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THE OPTIMAL TREATMENT OF TAX EXPENDITURES

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### **ABSTRACT**

This paper analyzes the optimal treatment of tax expenditures. It develops an optimal tax model where individuals derive utility from spending on a “contribution” good such as charitable giving. The contribution good has also a public good effect on all individuals in the economy. The government imposes linear taxes on earnings and on the contribution good so as to maximize welfare. The government may also finance directly the contribution good out of tax revenue. Optimal tax and subsidy rates on earnings and the contribution good are expressed in terms of empirically estimable parameters and the redistributive tastes of the government. The optimal subsidy on the contribution good is increasing in the size of the price elasticity of contributions, the size of the crowding-out effect of public contributions on private contributions, and the size of the public good effect of the contribution good. Numerical simulations show that the optimal subsidy on contributions is fairly sensitive to the size of these parameters but that, in most cases, it should be lower than the earnings tax rate.

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# 1 Introduction

The U.S. government encourages a number of economic activities or consumption patterns through tax incentives. Individuals are allowed to deduct expenses such as charitable contributions or mortgage interest payments from their taxable income. In 1995, itemized deductions reported on excess of the standard deduction represented around 12% of taxable income and cost the federal government over \$80 billion in tax revenues (which is around 15% of total individual federal income taxes collected in that year). Charitable giving represent about 15% of itemized deductions, and mortgage interest payments about 35%. Unsurprisingly, the use of these tax expenditures has been the subject of substantial controversy and the focus of debate among tax policy analysts.

Supporters of tax expenditures point out that it is efficient to encourage certain kinds of economic behaviors instead of using direct expenditures to achieve similar objectives. They argue that tax expenditures such as charitable giving or home ownership have positive external effects and are very responsive to tax incentives. Therefore, the government should promote these types of activities by providing a tax break. A common argument<sup>1</sup> is that if the elasticity of charitable contributions with respect to its tax price is higher than one, allowing the deduction of these expenditures from taxable income generates more contributions than what is lost in tax revenue because of the subsidy. This narrow “efficiency” concept is often mentioned to argue in favor of the use of tax expenditures by empirical studies that find large elasticities (see e.g. Feldstein and Clotfelter (1976)).

Opponents emphasize that the external effect of such tax expenditures is too small to justify a complete tax exemption. Moreover, as tax expenditures are likely to be much more responsive to taxation than labor supply, they point out that allowing tax expenditures may both reduce the size of the tax base and increase significantly the elasticity of taxable income, thus increasing significantly the total deadweight burden from the income tax.<sup>2</sup> Finally, tax expenditures are often criticized on redistributive

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<sup>1</sup>This argument was first made by Vickrey (1962). See Feldstein (1980) for a detailed exposition.

<sup>2</sup>Hall and Rabushka (1985) who advocate a switch to a low rate flat tax with no tax expenditures

grounds. For example, high incomes both contribute to and benefit disproportionately from some forms of charitable contribution such as gifts to the arts or higher education.

The economic literature has devoted considerable attention to the empirical analysis of the behavioral responses to tax incentives. Many studies have analyzed the effect of tax subsidies on home ownership<sup>3</sup> and charitable giving.<sup>4</sup> The distribution effect of these tax expenditures, though less systematically investigated, has also attracted some attention.<sup>5</sup> However, in order to illuminate the policy debate on the desirability of tax expenditures, it is necessary to develop theoretical models that incorporate formally the pro and cons elements that are brought into the debate. Such models should allow to determine quantitatively how the different considerations intervene and should provide optimal tax or subsidy formulas expressed in terms of magnitudes empirically estimable. No study has provided precise policy recommendations using estimates from the empirical literature and very few studies have investigated the normative side of the tax treatment of charitable contributions or other potential tax expenditures. Three exceptions to the lack of normative analysis are Atkinson (1976), Feldstein (1980), and Roberts (1987).

Atkinson (1976) develops an altruistic model where high income individuals care about the needy. Using a simple log functional form specification for the utility function, he obtains fairly simple optimal tax credit formulas. Feldstein (1980) develops a representative individual tax model to compare the cost of increasing the level of a public good through government expenditure versus private giving. Roberts (1987) follows upon Feldstein (1980) and analyzes under what conditions it is preferable to finance a public good through tax revenue rather than subsidies to voluntary contributions. Roberts analyzes in detail the role of crowding out of private contribution by public provision. The present paper builds upon these previous contributions and proposes a general model which en-

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allowed develop these points informally.

<sup>3</sup>See e.g. Rosen (1985) for a survey.

<sup>4</sup>Clotfelter (1985) provides an extensive survey of empirical analyzes on charitable giving. Steinberg (1990) updates this survey.

<sup>5</sup>See for example Clotfelter (1992) for an extensive analysis of the redistributive effects of the nonprofit sector.

compasses most of the situations previously analyzed.

This paper considers a model with three goods: private consumption, earnings, and a “contribution” good to which individuals may choose to contribute voluntarily and which also has a positive external effect. This contribution good can be for example charitable contributions, or home ownership. The government has redistributive goals and may also finance the contribution good out of general tax revenues. The paper derives optimal tax rates on labor income and the contribution good. Optimal tax rates are equal to standard Ramsey tax rates plus a Pigovian corrective tax depending on the size of the externality.<sup>6</sup> A number of simplifying assumptions on behavioral responses to taxes are made to obtain simple optimal tax and subsidy formulas directly expressed in terms of observable magnitudes. Four important elements enter optimal tax and subsidy formulas.

First and obviously, the size of the subsidy is closely related to the size of the external effect. Everything else equal, goods with low external effects (such as for example secondary residences) should be subsidized less than goods with high external effects (such as charitable giving to social services or education). When the government has redistributive tastes, it is important to assess the redistributive benefits of each type of contribution good to estimate the social external effect. If the government can also finance directly the public good with tax revenue, then it can choose the total level of public good so as to equate the external effect to the marginal value of public funds. When the contribution good is socially overprovided by the private sector, the government cannot undo this overprovision. For a number of goods, such as religious services, the government is constrained by law not to contribute and there may be either over or under provision even when taxes are set optimally.

Second, the optimal subsidy is positively related to the price elasticity of the contribution good. Inelastic contribution goods should be heavily taxed even if they generate a large external effect. However, in contrast to the “efficiency” principle described above,

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<sup>6</sup>This theoretical model is closely related to the optimal tax model of Sandmo (1975) who considers an optimal commodity tax model where a particular good generates an externality.

the price elasticity is not the unique factor entering optimal subsidy formulas.

Third, as voluntary contributions arise out of individual utility maximization, they can be seen as equivalent to “consumption”. Therefore when redistribution is valued, contribution goods to which high incomes contribute disproportionately, such as the arts, culture or higher education, should be subsidized less than those to which contributions are less concentrated at the top income end, such as religious organizations contributions.

Fourth, when the government can freely contribute to the public good, the more private contributions are crowded out by public contributions, the higher should be the subsidy on voluntary contributions. In the extreme case with complete crowding out, voluntary contributions should be made free. The intuition is the following. When crowding out is high, it requires more than one dollar of direct public contributions to increase the total level of the contribution good by one dollar. Therefore the marginal cost of an extra dollar of contribution good is higher when crowding out is important. As a result, the subsidy should be higher in those cases.

It is interesting to note the relation between the optimal subsidy rate and the optimal tax rate on earnings. There is no theoretical reason to link the subsidy rate on the contribution good to the income tax rate as is currently done in the U.S. income tax code. In the model developed here, the optimal tax rate on earnings is fairly independent from the price elasticity of the contribution good and can be high if earnings are not very responsive to taxation and redistributive tastes are strong. However, tying the subsidy rate to the income tax rate, as is done in the U.S. income tax system, may increase substantially the elasticity of taxable income because contributions are much more price elastic than earnings. In the case where the optimal subsidy rate is far from the optimal tax rate on earnings, tying the subsidy rate to the tax rate may weaken substantially the redistributive power of the government and reduce substantially total welfare.

The present paper is organized as follows. Section 2 presents the model and derives the optimal tax and subsidy conditions of the government. Section 3 introduces additional assumptions to simplify the optimal tax formulas and discusses in detail the different

effects that come into play. Section 4 proposes a calibration exercise to assess the size of optimal subsidies using a range of empirical estimates on responses to taxation and distributional effects of tax expenditures. Finally, Section 5 offers a brief conclusion.

## 2 The Model

### 2.1 The individual Program

I consider a model with three goods, private consumption  $c$ , earnings  $z$  and a “contribution” good  $g$ . The contribution good will stand for either charitable contributions or general tax expenditures such as mortgage interest payment or health expenditures. The utility of each individual is increasing in consumption  $c$  and decreasing in earnings  $z$  (labor supply is costly). Individuals may also derive utility from personal contributions  $g$ . Therefore, individual utility functions depend directly on the individual “consumption” choices of the three goods  $(c, z, g)$ . As a potential public good, contributions may also provide indirect utility to the individuals in the economy. For example, contributions to a particular religious organization improve the service provided to members of this organization. To model the public good nature of contributions, I assume that the level of contributions *per capita*, which I denote by  $G$ , is an additional argument in the utility functions of individuals. Therefore, each individual has a utility function  $u = u(c, z, g, G)$  which is non-decreasing in  $c$ ,  $g$ , and  $G$ , and decreasing in  $z$ .

Note that contributions are modeled both as a private good, through the argument  $g$  in  $u(\cdot)$ , and as a public good, through the argument  $G$  in  $u(\cdot)$ . This warm glow model of giving, developed by Andreoni (1990), captures accurately the actual situation because it is impossible to account for actual levels of contributions without assuming that most contributors derive direct utility from giving.

The government sets a flat tax rate  $\tau$  on earnings, a tax rate  $t$  on contributions, and provides a lump-sum payment  $R$  to all individuals in the economy. The government may also finance directly an amount  $G^0$  of the contribution good per capita. Thus the

total per capita amount of the contribution good is  $G = G^0 + G^P$  where  $G^P$  denotes average individual voluntary contribution. Consumption  $c$  is the untaxed good. It is useful to adopt this normalization as we want to investigate how contributions should be taxed relative to earnings.<sup>7</sup> For example, the case  $t = -\tau$  corresponds to fully deductible charitable contributions. Individuals are indexed by  $h \in H$  where  $H$  is an index set. I normalize the total population to one and I denote by  $d\nu(h)$  the density of individuals over  $H$ . The integration sign denotes summation over all individuals in  $H$ . Individual  $h$  maximizes  $u^h(c, z, g, G)$  subject to the budget constraint,  $c + g(1 + t) \leq z(1 - \tau) + R$ . Note that utility functions may differ from individual to individual.

I assume that the number of individuals is large enough so that all individuals take  $G$  as fixed when choosing their optimal contribution level  $g$ . I denote by  $v^h(1 - \tau, 1 + t, R, G)$  the indirect utility of individual  $h$ ,  $z^h = z^h(1 - \tau, 1 + t, R, G)$  his earnings level, and  $g^h = g^h(1 - \tau, 1 + t, R, G)$  his contribution level given the tax parameters. The individual welfare effects of changes in  $t$  and  $\tau$  can be obtained using the Roy's identity conditions,  $v_{1-\tau}^h = z^h v_R^h$  and  $v_{1+t}^h = -g^h v_R^h$ , where subscripts denote, from now on, derivatives.

## 2.2 Crowding Out

I denote by  $Z = Z(1 - \tau, 1 + t, R, G) = \int z^h d\nu(h)$  and  $G^P = G^P(1 - \tau, 1 + t, R, G) = \int g^h d\nu(h)$  the average earnings and private contributions. Note that the argument  $G$  in  $Z(\cdot)$  and  $G^P(\cdot)$  is equal to  $G^0 + G^P$  and is therefore endogenous. Consequently, it is conceptually useful to introduce  $\bar{Z} = \bar{Z}(1 - \tau, 1 + t, R, G^0)$  and  $\bar{G} = \bar{G}(1 - \tau, 1 + t, R, G^0)$  which denote the average earnings and voluntary private contribution for given tax parameters and a given level of government contribution  $G^0$ . Note that  $\bar{G}_{G^0} = \partial \bar{G} / \partial G^0$  is the total crowding out resulting from a one dollar increase in public contribution. This parameter has been extensively studied in the empirical literature.<sup>8</sup> Presumably,  $\bar{G}_{G^0} \leq 0$ , and  $\bar{G}_{G^0} = -1$  when there is complete crowding out.

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<sup>7</sup>As usual in optimal tax models, the normalization choice has no real effect on the optimal outcome.

<sup>8</sup>This is discussed in detail in Section 4.

## 2.3 The Government Program

As in standard optimal income tax models, the government sets the tax rates  $\tau$  and  $t$ , the lumpsum level  $R$ , and possibly  $G^0$  so as to maximize a social welfare function,

$$W = \int \mu^h v^h(1 - \tau, 1 + t, R, \bar{G} + G^0) d\nu(h),$$

where  $\mu^h$  is the weight associated to individual  $h$ , subject to the aggregate budget constraint,

$$\tau \bar{Z} + t \bar{G} \geq R + G^0 + E, \tag{1}$$

where  $E$  denotes government consumption per capita and is taken as exogenous. The government budget constraint states that total taxes collected must finance the lumpsum amount  $R$ , government contributions  $G^0$ , and government consumption  $E$ . This model is an extension of the optimal tax model of Diamond and Mirrlees (1971). This model is formally close to the environmental externality model of Sandmo (1975) who considers a Diamond-Mirrlees model with a good producing an externality such as the contribution good  $g$  of this model.<sup>9</sup> The present model is also related to the model of Atkinson and Stern (1974) where the government finances a public good through linear commodity taxation but where individuals do not voluntarily contribute.

## 2.4 General Optimal Tax Formulas

I denote by  $\lambda$  the multiplier of the government budget constraint (1). The multiplier is equal to the marginal value of public funds. The first order conditions with respect to  $\tau$ ,  $t$ , and  $R$ , for the optimal tax structure can be written as,

$$- \int \mu^h [v_{1-\tau}^h + v_G^h \bar{G}_{1-\tau}] d\nu(h) + \lambda [\bar{Z} - \tau \bar{Z}_{1-\tau} - t \bar{G}_{1-\tau}] = 0, \tag{2}$$

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<sup>9</sup>In contrast to the present paper, in the Sandmo model, the government cannot directly affect the quantity of the good producing the externality.

$$\int \mu^h [v_{1+t}^h + v_G^h \bar{G}_{1+t}] d\nu(h) + \lambda [\bar{G} + \tau \bar{Z}_{1+t} + t \bar{G}_{1+t}] = 0, \quad (3)$$

$$\int \mu^h [v_R^h + v_G^h \bar{G}_R] d\nu(h) + \lambda [-1 + \tau \bar{Z}_R + t \bar{G}_R] = 0. \quad (4)$$

Finally, in the case where the government can choose to contribute to the public good, the first order condition for  $G^0$  is,

$$\int \mu^h [v_G^h + v_G^h \bar{G}_{G^0}] d\nu(h) + \lambda [-1 + \tau \bar{Z}_{G^0} + t \bar{G}_{G^0}] = 0. \quad (5)$$

As the government cannot possibly contribute *negative* amounts to the public good, there is an additional constraint  $G^0 \geq 0$ . This constraint binds when the left-hand-side of (5) is negative at  $G^0 = 0$ . In that case, the public good is socially over-provided by the private sector and the government cannot undo directly this overprovision.

In some cases, the government may not be able to contribute to the public good. For example, in the U.S., religious organizations cannot receive government funding and can only be financed by private contributions. In that case,  $G^0 = 0$  and the amount of contributions may be either above or below the social optimal level and the first order condition (5) does not hold in general.

I denote by  $\beta^h = \mu^h v_R^h / \lambda$  the social marginal value of consumption by individual  $h$  in terms of public funds. These social weights summarize the redistributive tastes of the government. For example, if the government values redistribution, then  $\beta^h$  is high for poor individuals and low for well-off individuals. If the government does not value redistribution at all, then the weights  $\beta^h$  are equal across individuals. I note,  $\beta(R) = \int \beta^h d\nu(h)$ , the average social value (in terms of public funds) of giving one additional dollar to all individuals (i.e., increasing the lumpsum  $R$  by one dollar). Similarly, I denote by,  $\beta(Z) = \int z^h \beta^h d\nu(h) / \bar{Z}$ , the average social weight weighted by earnings and  $\beta(G) = \int g^h \beta^h d\nu(h) / \bar{G}$ , the average social weight weighted by contribution levels. If the government has no redistributive tastes, then obviously,  $\beta(R) = \beta(Z) = \beta(G)$ . If the

government values redistribution, then  $\beta^h$  is negatively correlated to income  $z^h$  and thus  $\beta(Z) < \beta(R)$ . If private contributions  $g^h$  are even more concentrated toward the high end of the income distribution than earnings, as it is the case with charitable contributions in the U.S., then  $\beta(G) < \beta(Z)$ .<sup>10</sup>

Finally, I define by,

$$e = \int \frac{\mu^h v_G^h d\nu(h)}{\lambda} = \int \beta^h \frac{v_G^h}{v_R^h} d\nu(h), \quad (6)$$

the social marginal value of the contribution good in terms of public funds. The parameter  $e$ , which measures the external effect of a marginal increase in the level of the contribution good, is a key element to determine the optimal tax rate on contributions. Using (6), the Roy's identities and the definitions of  $\beta(R)$ ,  $\beta(Z)$ , and  $\beta(G)$ , equations (2), (3), (4), and (5) can be rewritten as,

$$[1 - \beta(Z)]\bar{Z} = \tau\bar{Z}_{1-\tau} + (t + e)\bar{G}_{1-\tau}, \quad (7)$$

$$[1 - \beta(G)]\bar{G} = -\tau\bar{Z}_{1+t} - (t + e)\bar{G}_{1+t}, \quad (8)$$

$$1 - \beta(R) = \tau\bar{Z}_R + (t + e)\bar{G}_R, \quad (9)$$

$$e = 1 - \tau\bar{Z}_{G^0} - (t + e)\bar{G}_{G^0}. \quad (10)$$

Equations (7), (8), and (9) are close to the standard optimal tax formulas of Diamond and Mirrlees (1971). There are two important points to note relative to the standard case. The first difference is the external  $e$  term. The tax rate  $t$  on the right-hand-side of equations (7), (8), (9), and (10) is replaced by  $t' = t + e$  which I call the *shadow tax rate* on contributions. Therefore, the optimal tax rates can be computed in two steps. First, as in the standard case, the tax rates  $(\tau, t')$  can be derived ignoring the external effect. Second,

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<sup>10</sup>The calibration of the  $\beta$ 's is discussed in Section 4.

the real rate  $t$  on contributions is obtained by subtracting from the shadow tax rate  $t'$  the social external effect  $e$ . The tax subsidy  $e$  due to the external effect is conceptually equivalent to the classical Pigouvian tax or subsidy.<sup>11</sup> This additivity property has been noted by Sandmo (1975). Second, when the government can set  $G^0$  freely, it sets the total level of public good such that the size of the external effect  $e$  is given by the first order condition (10). In the case where earnings are not affected by  $G$  (i.e.,  $\bar{Z}_{G^0} = 0$ ) and with no crowding out (i.e.,  $\bar{G}_{G^0} = 0$ ), equation (10) shows that the external effect  $e$  is equal to one at the optimum.

### 3 Specializing the Model

Equations (7), (8), (9), and (10) are too general to allow the derivation of quantitative tax policy recommendations. Therefore, in this section, I specialize the supply side response of the model to the case where simple optimal tax formulas can be obtained and discussed in the light of empirical estimates on behavioral responses to taxation.

#### 3.1 Simplifying Assumptions

In this subsection, I introduce three simplifying assumptions. I assume first that there are no income effects on earnings at the individual level. That is, increasing the lumpsum  $R$  has no effect on labor supply. Most empirical studies have found that income effects are small relative to substitution effects (see e.g., the surveys by Pencavel (1986) and Blundell and MaCurdy (1999)). Therefore, this assumption is justified as a first approximation to the actual situation.

**Assumption 1** *There are no income effects on earnings at the individual level,  $z_R^h = 0$  for all  $h$ .*

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<sup>11</sup>It is straightforward to extend this model to the the case with many goods. Each tax rate should be equal to the standard Diamond-Mirrlees tax rate minus the social external effect produced by that particular good.

The large empirical literature on charitable giving in the U.S. (see e.g., Clotfelter (1985) for a comprehensive survey) has focused on the effect of the tax price subsidy and the income level on the level of charitable contributions. Those studies make in general two implicit important assumptions on the structure of behavioral responses to taxation.

They first assume implicitly that earnings are not affected by the tax rate  $t$  on contributions. It is very likely that individuals decide about the level of their charitable givings once their earnings are realized and that their labor supply decisions are not much affected by their prospective charitable contributions levels and hence by the tax rate  $t$  on charitable givings. Therefore, in order to simplify the model of the previous section, it seems natural to assume the level of the contribution good  $G$  and tax rate  $t$  do not affect earnings and thus that  $\bar{Z}_{G^0} = 0$  and  $\bar{Z}_{1+t} = 0$ .

This assumption might be violated in the case of charities providing income support for the poor. Such organizations, similarly to public welfare programs, might reduce labor supply of beneficiaries. At the other end of the income distribution, better art museums funded by contributions might increase average time spent in the museums and thus reduce labor supply accordingly. Very little is known about these effects. Therefore, assuming zero effects seems to be a reasonable starting point.

**Assumption 2** *Aggregate earnings are not affected by the level of the contribution good  $G$  and by the tax rate on contributions,  $\bar{Z}_{G^0} = 0$  and  $\bar{Z}_{1+t} = 0$ .*

Second, most empirical studies assume that a change in tax rate  $\tau$  on earnings affects contributions only to the extent that it affects disposable earnings  $z^h(1-\tau)+R$ . Therefore, it is reasonable to assume that a *compensated* change in  $\tau$  has no effect on the level of contributions. In other words,  $\partial g^h / \partial(1-\tau)|_u = 0$  where the subscript  $u$  means that the derivative is taken keeping the utility level constant.

**Assumption 3** *For all individuals, the compensated supply of contributions does not depend on the tax rate on earnings,  $\partial g^h / \partial(1-\tau)|_u = 0$ .*

Using the Slutsky equation, Assumption 3 implies,

$$\frac{\partial g^h}{\partial(1-\tau)} = \frac{\partial g^h}{\partial(1-\tau)} \Big|_u + z^h \frac{\partial g^h}{\partial R} = z^h \frac{\partial g^h}{\partial R}. \quad (11)$$

Summing equation (11) over all individuals, we obtain,

$$\bar{G}_{1-\tau} = \bar{Z} \hat{G}_R, \quad (12)$$

where  $\hat{G}_R$  is the average response weighted by earnings of contributions to a uniform one dollar increase of the lumpsum  $R$ .<sup>12</sup>

Assumptions 1, 2, and 3 allow to rewrite the optimal tax equations (7) and (8) in a much simpler form. I define the elasticity of aggregate earnings with respect to (one minus) the tax rate by,  $\epsilon_Z = (1-\tau)\bar{Z}_{1-\tau}/\bar{Z}$ . Under assumption 1, there are no income effects, and thus, uncompensated and compensated elasticities are identical. Hence, there is no need to distinguish the two concepts. Note that  $\epsilon_Z$  is an average of the individual earnings elasticities  $\epsilon_z^h$  weighted by earnings levels,  $\epsilon_Z = \int \epsilon_z^h z^h d\nu(h) / \int z^h d\nu(h)$ . I introduce the parameter  $\rho = -\bar{G}_{1+t}/\bar{G}$  to measure the size of the price response of aggregate private contributions. As we expect a decrease in contributions when the price  $1+t$  increase, we assume from now on that  $\rho > 0$ . Note that  $(1+t)\rho$  is the (uncompensated) elasticity of total contributions with respect to the price  $1+t$ . I discuss below in detail why using  $\rho$  is preferable to using the elasticity concept. We can state the following proposition,

**Proposition 1** *Under Assumptions 1, 2, and 3, the optimal tax rates formulas can be expressed as,*

$$t = -e + \frac{1}{\rho}[1 - \beta(G)], \quad (13)$$

$$\frac{\tau}{1-\tau} = \frac{1}{\epsilon_Z}[1 - \beta(Z) - (t+e)\hat{G}_R], \quad (14)$$

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<sup>12</sup> $\hat{G}_R$  and  $\bar{G}_R$  are not identical in general because  $\hat{G}_R$  is weighted by earnings while  $\bar{G}_R$  is unweighted.

$$\beta(R) = 1 - (t + e)\bar{G}_R. \quad (15)$$

Finally, if the government can freely choose  $G^0$  and that  $G^0 > 0$  at the optimum,

$$e = 1 - (t + e)\bar{G}_{G^0} = \frac{1 - t\bar{G}_{G^0}}{1 + \bar{G}_{G^0}}, \quad (16)$$

and the optimal tax rate  $t$  is then given by,

$$t = -1 + \frac{1}{\rho}(1 + \bar{G}_{G^0})[1 - \beta(G)]. \quad (17)$$

Proof: The proof follows from a direct manipulation of (7), (8), (9), and (10) using the assumptions. It is perhaps useful to give a direct proof of equation (17) using a methodology closer to Roberts (1987). Suppose that the government increases the tax rate on the contribution good by  $dt$  and modifies the level of government provided public good  $G^0$  so that the total level of public good  $\bar{G} + G^0$  stays constant. Therefore  $d\bar{G} + dG^0 = 0$ .

This tax rate increase has a mechanical effect on tax revenue equal to  $\bar{G}dt$ . Increasing the tax rate has also a negative welfare effect on each individual equal to  $du^h = v_{1+t}^h dt = -g^h v_R^h dt$ . So using the definition of  $\beta(G)$ , the aggregated welfare effect, expressed in terms of tax revenue, is equal to  $-\beta(G)\bar{G}dt$ .

Increasing the tax rate by  $dt$  reduces private contributions by  $d\bar{G} = \bar{G}_{1+t}dt + \bar{G}_{G^0}dG^0$  through the price effect and the crowding out effect. Using the fact that  $dG^0 = -d\bar{G}$ , we have,  $d\bar{G} = \bar{G}_{1+t}dt/(1 + \bar{G}_{G^0})$ . The tax loss due to behavioral responses is equal to  $t d\bar{G}$  and the cost for the government of adjusting  $G^0$  is equal to  $-dG^0 = d\bar{G}$ .

At the optimum, the sum of these four effects must be zero, therefore, we have,  $\bar{G} - \beta(G)\bar{G} + (t + 1)\bar{G}_{1+t}/(1 + \bar{G}_{G^0}) = 0$  which is equivalent to equation (17).

### Interpretation

Formula (13) shows that the optimal rate  $t$  is equal to a subsidy equal to the external effect  $e$  plus a standard commodity tax component.<sup>13</sup> The standard component is decreasing in  $\beta(G)$ . A low  $\beta(G)$  means that the well-off contribute disproportionately. In that case, taxing contributions is valuable from a redistributive view point. Note that, in the model, contributions are voluntary and thus are equivalent to a consumption good for the donors. This is exactly the opposite of the common sense view that considers contributions as a sacrifice. Assuming that  $\beta(G) < 1$ , the standard component is inversely proportional to the size of the price response of contributions  $\rho = -\bar{G}_{1+t}/\bar{G}$ . This is the standard inverse elasticity rule of optimal taxation: elastic goods should be taxed less than inelastic goods. In the case where contributions are infinitely elastic, the optimal rate  $t$  is negative and the subsidy rate is exactly equal to the external effect  $e$ . However, when the price response of contributions is small, the tax rate  $t$  can be large even in the presence of substantial external effects.

When the government can contribute directly to the public good,  $e$  is given by (16). Crowding out of private contributions by public contributions implies that  $\bar{G}_{G^0} < 0$ . As equation (13) implies that  $t+e > 0$ , (16) shows that  $e > 1$ . The intuition is the following: when crowding out is high, it requires more than one dollar of direct public contributions to increase the total level of the contribution good by one dollar and therefore the marginal value of the contribution good is higher.<sup>14</sup> In that case, the expression for  $e$  can be used to rewrite the optimal tax rate  $t$  as in (17). Equation (17) shows that the optimal  $t$  is decreasing in  $\beta(G)$ , the size of the price response of contributions  $\rho$ , and in the absolute size of crowding out  $\bar{G}_{G^0}$ . The intuition for the latter result is the following. When crowding out is important, direct government funding of the public good is more expensive. As

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<sup>13</sup>Because the individual labor supply decisions  $z^h$  are independent of the level of the contribution good and the tax rate on contributions  $t$ , the optimal rate on contributions  $t$  does not depend explicitly on labor supply behavioral responses.

<sup>14</sup>This equation is a generalization of the famous Samuelson rule for the optimal level of public good. Atkinson and Stern (1974) who consider an optimal tax model with a public good exclusively provided by the government obtain a formula close to (16).

a result, it is better to rely more on private contributions, and the subsidy to private contributions should be increased accordingly. Note that in the extreme case of complete crowding out,  $\bar{G}_{G^0} = -1$ , the optimal rate should be  $t = -1$ , implying that contributions should be made free.<sup>15</sup>

As mentioned above, equations (13) and (17) are *not* expressed in terms of the elasticity  $\epsilon_G = -(1+t)\bar{G}_{1+t}/\bar{G}$ . It is possible to rewrite (17) in terms of the elasticity  $\epsilon_G$  as follows,

$$\epsilon_G = (1 + \bar{G}_{G^0})[1 - \beta(G)]. \quad (18)$$

The interpretation of (18) is the following. When the elasticity  $\epsilon_G$  is larger than the right-hand-side expression, the subsidy rate should be increased up to the point where the elasticity is driven down to the value of the right-hand-side. Formula (18) is a generalization of the “efficiency” concept: when there is no crowding-out ( $\bar{G}_{G^0} = 0$ ) and the welfare of the contributors is not taken into account ( $\beta(G) = 0$ ), equation (18) becomes  $\epsilon_G = 1$  which states precisely that subsidies to contributions should be increased when the elasticity is above unity and should be reduced when the elasticity is below unity.<sup>16</sup>

However, equation (18) does not provide an explicit expression for the optimal subsidy rate and is better used to assess whether the current tax system provides too much or too little subsidies. Previous studies by Feldstein (1980) and Roberts (1987) focused mostly on this type of issues because they used formulas of the type (18) specialized to particular cases. If the elasticity  $\epsilon_G$  is treated as an immutable parameter, then formula (18) states that the tax rate  $t$  should be either infinite or equal to minus one. In practice, we expect the elasticity  $\epsilon_G$  to be affected by large changes in  $t$ . As a result, to cast light on optimal subsidy rates, it seems much preferable to use the form (17) whose interpretation requires to assume implicitly that the parameter  $\rho$  is the immutable parameter.<sup>17</sup> The optimal tax

<sup>15</sup>This particular case has been studied in detail by Roberts (1987).

<sup>16</sup>The more general case where  $\bar{G}_{G^0} < 0$  and  $\beta(G) = 0$  has been analyzed by Roberts (1987) along these lines.

<sup>17</sup>There is no general reason to consider the elasticity parameter  $\epsilon_G$  rather than the parameter  $\rho$  as the “exogenous” parameter. Both parameters may potentially vary with the tax parameters.

simulations presented in Section 4 specify a model with constant parameter  $\rho$  calibrated using the actual elasticity and actual subsidy rate.<sup>18</sup>

The optimal tax rate  $\tau$  on earnings is given by formula (14). This formula is similar to the usual optimal linear income tax formula (see e.g., Dixit and Sandmo (1980)). Unsurprisingly,  $\tau$  is decreasing with the elasticity of earnings  $\epsilon_Z$  and with the average social weight  $\beta(Z)$ . As  $e+t$  is positive (equation (13)), the optimal rate  $\tau$  is also decreasing with the size of income effects on contributions  $\hat{G}_R$ . The intuition is the following. If the tax rate  $\tau$  increases, then not only are tax revenues reduced because of the supply side response of earnings but also because lower disposable income leads to lower contributions  $\bar{G}$  and thus further reductions in social welfare as the shadow tax rate  $t' = t + e$  on contributions is positive.

Two important lessons from the previous analysis should be finally noted. First, there is no a-priori reason to tie the subsidy  $-t$  to the tax rate  $\tau$  as this is currently done in the U.S. income tax system. Second, in the case where the government cannot directly contribute optimally to the public good, it is critical to assess the value of the external effect  $e$  in order to implement the optimal tax rates.

## 3.2 Extensions

### 3.2.1 Allowing Tax expenditures versus Broader Base Taxation

As mentioned in the introduction, a very important provision of the U.S. income tax law states that a number of expenditures can be fully deducted from taxable income. As a result, these expenditures are effectively subsidized at the income tax rate (that is, in the notation of the model  $t = -\tau$ ). This tax expenditure allowance has generated heated controversy. The main criticism is that, because tax expenditures are far more elastic

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<sup>18</sup>These simulations might be misleading if the parameter  $\rho$  is in fact very sensitive to the subsidy rate because in that case, the parameter  $\rho$  in the optimal tax formulas might be different from the the current parameter  $\rho$  estimated with the actual tax system in place.

than earnings, the elasticity of taxable income, and hence the deadweight burden of the income tax, are substantially increased by this provision. In this subsection, I derive the optimal tax rate  $\tau$  when the government is constrained to set  $t = -\tau$ .

I denote by  $y^h = z^h - g^h$  taxable income. The budget constraint of individual  $h$  is  $c^h \leq (1 - \tau)(z^h - g^h) + R$ . The program of the government is the same as in Section 2.3, except that  $t = -\tau$ . The general first order condition for  $\tau$  becomes,

$$[1 - \beta(Z)]\bar{Z} - [1 - \beta(G)]\bar{G} = \tau\bar{Z}_{1-\tau} + (-\tau + e)\bar{G}_{1-\tau} + \tau\bar{Z}_{1+t} + (-\tau + e)\bar{G}_{1+t}. \quad (19)$$

I denote by  $\bar{Y}(1 - \tau, R, G^0) = \bar{Z} - \bar{G}$  aggregate taxable income,  $\epsilon_Y = (1 - \tau)\bar{Y}_{1-\tau}/\bar{Y}$  the aggregate taxable income elasticity,<sup>19</sup> and  $\beta(Y) = \int \beta^h y^h d\nu(h) / \int y^h d\nu(h)$  the average  $\beta^h$  weighted by taxable income. Routine computations show that  $\beta(Y) = \beta(Z)(\bar{Z}/\bar{Y}) - \beta(G)(\bar{G}/\bar{Y})$  and  $\epsilon_Y = \epsilon_Z(\bar{Z}/\bar{Y}) + \rho\bar{G}(1 - \tau)/\bar{Y} - \hat{G}_R\bar{Z}(1 - \tau)/\bar{Y}$ .

**Proposition 2** *Under assumptions 1, 2, and 3, the optimal tax rate on taxable income  $\tau$  is given by,*

$$\frac{\tau}{1 - \tau} = \frac{1}{\epsilon_Y} \left[ 1 - \beta(Y) + e \left( \rho \frac{\bar{G}}{\bar{Y}} - \hat{G}_R \frac{\bar{Z}}{\bar{Y}} \right) \right]. \quad (20)$$

*If the government can freely choose  $G^0$  and that  $G^0 > 0$  at the optimum,*

$$e = \frac{1 + \tau\bar{G}_{G^0}}{1 + \bar{G}_{G^0}}. \quad (21)$$

Proof: The proof follows from a direct manipulation of (19) using the assumptions and the definitions of  $\epsilon_Y$  and  $\beta(Y)$ .

### Interpretation

There are three important differences between the optimal tax rate on taxable income given by (20) and the optimal tax rate on earnings given by (14).

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<sup>19</sup> $\epsilon_Y$  is average of the individual taxable income elasticities weighted by taxable income.

First, as  $\beta(Y) = \beta(Z)(\bar{Z}/\bar{Y}) - \beta(G)(\bar{G}/\bar{Y})$ , if we assume that contributions are disproportionately made by high income earners, then  $\beta(G) < \beta(Z)$ , and thus  $\beta(Y) > \beta(Z)$ . The intuition is the following. As contributions are more concentrated than earnings, taxable income  $y$  is more equally distributed than earnings. As a result, the correlation between  $\beta^h$  and  $y^h$  is weaker than the correlation between  $\beta^h$  and  $z^h$ .

Second, since contributions are much more responsive than earnings, we expect  $\epsilon_Y > \epsilon_Z$ . These first two differences tend to make the tax rate on taxable income given by (20) *lower* than the optimal tax rate on earnings given by (14).

Third, lowering the tax rate on taxable income has a positive effect on contributions through the income effect on disposable income (which was also present in the earnings tax case) but also increases the price of giving and thus has a direct *negative* price effect on contributions. As displayed in equation (20), the net effect depends on the relative sizes of  $\rho$  and  $\hat{G}_R$ . In particular, the higher the price response of contributions, the higher the tax rate on taxable income. This new price effect relative to the situation of Proposition 1 tends to make the tax rate on taxable income *higher* than the optimal tax rate on earnings. Note that in the case where the external effect  $e$  is zero, this effect disappears and the first two considerations suggest that the tax rate on taxable income should be lower than the tax on the broader earnings base.

It is necessary to turn to simulations to assess quantitatively the difference between these two tax rates and how changing parameters affects each of them. Some parameters inside formulas (14) and (20) are endogenous and therefore general equilibrium effects might be important and should be taken into account. Next section proposes an numerical calibration that casts light on all these effects.

When the optimal rates  $(\tau, t)$  on earnings and contributions of Proposition 1 are such that  $t$  is very different from  $-\tau$ , tying the subsidy on contribution to the income tax rate as in Proposition 2 lowers welfare.<sup>20</sup> In particular, when there are little external effects

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<sup>20</sup>Obviously, when the optimal rates of Proposition 1 are such that  $t = -\tau$ , then the optima of Proposition 1 and Proposition 2 are identical and there is no welfare loss of imposing the constraint  $t = -\tau$ .

and that, at the optimum  $t > 0$ , then imposing  $t = -\tau$  is suboptimal. Next section discusses this point in detail.

### 3.2.2 Leaky Private Contributions

In the model, we have assumed that contributions from individuals are exactly equivalent to government contributions. This is obviously a strong simplification assumption and there are many reasons why this might not be the case in practice.

First, private contributions maybe less efficient than direct government contributions because costly advertising campaigns are necessary to raise private contributions. This can be simply modeled, as in Feldstein (1980), by assuming that a dollar of private contribution translates into only  $s < 1$  dollars of public good  $G$  and that  $1 - s$  are dissipated in advertisement costs.

Second and more generally, private and public contributions are not perfect substitutes. For example, private and public schools do not provide exactly the same services and are not attended by the same public. In principle, this should be modeled directly using a multi-good setting. However, assuming as above that a dollar of private contribution translates into only  $s < 1$  dollars of government provided public good  $G$  is a parsimonious and perhaps reasonable way of modeling imperfect substitutability.

In that case, the effective total level of contribution good is  $G = s\bar{G} + G^0$  but the government budget constraint (1) is unchanged. The external effect  $e$  measures the effect of one additional dollar of government provided public good (or equivalently,  $1/s$  dollars of privately provided public good). It is easy to see that, the only difference is that, in equations (7), (8), (9), and (10), on the right-hand-side,  $t + e$  is replaced by  $t + s \cdot e$ .

Proposition 1 should be modified such that in (13), (14), and (15),  $e$  is replaced by  $s \cdot e$ . Equation (16) becomes,  $e = 1 - (t + s \cdot e)\bar{G}_{G^0} = (1 - t\bar{G}_{G^0})/(1 + s \cdot \bar{G}_{G^0})$ , and equation (17) becomes,

$$t = -s + \frac{1}{\rho}(1 + s \cdot \bar{G}_{G^0})[1 - \beta(G)]. \quad (22)$$

Similarly, in equation (19),  $-\tau + e$  should be replaced by  $-\tau + s \cdot e$ . In Proposition 2, in equation (20),  $e$  is replaced by  $s \cdot e$  and equation (21) becomes  $e = (1 + \tau\bar{G}_{G^0})/(1 + s \cdot \bar{G}_{G^0})$ . When  $s = 0$ , private contributions are of no value for the government and the contribution good should be treated as a standard Ramsey consumption good. The simulations presented in Section 4 display the quantitative effect on tax and subsidy rates of changing  $s$ .

## 4 Numerical Application

### 4.1 Empirical Estimates

#### 4.1.1 Behavioral Responses to Taxes

The empirical literature on responses of charitable giving to taxes has found in general elasticities with respect to price in excess of one (often around 1.3) and elasticities with respect to disposable income around 0.8. Clotfelter (1985) provides an extensive review of the empirical literature on charitable giving.<sup>21</sup> However, a recent study by Randolph (1995) using panel data and decomposing responses into short-term versus long-term responses has found smaller long-term price elasticities (around 0.5) and larger disposable income elasticities (around 1.3). There is therefore still substantial controversy about the size of these parameters. In general, the estimates from the literature are unweighted elasticities. We have seen that the relevant parameters are elasticities weighted by the level of contributions. There is evidence in the literature that both price and disposable income elasticities of contributions are increasing with income (see, e.g., Table 2.15 in Clotfelter (1985)). This suggests that the relevant elasticities are somewhat higher than the unweighted estimates reported in the literature.

The price response parameter  $\rho = -\bar{G}_{1+t}/\bar{G}$  that enters optimal tax formulas can be obtained from the empirical estimate of the price elasticity of contribution  $\epsilon_G$  as,

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<sup>21</sup>Steinberg (1990) updates this survey of empirical findings.

$\rho = \epsilon_G/(1+t)$ , where  $1+t$  is the average current price of contributions. I assume that  $1+t = 0.7$ , that is, that the average marginal income tax rate of contributors is 30%. In the simulations, I consider three different values for the elasticity  $\epsilon_G$ , namely 0.5, 1, and 1.5. The income effect on contributions  $\hat{G}_R$  which enters formula (13) can be deduced from the disposable income elasticity of contributions reported in empirical studies, which I denote by  $\epsilon_R$ , using the approximation formula,  $\hat{G}_R = \epsilon_R G/((1-\tau)Z+R)$ . The factor  $G/((1-\tau)Z+R)$  is the average contribution level over average disposable income which is around 0.025 for charitable giving but higher and around 0.15 for all itemized deductions bundled together. I assume in the simulations that  $\epsilon_R = 1$  or  $\epsilon_R = 0.5$ .

There is an extensive empirical literature on the behavioral responses of earnings to taxation. The labor supply literature that has mostly focused on hours of work has in general found small elasticities of hours with respect to (net-of-tax) wages (see e.g., the surveys of Pencavel (1986), and Blundell and MaCurdy (1999)). Elasticities are in general smaller than 0.25 and often very close to zero. However, as pointed out by Feldstein (1995), the response of earnings may not be limited to changes in hours of work but may also include intensity of work, occupational changes or labor force participation. As a result, the full elasticity of earnings may be substantially higher. Feldstein (1995) estimates very large elasticities, in excess of one, of Taxable Income and Adjusted Gross Income with respect to (one minus) the tax rate. A number of studies have followed upon Feldstein (1995) and have found much smaller elasticities ranging from 0 to 0.8. This literature is summarized in Gruber and Saez (2000) who find that taxable income, from which tax expenditures have been deducted, is much more responsive than gross income before deducting tax expenditures. They find a taxable income elasticity around 0.4 and a broad income elasticity around 0.15. It seems reasonable to assume that the earnings elasticity  $\epsilon_Z$  is substantially lower than the price elasticity of contributions. In the simulations, I consider two possible values for this elasticity: 0.25 and 0.5.

### 4.1.2 External Effects

As we saw in the previous sections, to derive optimal tax rates, it is crucial to assess whether the government can freely contribute directly to the public good. If this is the case, then the government sets the total level of public good optimally and the external effect is given by equation (16). In many instances, public goods are financed by both the government and private contributions. This is the case, for example, for Health Services, Education, and Social Services. However, it is often the case that private and public contributions are not perfect substitutes. As discussed in Section 2.3, this is modeled by assuming that a dollar of private contribution is worth only  $s$  dollars of government contributions. In most simulations, I assume that  $s = 0.75$  and do some sensitivity analysis with  $s = 0.5$  and  $s = 1$ .

In other instances, the government cannot contribute to the public good or there is overprovision by the private sector. An example of the former is contribution to religious organizations. It is a matter of debate to assess whether some public goods are overprovided by the private sector. In those cases, the external effect is no longer given by equation (16) and should in principle be computed directly using equation (6). To compute  $e$ , it is necessary to assess, by income level, who benefits from the contribution good.

Relatively few studies have tried to assess the redistributive effects of the nonprofit sector. A notable exception is Clotfelter (1992) which finds that the redistributive effect is in general modest but with variations by sectors. Non-profit health providers serve more low income patients than for-profit but less than public institutions suggesting that non-profit institutions are not a perfect substitute to public institutions and thus less valuable from a government perspective. Similarly non-profit education institutions serve on average more affluent families than public institutions, especially at the university level. In the U.S., religious organizations are fully privately funded. Sacramental activities constitute around 70% of congregational spending and redistribution to the needy less than 10%. Religious organizations have therefore little redistributive impact. Arts and Culture

are disproportionately consumed by the affluent but are also to a large extent funded by public money. Social and Human services are clearly the most redistributive non-profit organizations. However, the higher federal funding, the higher the agencies orientation toward the poor, suggesting again that these agencies are not perfect substitutes to public money.<sup>22</sup>

### 4.1.3 Crowding Out

It is well known (see Warr (1983)) that for a privately provided pure public good, there is a case for expecting in theory 100% crowding-out. However, the pure public good case fails to capture many important aspects of the problem.<sup>23</sup> When there is warm glow of giving, as modeled in the present paper, crowding-out is substantially reduced and might well be negligible for large populations. There is a very large empirical literature on crowding-out for many public goods. Findings are very diverse, ranging from zero crowding-out (see e.g., Reece (1979)) up to complete crowding out (see e.g., Roberts (1984)). However, most studies find modest crowding out, less than 20% in general (see e.g., Schiff (1985)). Therefore, in the simulations, the crowding out parameter takes two values: 0 and 25%.

## 4.2 Numerical Results

### 4.2.1 Calibration

Simulations are presented using the model described in Section 3. Government consumption  $E$  per capita is taken equal to \$6,000 which corresponds to the actual tax revenue raised by the federal plus state income tax. In order to simplify the computations, I do not fully specify all individual utility functions and I assume simple functional forms for

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<sup>22</sup>It is obviously impossible to assess precisely the redistributive effects of the non-profit sector. For example, many advances in medicine or in agriculture have been funded by private foundations and have had large positive impacts both in the US and in less developed countries.

<sup>23</sup>Even in an experimental set-up which reproduces as closely as possibly the pure public good case, Andreoni (1993) finds less than 70% crowding-out.

the *aggregate* supply functions. The appendix presents the technical details of the simulations. I assume that the aggregate earnings elasticity  $\epsilon_Z$  is constant. The aggregate contribution level  $\bar{G}$  is specified so that the price response  $\rho$ , the income elasticity  $\epsilon_R$ , and the crowding-out effect  $\bar{G}_{G^0}$  are approximately constant. I consider two scenarios for the level of the contribution good. The first scenario models the contribution good as charitable giving only. In that case, using current tax parameters, the level  $\bar{G}$  matches the current level of charitable giving, namely 2.0% of Adjusted Gross Income. In the second scenario the contribution good represents a broader set of itemized deductions that are allowed in the individual income tax code. In that case, the level  $\bar{G}$  matches approximately the current level of itemized deductions, namely 12.0% of Adjusted Gross Income.<sup>24</sup>

The external effect of contributions on welfare is modeled such that it depends only of the total effective level of contribution good  $s \cdot \bar{G} + G^0$  with decreasing returns. I consider again two scenarios. In the first scenario, the contribution has a strong external effect so that it is optimal for the government to supplement private contributions with public contributions ( $G^0 > 0$ ). In the second scenario, the external effect is smaller and thus the contribution good is overprovided by the private sector and thus government contributions are zero. In this case, the external effect is calibrated to be around 0.5.

I assume that the marginal welfare weights  $\beta^h$  depend on disposable income only and thus are specified as,  $\beta^h = 1/\lambda(z^h(1-\tau)+R)^\nu$ , where  $\lambda$  is the multiplier of the government budget constraint and  $\nu$  is a (constant) parameter measuring the redistributive tastes of the government.  $\nu = 0$  corresponds to no redistributive tastes and  $\nu = +\infty$  corresponds to the Rawlsian criterion.  $\nu = 1$  means that the government values twice as much a marginal increase in consumption of a taxpayer with disposable income  $I/2$  relative to a marginal increase in consumption of a taxpayer with disposable income  $I$ . In the simulations,  $\nu$  takes 3 values, 0.25, 1, and 4.

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<sup>24</sup>More precisely, 12.0% is the projected level of itemized deductions (if there were no standard deduction) and excluding state income tax deductions.

Computing  $\beta(R)$ ,  $\beta(Z)$ , and  $\beta(G)$  requires to know the individual distribution of  $z^h$  and  $g^h$ . These distributions are calibrated using individual tax return data for year 1995 so that when using the actual tax parameters, the distributions of  $z^h$  and  $g^h$  match the actual distribution of Adjusted Gross Income and Charitable Giving. Complete details are provided in appendix.

#### 4.2.2 Results

The results are presented in Tables 1, 2, and 3. In each Table, I consider, in Panel A, the basic specification where  $\epsilon_G = 1$  (price elasticity of contributions),  $\epsilon_Z = 0.25$  (earnings elasticity),  $\nu = 1$  (redistributive tastes),  $s = 0.75$  (relative value of private contributions),  $\bar{G}_{G^0} = 0$  (crowding-out parameter), and  $\epsilon_R = 1$  (income elasticity of contributions). Panel B displays simulation results for alternative values of the elasticities  $\epsilon_G$  and  $\epsilon_Z$  (keeping the other parameters as in Panel A) and Panel C considers alternative values of the other parameters. For each specification, the first five columns display simulation results when the government can set differentiated tax rates on earnings and contributions as in Proposition 1. The optimal tax rate on earnings  $\tau$ , the optimal tax rate  $t$  on the contribution good (a negative number is a subsidy), the guaranteed income level  $R$ , the level of private contributions over earnings  $\bar{G}/\bar{Z}$ , and the level of public contributions  $G^0/\bar{Z}$  are reported. The last five columns display simulation results in the case where the government sets a unique tax rate on earnings minus contributions as in Proposition 2. The optimal rate  $\tau$ , the guaranteed income level  $R$ , the level of private contributions  $\bar{G}/\bar{Z}$ , the level of public contributions  $G^0/\bar{Z}$ , and the elasticity of taxable income  $\epsilon_Y$  are reported.

Table 1 considers the scenario where the contribution good level matches the level of charitable contributions (around 2.0% of AGI using actual tax parameters) and where the external effect is high enough so that government contributions are positive at the optimum. As private contributions are a small share of earnings, the earnings tax rate (column (1)), the taxable income tax rate (column (6)), and the guaranteed income levels

(columns (3) and (7)) are hardly affected by contribution parameters.<sup>25</sup> The optimal rate  $\tau$  is 60% and  $R$  around \$10,000 when  $\epsilon_Z = 0.25$  and  $\nu = 1$ . Unsurprisingly, increasing  $\epsilon_Z$  to 0.5, decreases  $\tau$  to 48% and  $R$  to \$5,300. Changing the redistributive taste parameter  $\nu$  has also the expected effects on  $\tau$  and  $R$ .

The optimal subsidy rate  $t$  (column (2)) is very sensitive to most parameters. In the basic specification,  $t = -40\%$ ,<sup>26</sup> showing that contributions should be extensively subsidized. In Panel B, we see that if  $\epsilon_G = 1.5$ , the subsidy should be increases to 52% but if  $\epsilon_G = 0.5$ , the subsidy is reduced to a negligible 5%. Note also the increasing  $\epsilon_Z$  also reduces the optimal subsidy rate through general equilibrium effects. In Panel C, we see that the subsidy rate is negatively related to the redistributive tastes of the government because contributions are more concentrated than earnings. The subsidy rate is very strongly positively related to the relative value of private contributions  $s$ . It increases to 65% with  $s = 1$  and drops to 15% with  $s = 0.5$ . A crowding out rate of 25% increases to optimal subsidy to 54%. The income elasticity of contributions has a negligible impact on  $t$ . In all cases, the government contributes directly to the public good (see columns (5) and (9)). Note that government contributions are adjusted to the level of private contributions so that the total level of effective public good is optimal. This shows that the spending policy of the government is closely linked to its tax policy and subsidy policy.

Table 2 repeats the same set of simulations but assumes that the contribution good is overprovided by the private sector. Government contributions are zero and columns (5) and (9) display the (sub-optimal) external effect instead of government contributions as in Table 1. Relative to Table 1, the optimal tax rate  $t$  on contribution is substantially higher and becomes positive in a number of cases. For example, in the basic specification,  $t = -5\%$  instead of  $-40\%$  in Table 1. Note that in the case where the subsidy rate is tied to the tax rate, the contribution level is much higher due to stronger incentives and the external effect becomes correspondingly smaller. However, the optimal tax rate and guaranteed income levels are almost identical to the case where  $t$  may differ from

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<sup>25</sup>Note in column (10) that the taxable income elasticity  $\epsilon_Y$  is almost identical to  $\epsilon_Z$ .

<sup>26</sup>As  $\tau = 60\%$ , this is equivalent to a deduction of two thirds of contributions from earnings.

$-\tau$  because the level of contributions relative to earnings is just too small to affect the general income tax rate.

Table 3 repeats the situation of Table 2 but with a much higher equilibrium level of contribution calibrated to the total level of itemized deductions (excluding state income taxes paid) instead of charitable giving only. I assume, as in Table 2, that the contribution good is overprovided by the private sector so that  $G^0 = 0$  and  $e$  is suboptimal. The tax and subsidy rates, and the guaranteed income levels are strikingly similar to those displayed in Table 2. In particular, even though the elasticity of taxable income  $\epsilon_Y$  (column (10)) is sometimes substantially different from the earnings elasticity, the tax rate on taxable income (column (6)) is almost identical to the optimal tax rate on earnings (column (1)). These simulations therefore suggest, somewhat strikingly, that even if itemized deductions are a large share of gross income and are substantially more elastic than gross income, the optimal tax rate on taxable income should be very close to the optimal rate on gross income. Note however that the level of private contributions is much higher (around 15-20% of earnings) in the full deduction case than in the differentiated tax case because contributions are much more subsidized in the former case and respond to price incentives. It is interesting to note, however, that the guaranteed income level in the differentiated tax rates case is noticeably higher than in the single tax rate because for a given income tax rate, the former raises much more revenue than the latter because the earnings base is substantially higher than the taxable income base.

## 5 Conclusion

This paper has analyzed the optimal tax treatment of tax expenditures. Optimal tax and subsidy rates formulas have been derived in terms of empirically estimable parameters and numerical simulations have been presented using a range of realistic parameters. There are a number of important lessons to take away from this exercise.

First, a fairly simple formula for the optimal subsidy rate which generalizes previous

findings has been obtained. This optimal subsidy rate is expressed in terms of the price response of contributions, the size of crowding out of private contributions by public contributions, and the redistributive tastes of the government. Second, it is critical to note that this formula is correct only in the case where the contribution good is underprovided by the private sector and when the government can complement private contributions with direct funding. If these conditions are not satisfied, the optimal subsidy rate depends directly on size of the external effect of marginal private contributions, which can be measured by assessing who benefits from contributions. Third, numerical simulations show that the optimal tax rate on earnings is fairly independent from the contributions supply side parameters even when contributions are a large share of earnings. Fourth, tying the subsidy rate to the income tax rate as this is the case in the U.S., generates in most simulations more generous subsidies than optimal. However, simulations show that the tax rate on income is almost always identical in the full deduction case and in the case where the tax rate on earnings and the subsidy rate on contributions can be differentiated. This suggests that, even though the elasticity of income net of contributions is higher than the elasticity of broad income, it is not necessarily the case that the former should be taxed less than the latter.

There is still substantial uncertainty on many of the parameters entering tax formulas. Though the supply side parameters have been extensively studied in the empirical literature, the size of these central parameters is still controversial. It is also critical to assess the value of private contributions relative to direct government contributions (through the parameter  $s$ ). This parameter is impossible to measure explicitly and depends critically on the views of the government. Finally, the clean theoretical distinction between cases where the government can and cannot contribute directly to the public good, and which is so important to assess optimal contribution rates, is blurred in practice because government and private contributions are rarely perfect substitutes. Investigating these issues in more depth is necessary to cast further light on the controversial policy issue of tax expenditures.

## Appendix

This appendix describes the details of the numerical simulations.

### • Aggregate Functions

I assume that the earnings elasticity  $\epsilon_Z$  is constant and thus aggregate earnings are specified as,

$$\bar{Z} = \bar{Z}_0 \left( \frac{1 - \tau}{1 - \tau_0} \right)^{\epsilon_Z}, \quad (23)$$

where  $\bar{Z}_0$  is baseline aggregate earnings and  $\tau_0$  is the current average marginal income tax rate taken as equal to 30%.

Aggregate contributions  $\bar{G}$  are specified as follows,

$$\bar{G} = \bar{G}_0 \frac{e^{-\rho(1+t)}}{e^{-\rho(1+t_0)}} \left[ \frac{\bar{Z}(1 - \tau) + R}{\bar{Z}_0(1 - \tau_0) + R_0} \right]^{\epsilon_R} - \alpha G^0, \quad (24)$$

where  $\bar{G}_0$  is baseline aggregate private contributions,  $\rho = -\bar{G}_{1+t}/\bar{G}$  is the (constant parameter) measuring the price response of contributions,  $\epsilon_R$  is the (constant) income elasticity of contributions, and  $\alpha$  is the (constant) crowding-out parameter  $-\bar{G}_{G^0}$ . Note that because of the crowding out term,  $\rho$  and  $\epsilon_R$  are not exactly equal to  $-\bar{G}_{1+t}/\bar{G}$  and the income elasticity. However, as  $\alpha$  is small in the simulations, this approximation is acceptable.<sup>27</sup> The baseline level  $\bar{G}_0$  is calibrated from tax return data. There are two scenarios. In the first,  $\bar{G}_0$  is calibrated on charitable contributions and in the second,  $\bar{G}_0$  is calibrated on total itemized deductions (less state income tax deductions).

Finally, the external effect of contributions on individual utilities is taken as homogeneous and such that,

$$\frac{v_G^h}{v_R^h} = B \cdot (s \cdot \bar{G} + G^0)^{-l}, \quad (25)$$

where  $B$  and  $l$  are constant parameters. Therefore, using equation (6), the external effect is given by  $e = B \cdot (s \cdot \bar{G} + G^0)^{-l} \beta(R)$ . In the simulations,  $l = 0.5$  and  $B$  takes two values:

<sup>27</sup>This approximation is exact in most simulations where  $\alpha = 0$ .

a high value so that, at the optimum, the government contributes a positive amount  $G^0$  and a low value where the public good is overprovided by the private sector and the government contributes zero.

### • Individual Functions

I assume that individual earnings are equal to,

$$z^h = z_0^h \left( \frac{1 - \tau}{1 - \tau_0} \right)^{\epsilon z}$$

where  $z_0^h$  is the baseline earnings level for individual  $h$ , and  $\tau^0$  is the average marginal tax rate. Therefore, it is assumed that the elasticity is constant and equal across individuals. As only linear taxation is considered, this assumption is innocuous. The distribution  $z_0^h$  is computed using the actual distribution of Adjusted Gross Income (AGI) from tax returns data for year 1995 assuming that everybody faces a constant marginal tax rate equal to  $\tau^0 = 0.3$ . The distribution of incomes is summarized by 30 representative individuals whose income range from \$0 to \$200,000. As only linear taxation is considered, the simulations are hardly sensitive to the number of representative individuals.

The marginal welfare weights  $\beta^h$  depend on disposable income only and thus are specified as,  $\beta^h = 1/(z^h(1 - \tau) + R)^\nu$ , where  $\nu$  is a (constant) parameter measuring the redistributive tastes of the government. Finally, the distribution of contributions is calibrated so that, with a flat tax of 30%, it is distributed as the current distribution of charitable contributions in the first scenario and as the current distribution of itemized deductions in the second scenario. Note again that the price and income elasticities of individual contributions are considered as constant and equal across individuals. It would have been strictly equivalent to assume that the probability of contributing varies by income level.

### • Computations

The exogenous government consumption level  $E$  is taken equal to \$6,000 so that the simulated tax schedule raises as much revenue (net of government direct contributions

and subsidies) than the actual federal plus state income tax system.

In the case of different rates on earnings and contributions, the non-linear system of equations (1), (13), (14), (15), and (16) is solved in the unknowns  $\tau$ ,  $t$ ,  $R$ ,  $G^0$ , and  $\lambda$ . If  $G^0 < 0$  then  $G^0$  is set equal to zero and the system is solved discarding equation (16).

When  $t = -\tau$ , the system of equations (1), (15), (20), and (21) is solved in the unknowns  $\tau$ ,  $R$ ,  $G^0$ , and  $\lambda$ . Again, if  $G^0 < 0$  then  $G^0$  is set equal to zero and the system is solved discarding equation (21).

The values at the optimum of  $\tau$ ,  $t$ ,  $R$ ,  $\bar{G}/\bar{Z}$ ,  $G^0/\bar{Z}$ , ( $e$  when  $G^0 = 0$ ), and  $\epsilon_Y$  are reported in Tables 1,2, and 3.

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Table 1: Numerical Simulations with large external effects and positive government contributions

	Differential Earnings and Contribution Tax Rate					Unique Taxable Income Tax Rate				
	Earnings	Contribution	Guaranteed	Private	Public	Taxable Inc.	Guaranteed	Private	Public	Taxable Inc.
	Tax Rate	Tax Rate	Income	Contributions	Contributions	Tax Rate	Income	Contributions	Contributions	Elasticity
	$\tau$	$t$	$R$	$G/Z$	$G^0/Z$	$\tau$	$R$	$G/Z$	$G^0/Z$	$\varepsilon_Y$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
<b>PANEL A: Basic Specification <math>e_Z = 0.25</math>, <math>e_G = 1</math>, <math>n = 1</math>, <math>s = 0.75</math>, <math>e_R = 1</math>, and <math>G_{G0} = 0</math></b>										
	60	-40	\$10,000	2.0%	3.3%	60	\$10,000	2.7%	2.6%	0.26
<b>PANEL B: Varying earnings elasticity <math>e_Z</math> and contributions price elasticity <math>e_G</math></b>										
$\varepsilon_Z = 0.25, \varepsilon_G = 1.5$	60	-52	\$10,100	2.9%	2.6%	59	\$10,000	3.4%	2.0%	0.27
$\varepsilon_Z = 0.25, \varepsilon_G = 0.5$	60	-5	\$10,100	1.5%	3.9%	60	\$10,100	2.2%	3.1%	0.25
$\varepsilon_Z = 0.5, \varepsilon_G = 1$	48	-31	\$5300	1.8%	4.1%	48	\$5300	2.3%	3.6%	0.51
$\varepsilon_Z = 0.5, \varepsilon_G = 1.5$	48	-45	\$5300	2.5%	3.4%	47	\$5300	2.6%	3.3%	0.52
$\varepsilon_Z = 0.5, \varepsilon_G = 0.5$	48	14	\$5300	1.3%	4.5%	48	\$5400	2.0%	3.7%	0.50
<b>PANEL C: Varying redistributive tastes <math>n</math>, value of private contributions <math>s</math>, income elasticity of contributions <math>e_R</math>, and crowding out <math>G_{G0}</math></b>										
$v = 4$	71	-23	\$11,600	1.6%	4.2%	71	\$11,600	3.2%	2.5%	0.26
$v = 0.25$	41	-56	\$5,900	2.6%	2.4%	41	\$5,900	2.1%	2.9%	0.26
$s = 1$	60	-65	\$10,000	3.0%	2.4%	60	\$10,000	2.7%	2.6%	0.26
$s = 0.5$	60	-15	\$10,000	1.5%	4.0%	60	\$10,000	2.7%	2.6%	0.26
$\varepsilon_R = 0.5$	60	-39	\$10,200	3.0%	2.5%	59	\$10,000	4.0%	1.5%	0.27
$G_{G0} = -0.25$	60	-54	\$10,400	4.1%	0.6%	60	\$10,300	4.5%	0.4%	0.26

Notes: Simulations are calibrated on current level and distribution of charitable contributions. Government consumption is  $E = \$6,000$ .

Table 2: Numerical Simulations with low external effects

Differential Earnings and Contribution Tax Rate					Unique Taxable Income Tax Rate					
Earnings Tax Rate	Contribution Tax Rate	Guaranteed Income	Private Contributions	External Effect	Taxable Inc. Tax Rate	Guaranteed Income	Private Contributions	External Effect	Taxable Inc. Elasticity	
$\tau$	$t$	R	G/Z	e	$\tau$	R	G/Z	e	$\varepsilon_Y$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
<b>PANEL A: Basic Specification: <math>e_Z = 0.25</math>, <math>e_G = 1</math>, <math>n = 1</math>, <math>s = 0.75</math>, <math>e_R = 1</math>, and <math>G_{G0} = 0</math></b>										
	59	-5	\$11,100	1.3%	0.51	59	\$10,700	2.8%	0.34	0.26
<b>PANEL B: Varying earnings elasticity <math>e_Z</math> and contributions price elasticity <math>e_G</math></b>										
$e_Z = 0.25, e_G = 1.5$	59	-15	\$11,100	1.4%	0.50	60	\$10,600	3.5%	0.31	0.27
$e_Z = 0.25, e_G = 0.5$	59	28	\$11,200	1.3%	0.52	60	\$10,800	2.3%	0.38	0.25
$e_Z = 0.5, e_G = 1$	47	1	\$6,400	1.2%	0.55	47	\$6,100	2.4%	0.39	0.51
$e_Z = 0.5, e_G = 1.5$	47	-12	\$6,300	1.3%	0.53	47	\$6,000	2.7%	0.37	0.52
$e_Z = 0.5, e_G = 0.5$	47	43	\$6,500	1.2%	0.56	47	\$6,200	2.2%	0.41	0.50
<b>PANEL C: Varying redistributive tastes <math>n</math>, value of private contributions <math>s</math>, income elasticity of contributions <math>e_R</math>, and crowding out <math>G_{G0}</math></b>										
$v = 4$	71	8	\$12,900	1.1%	0.57	71	\$12,200	3.3%	0.33	0.26
$v = 0.25$	41	-16	\$6,800	1.5%	0.45	41	\$6,700	2.1%	0.38	0.26
$s = 1$	59	-14	\$11,100	1.5%	0.47	59	\$10,700	2.8%	0.34	0.26
$s = 0.5$	59	6	\$11,200	1.2%	0.55	59	\$10,700	2.8%	0.34	0.26
$e_R = 0.5$	59	1	\$11,200	1.7%	0.45	60	\$10,500	4.0%	0.29	0.27
$G_{G0} = -0.25$	59	-6	\$11,100	2.2%	0.39	60	\$10,400	4.6%	0.27	0.26

Notes: Simulations are calibrated on current level and distribution of charitable contributions. Government consumption is  $E = \$6,000$ .

Table 3: Numerical Simulations with low external effects and high contribution levels

	Differential Earnings and Contribution Tax Rate					Unique Taxable Income Tax Rate				
	Earnings Tax Rate	Contribution Tax Rate	Guaranteed Income	Private Contributions	External Effect	Taxable Inc. Tax Rate	Guaranteed Income	Private Contributions	External Effect	Taxable Inc. Elasticity
	$\tau$	$t$	R	G/Z	e	$\tau$	R	G/Z	e	$\varepsilon_Y$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<b>PANEL A: Basic Specification <math>e_Z = 0.25</math>, <math>e_G = 1</math>, <math>n = 1</math>, <math>s = 0.75</math>, <math>e_R = 1</math>, and <math>G_{G0} = 0</math></b>										
	59	-6	\$10,900	9.4%	0.55	59	\$8,100	17.0%	0.37	0.28
<b>PANEL B: Varying earnings elasticity <math>e_Z</math> and contributions price elasticity <math>e_G</math></b>										
$\varepsilon_Z = 0.25, \varepsilon_G = 1.5$	59	-17	\$10,600	9.9%	0.54	60	\$7,600	20.9%	0.35	0.36
$\varepsilon_Z = 0.25, \varepsilon_G = 0.5$	57	33	\$11,600	8.9%	0.54	60	\$8,800	14.6%	0.37	0.23
$\varepsilon_Z = 0.5, \varepsilon_G = 1$	46	1	\$6,200	8.7%	0.58	47	\$4,400	15.2%	0.41	0.54
$\varepsilon_Z = 0.5, \varepsilon_G = 1.5$	46	-13	\$6,000	9.3%	0.57	46	\$4,200	16.7%	0.40	0.62
$\varepsilon_Z = 0.5, \varepsilon_G = 0.5$	44	49	\$7,000	8.2%	0.56	49	\$4,900	13.8%	0.37	0.48
<b>PANEL C: Varying redistributive tastes <math>n</math>, value of private contributions <math>s</math>, income elasticity of contributions <math>e_R</math>, and crowding out <math>G_{G0}</math></b>										
$v = 4$	70	6	\$12,900	8.1%	0.61	69	\$9,000	19.2%	0.34	0.29
$v = 0.25$	40	-18	\$6,300	10.6%	0.50	41	\$5,200	14.0%	0.43	0.28
$s = 1$	59	-15	\$10,600	10.6%	0.51	59	\$8,100	17.4%	0.37	0.28
$s = 0.5$	59	5	\$11,100	8.1%	0.59	59	\$8,100	17.3%	0.37	0.28
$\varepsilon_R = 0.5$	59	0	\$11,000	12.3%	0.49	60	\$6,800	25.5%	0.32	0.41
$G_{G0} = -0.25$	58	-5	\$10,800	15.3%	0.42	59	\$6,600	26.1%	0.28	0.28

Notes: Simulations are calibrated on current level and distribution of itemized deductions less state income tax deduction. Government consumption is  $E = \$6,000$ .