varian. 1986. "On the Private Provision of Public Goods." *Journal of Public Economics*, 29(1): 25-49.

[16] When the utility function is specified as in Vesterlund (2003) and when there are only two values that the quality variable α can take, the conditions under which crowding in occurs can be found analytically. Intuitively, it is when the difference in charity quality is sufficiently greater than the difference in the tax signals. When imposing the same utility form but allowing a continuous level of charity quality α, it is not possible to find these conditions, since the signal function $\alpha(\tau)$ cannot be found.

Breman, Anna. 2008. "When Government Grants Crowd Out Private Donations." http://sites.google.com/site/annabreman/Crowding_Out_2008_10.pdf

Harbaugh, William, Ulrich Mayr, and Daniel Burghart. 2007. "Neural Responses to Taxation and Voluntary Giving Reveals Motives for Charitable Donations." *Science*, 316: 1622-1625.

Knight, Brian. 2002. "Endogenous Federal Grants and Crowd-out of State Government Spending: Theory and Evidence from the Federal Highway Aid Program." *American Economic Review*, 92(1): 71-92.

Kotchen, Matthew. 2006. "Green Markets and the Private Provision of Public Goods." *Journal of Political Economy*, 114(4): 816-834.

Payne, Abigail. 2001. "Measuring the Effect of Federal Research Funding on Private Donations at Research Universities: Is Federal Research Funding More than a Substitute for Private Donations?" *International Tax and Public Finance*, 8(5-6): 731-751.

Ribar, David, and Mark Wilhelm. 2002. "Altruistic and Joy-of-Giving Motivations in Charitable Behavior." *Journal of Political Economy*, 110(2): 425-457.

Spence, Michael. 1973. "Job Market Signalling." *Quarterly Journal of Economics*, 87(3): 355-374.

Varian, Hal. 1994. "Sequential Contributions to Public Goods." *Journal of Public Economics*, 53(2): 165-186.

Vesterlund, Lise. 2003. "The Informational Value of Sequential Fundraising." *Journal of Public Economics*, 87(3-4): 627-657.

Appendix Table A1

The Determinants of Private Donations, No IV[a]						
	(1)	(2)	(3)	(4)	(5)	(6)
Government Grants	-0.0618***	0.00326	-0.0715***	-0.0654***	-0.0177***	-0.0607***
	(0.0159)	(0.0101)	(0.0203)	(0.0201)	(0.00368)	(0.0131)
Fundraising Expenditures	1.494***	0.438**	1.593***	1.552***	0.617***	1.601***
	(0.202)	(0.180)	(0.375)	(0.280)	(0.0634)	(0.188)
Program Service Revenue	-0.0407***	-0.0188***	-0.0533***	-0.0492***	-0.00248**	-0.0392***
	(0.00955)	(0.00634)	(0.0150)	(0.0162)	(0.00104)	(0.00744)
Other Revenues	-0.0234*	-0.0155	-0.0201	-0.0152	0.00107	-0.0124
	(0.0133)	(0.0140)	(0.0213)	(0.0203)	(0.00262)	(0.00940)
Population	0.00518	0.00196	0.00946	0.00562	-7.75e-05	-0.000248
	(0.00387)	(0.00389)	(0.00686)	(0.00563)	(0.000970)	(0.000491)
Income	-0.213	-0.284	-0.919	-0.683	0.139	2.043*
	(0.881)	(0.905)	(1.712)	(1.236)	(0.156)	(1.242)
Unemployment Rate	-1569	-1390	-1787	-2071	-58.28	-1190
	(1452)	(1737)	(2119)	(2078)	(428.9)	(2359)
Percent Population > 65	-1792307***	-1395893**	-3031024***	-2283532***	-447337***	-995929***
	(525416)	(602294)	(1.02e+06)	(759465)	(149303)	(313287)
Number Dem Senators	43.43	-4909	-6060	-160.9	1106	795.0
	(3700)	(5214)	(5896)	(5446)	(991.4)	(3063)
Percent Congress members Dem	27393	22378	52106*	18813	6601	15948
	(18941)	(20563)	(31193)	(27529)	(5092)	(14359)
Indicator for Democratic governor	-674.9	2526	-5808	2325	-1643	-3246
	(3964)	(4310)	(5742)	(5616)	(1073)	(3147)
Constant	492061***	450588***	730831***	617962***	168046***	290625***
	(77929)	(85760)	(147615)	(111803)	(20569)	(58179)
Observations	174828	145690	85770	111474	158390	271436
Number of Organizations	29138	29138	14306	18579	27561	59020

Data are from 1998-2003 and only include those organizations that are in the panel for all six years (except column 6), whose reported categorical revenues sum up to reported total revenues, likewise for expenses, and who never report a negative amount in a revenue category. Year indicator variables are included in each regression. Heteroskedasticity consistent standard errors are in parentheses. Column definitions are the same as in Table 2.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A2

The Determinants of Government Grants, No IV[a]						
	(1)	(2)	(3)	(4)	(5)	(6)
Private Donations	-0.0664***	0.00184	-0.110***	-0.0642***	-0.0343***	-0.0582***
	(0.0182)	(0.0103)	(0.0328)	(0.0208)	(0.00830)	(0.0137)
Program Service Revenue	-0.265***	-0.277***	-0.464***	-0.257***	-0.0425***	-0.247***
	(0.0321)	(0.0418)	(0.0283)	(0.0528)	(0.00742)	(0.0241)
Other Revenues	-0.0180	-0.0245	-0.0127	-0.00309	-0.00170	-0.00226
	(0.0123)	(0.0149)	(0.0248)	(0.0154)	(0.00482)	(0.00907)
Population	0.00484	-0.00132	0.00988	0.00751	9.90e-05	0.00218***
	(0.00374)	(0.00326)	(0.00750)	(0.00459)	(0.00184)	(0.000793)
Income	-1.137	-1.334*	-2.306	-1.020	-0.417*	-4.917**
	(0.839)	(0.754)	(1.783)	(1.162)	(0.218)	(1.936)
Unemployment Rate	-2336	-2582	-4166	-5048*	-1193	-11713***
	(2137)	(2126)	(3675)	(2929)	(869.2)	(2965)
Percent Population > 65	-917095	-435464	-3628034	462123	-454900*	-615543
	(983391)	(875084)	(2.62e+06)	(1.21e+06)	(253520)	(426132)
Number Dem Senators	4387	9658	1490	2808	-1618	4427
	(4855)	(6126)	(8984)	(6783)	(1613)	(3755)
Percent Congress members Dem	42882	64678**	143450***	66103*	12167	17649
	(26765)	(29477)	(49382)	(37025)	(8552)	(19079)
Indicator for Dem governor	13237***	19397***	27128***	19913***	2024	12529***
	(4993)	(5051)	(8993)	(6711)	(1758)	(3892)
Constant	701506***	643952***	1.41e+06***	495545***	273145***	698577***
	(135541)	(129385)	(344128)	(169543)	(35461)	(75814)
Observations	174828	145690	85770	111474	158390	271436
Number of Organizations	29138	29138	14306	18579	27561	59020

[a] Data are from 1998-2003 and only include those organizations that are in the panel for all six years (except column 6), whose reported categorical revenues sum up to reported total revenues, likewise for expenses, and who never report a negative amount in a revenue category. Year indicator variables are included in each regression. Heteroskedasticity consistent standard errors are in parentheses. Column definitions are the same as in Table 3.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A3

First Stage Regressions, Dependent Variable = Government Grants[a]						
	(1)	(2)	(3)	(4)	(5)	(6)
SSI payments, total	0.0234**	0.0210**	0.0356*	0.0243*	-0.00210	0.0234***
	(0.0106)	(0.0105)	(0.0191)	(0.0144)	(0.00377)	(0.00886)
SSI payments, elderly	-0.121***	-0.114**	-0.216***	-0.133**	-0.00972	-0.110***
	(0.0438)	(0.0445)	(0.0805)	(0.0605)	(0.0150)	(0.0365)
Management Expenses	0.450***	0.251***	0.691***	0.470***	0.0670***	0.430***
	(0.0850)	(0.0591)	(0.244)	(0.133)	(0.0179)	(0.0695)
Total Liabilities	0.0144***	0.0128***	0.0508***	0.0151**	0.00241***	0.0129***
	(0.00354)	(0.00326)	(0.0166)	(0.00595)	(0.000732)	(0.00245)
Program Service Revenue	-0.294***	-0.105***	-0.496***	-0.281***	-0.0487***	-0.276***
	(0.0355)	(0.0204)	(0.0290)	(0.0571)	(0.00889)	(0.0266)
Other Revenues	-0.0262**	-0.00553	-0.0376	-0.0209	-0.00408	-0.00745
	(0.0131)	(0.00933)	(0.0252)	(0.0165)	(0.00494)	(0.00978)
Population	0.00507	0.00175	0.00603	0.00738	0.000351	0.00214***
	(0.00391)	(0.00304)	(0.00663)	(0.00456)	(0.00183)	(0.000790)
Income	-1.215	-0.152	-2.290	-1.077	-0.435**	-5.162***
	(0.792)	(0.923)	(1.588)	(1.083)	(0.219)	(1.919)
Unemployment Rate	-2801	1114	-5230	-5748**	-1240	-11589***
	(2078)	(2254)	(3512)	(2841)	(867.6)	(2923)
Percent Population > 65	-646183	525829	-1986579	844927	-449688*	-445784
	(977083)	(1.38e+06)	(2.55e+06)	(1.21e+06)	(254037)	(424516)
Number Dem Senators	4774	15265**	5212	3267	-1608	4297
	(4761)	(7650)	(8758)	(6665)	(1606)	(3691)
Percent Congress	46399*	-12623	119137**	65057*	13512	19700
members Dem	(26218)	(28963)	(47847)	(36443)	(8513)	(18693)
Indicator for Dem	13640***	8380	28872***	19271***	2217	12809***
governor	(4881)	(6113)	(8590)	(6580)	(1757)	(3815)
Constant	585937***	317600*	1.05e+06***	369730**	261776***	619439***
	(133602)	(179197)	(337105)	(167043)	(35512)	(74692)
Observations	174828	145690	85770	111474	158390	271436
Number of Organizations	29138	29138	14306	18579	27561	59020

[a] Data are from 1998-2003 and only include those organizations that are in the panel for all six years (except column 6), whose reported categorical revenues sum up to reported total revenues, likewise for expenses, and who never report a negative amount in a revenue category. Year indicator variables are included in each regression. Heteroskedasticity consistent standard errors are in parentheses. Column definitions are the same as in Table 2.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A4

First Stage Regressions, Dependent Variable = Fundraising Expenditures[a]						
	(1)	(2)	(3)	(4)	(5)	(6)
SSI payments, total	0.00127	0.00123*	0.00100	0.00218**	0.000540	0.000940
	(0.000795)	(0.000722)	(0.00112)	(0.00107)	(0.000416)	(0.000664)
SSI payments, elderly	-0.00621*	-0.00607*	-0.00663	-0.0110**	-0.00252	-0.00470
	(0.00362)	(0.00329)	(0.00472)	(0.00461)	(0.00168)	(0.00297)
Management Expenses	0.00587***	0.00445**	0.00865**	0.00569**	0.00128	0.00700***
	(0.00207)	(0.00203)	(0.00384)	(0.00275)	(0.000886)	(0.00201)
Total Liabilities	0.000377***	0.000405***	0.000853**	0.000417**	0.000140**	0.000232***
	(0.000120)	(0.000123)	(0.000407)	(0.000212)	(6.89e-05)	(7.81e-05)
Program Service Revenue	0.00144**	0.00149*	0.000762	0.00129	0.00190***	0.00143**
	(0.000698)	(0.000784)	(0.00100)	(0.000874)	(0.000465)	(0.000588)
Other Revenues	-0.000840	-0.00295**	-0.000101	0.00234		-1.75e-05
	(0.00164)	(0.00139)	(0.00321)	(0.00178)		(0.000907)
Population	0.000279	0.000712**	0.000500	0.000334	8.15e-05	3.08e-05
	(0.000302)	(0.000340)	(0.000416)	(0.000389)	(0.000147)	(0.000127)
Income	-0.0688	-0.141*	-0.167	-0.0381	-0.0181	0.0458
	(0.0827)	(0.0739)	(0.126)	(0.106)	(0.0288)	(0.171)
Unemployment Rate	746.2***	558.4***	997.6***	1020***	360.2***	-54.08
	(199.9)	(198.4)	(290.2)	(261.1)	(86.75)	(324.2)
Percent Population > 65	-275745***	-179623**	-365227***	-334492***	-130579***	-134684***
	(70558)	(70507)	(137262)	(101258)	(35995)	(42336)
Number Dem Senators	365.5	1017	403.2	168.2	-259.3	364.1
	(467.6)	(869.8)	(590.5)	(565.4)	(217.8)	(382.4)
Percent Congress members Dem	251.8	-352.2	-597.2	-327.4	-225.1	-937.5
	(2743)	(2621)	(3421)	(3157)	(1328)	(2103)
Indicator for Dem governor	353.6	-271.2	462.9	467.0	-134.3	308.0
	(596.2)	(410.5)	(949.7)	(839.7)	(238.6)	(460.3)
Constant	47610***	38233***	63404***	55400***	23117***	27074***
	(9319)	(9352)	(17074)	(13395)	(4920)	(9036)
Observations	174828	145690	85770	111474	158390	271436
Number of ein	29138	29138	14306	18579	27561	59020

[a] Data are from 1998-2003 and only include those organizations that are in the panel for all six years (except column 6), whose reported categorical revenues sum up to reported total revenues, likewise for expenses, and who never report a negative amount in a revenue category. Year indicator variables are included in each regression. Heteroskedasticity consistent standard errors are in parentheses. Column definitions are the same as in Table 2.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table A5

First Stage Regressions, Dependent Variable = Private Donations[a]	(1)	(2)	(3)	(4)	(5)	(6)
Dues	-0.104*	-0.0963*	-0.101	-0.122	-0.0276***	0.211
	(0.0615)	(0.0564)	(0.0934)	(0.0745)	(0.0101)	(0.176)
Program Service Revenue	-0.0216***	-0.00109	-0.0184**	-0.0300**	-0.000473	0.347**
	(0.00671)	(0.00390)	(0.00898)	(0.0121)	(0.000965)	(0.169)
Other Revenues	-0.0234*	0.00394	-0.0189	-0.0109	0.00359	0.0791
	(0.0138)	(0.0163)	(0.0228)	(0.0210)	(0.00259)	(0.118)
Population	0.00506	0.00102	0.00932	0.00525	-0.000103	0.00611
	(0.00391)	(0.00392)	(0.00678)	(0.00567)	(0.000984)	(0.00479)
Income	-0.336	0.175	-1.147	-0.797	0.103	-3.943
	(0.900)	(0.855)	(1.733)	(1.264)	(0.157)	(5.477)
Unemployment Rate	169.4	3986**	630.9	391.6	310.2	-8315
	(1501)	(1699)	(2182)	(2123)	(438.7)	(6716)
Percent Population > 65	-2002259***	-2540077***	-3154811***	-2683993***	-477979***	1.98e+06
	(534664)	(663197)	(1.06e+06)	(766403)	(150673)	(4.66e+06)
Number Dem Senators	-415.4	-9551	-6184	-703.4	807.3	2269
	(3772)	(6037)	(6060)	(5557)	(1010)	(10903)
Percent Congress members Dem	18011	52334**	33689	5246	4128	-19560
	(19632)	(21413)	(31949)	(28036)	(5141)	(51476)
Indicator for Dem governor	-4704	1491	-10825*	-2480	-2739**	-10614
	(4104)	(4566)	(5705)	(5830)	(1101)	(10470)
Constant	508749***	494835***	715667***	659231***	172993***	-185785
	(78631)	(94731)	(151091)	(113007)	(20719)	(543422)
Observations	174828	145690	85770	111474	158390	391591
Number of Organizations	29138	29138	14306	18579	27561	89813

[a] Data are from 1998-2003 and only include those organizations that are in the panel for all six years (except column 6), whose reported categorical revenues sum up to reported total revenues, likewise for expenses, and who never report a negative amount in a revenue category. Year indicator variables are included in each regression. Heteroskedasticity consistent standard errors are in parentheses. Column definitions are the same as in Table 3.
*** p<0.01, ** p<0.05, * p<0.1