THE UNIVERSITY *of York*

Discussion Papers in Economics

No. 2009/23

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First draft: 21 October 2009

Abstract

This paper examines a model of charitable contributions in which there exist both warm-glow and public good motives for giving, but where the warm-glow motive is competitive in the sense that individuals evaluate their own contribution relative to that of their peers. In this setting, it is shown that tax-financed charitable contributions by the government completely crowd out private contributions as the competitive element of the warm-glow motive intensifies. This implies that the warm-glow assumption may not be the best way of explaining the empirical evidence on incomplete crowding out. It is also shown that the tax-deductibility of charitable contributions acts to strengthen the crowding-out effect, and that it can be optimal to tax charitable contributions.

Keywords: Charitable contributions; warm-glow; crowding out; public goods.

JEL Classifications: H23, H41.

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1 Introduction

The literature on charitable contributions, or more generally private contributions to a public good, has identified two key motives for giving. The first is an altruistic or public good motive, which is based on the idea that individuals care about the level of the public good. Individuals therefore give to charity in order to increase the total level of contributions. However, since individuals care only about the level of contributions, and not the source of the contributions, free-riding may become problematic. Indeed, an important result in the literature is that tax-financed contributions by the government completely crowd out private contributions (see, e.g., Sugden [1982], Warr [1982], Roberts [1984], Bergstrom, et al. [1986], and Andreoni [1988]). The second key motive put forward for giving is known as the warm-glow motive. The idea here is that individuals obtain utility or a "warm-glow" from the act of giving itself. In this case, individuals do care about the source of the contribution—they prefer, *ceteris paribus*, that they make the contribution. As a result, Andreoni [1989, 1990] shows that crowding out is incomplete when there exist both warm-glow and public good motives for giving.

In this paper, we amend the warm-glow motive to include a competitive element. That is, we assume that individuals evaluate the utility from their own charitable contribution *relative to* the average contribution of their peers. The idea is that individuals like to be seen as being relatively generous, and they seek to signal their generosity by giving more than others. Apart from being intuitively appealing, the notion of a competitive warm-glow motive for giving is similar to the (widespread) use of "keeping up with the Joneses" preferences in macroeconomics. There is also empirical evidence that suggests individual contributions are positively influenced by the contributions of others; see for example Glazer and Konrad [1996], Harbaugh [1998b], Andreoni and Petrie [2004], and Rege and Telle [2004]. This is one of the reasons why charitable organisations often publicise the names of their major donors and the size of the contribution.

The main results of our analysis can be summarised as follows. First, we show that crowding out is incomplete when there are both competitive warm-glow and public good motives for giving, but crowding out becomes complete as the competitive part of the warm-glow motive intensifies. Second, since charitable contributions are tax deductible in many countries, taxable income in our model is endogenous and charitable contributions are deductible against this income. We then show that the tax-deductibility of charitable contributions acts to strengthen the crowding-out effect. Third, since the competitive warm-glow motive for giving implies that individual giving imposes a negative externality on others, the usual argument in favour of allowing charitable contributions to be tax deductible (which is based on its public good characteristics) is weakened. We therefore derive the optimal tax/subsidy on charitable contributions, and show that it can be optimal to tax charitable contributions.

The papers most closely related to ours are those by Glazer and Konrad [1996], Harbaugh [1998a], Romano and Yildirim [2001], Duncan [2004], and Blumkin and Sadka [2007]. The papers by Glazer and Konrad [1996], Harbaugh [1998a], and Blumkin and Sadka [2007] consider a prestige motive for giving, which is similar to the competitive warm-glow motive that we develop. However, their focus is on the use of charitable contributions to signal status and/or the implications for the crowding-out hypothesis are not explored.[1] Romano and Yildirim [2001] also allow for a prestige-like motive for giving, but their focus is on the strategic behaviour of donors and charitable organisations. Duncan [2004] develops an "impact" theory of philanthropy, in which individuals care about the effectiveness of their donations.[2] In his model, individual giving imposes a negative externality on others since under an assumption of diminishing returns, individual giving reduces the marginal effectiveness of additional contributions. Interestingly, Duncan [2004] shows, amongst other things, that tax-financed charitable contributions by the government can crowd *in* private contributions.

The remainder of the paper is organised as follows. Section 2 describes the model,

[1]In Glazer and Konrad [1996] charitable contributions are made to signal wealth, and they find that crowding out is incomplete. Harbaugh [1998a] and Blumkin and Sadka [2007] do not consider the crowding-out hypothesis. Harbaugh [1998a] focuses on the behaviour of charitable organisations rather than donors, while Blumkin and Sadka [2007] show that the optimal tax on charitable contributions is non-negative when it is chosen as part of an optimal redistributive tax system. Saez [2004] and Diamond [2006] also examine the taxation/subsidisation of charitable contributions as part of optimal redistributive tax systems.

[2]A similar idea to impact philanthropy has recently been developed by Atkinson [2009] to explain the prevalence of giving for overseas development.

Section 3 examines the crowding-out hypothesis, and Section 4 derives the optimal tax/subsidy applicable to charitable contributions. Section 5 concludes, while some mathematical details are relegated to an appendix.

2 Analytical Framework

Consider an economy populated by $n \geq 2$ identical individuals. Each individual i chooses her own consumption c_i, her contribution to charity g_i, and her labour supply l_i to maximise the utility function:

$$u(c_i) + v(\lambda(g_i - \alpha\overline{g}_{-i}) + (1-\lambda)G) - z(l_i) \tag{2.1}$$

subject to the budget constraint:

$$c_i + g_i \leq wl_i - t(wl_i - \theta g_i) - \tau_i \tag{2.2}$$

where the functions $u(\cdot)$ and $v(\cdot)$ are increasing and strictly concave, while $z(\cdot)$ is increasing and strictly convex. Total contributions to charity are denoted by G. The average contribution to charity by all individuals other than individual i is denoted by $\overline{g}_{-i}$, with $\alpha \in (0,1)$ measuring the extent to which individuals evaluate their own contribution relative to the average contribution of their peers. The parameter $\lambda \in (0,1)$ therefore represents the weight individuals place on the "competitive" warm-glow motive for giving, while $(1-\lambda)$ is the weight placed on the public good motive. It can be seen that individual charitable contributions impose a negative externality on others through the competitive warm-glow motive for giving, but they also generate a positive externality by increasing total contributions. It can also be seen that as $\lambda \to 0$, there is only the public good motive for giving, as in Bergstrom, et al. [1986] among others. And as $\alpha \to 0$, there is both the standard warm-glow motive and the public good motive, as introduced by Andreoni [1989, 1990].

The wage rate is denoted by w, the exogenously determined income tax rate is denoted by $t \in (0,1)$, and θ represents the tax/subsidy applied to charitable contributions.

For example, a value of $\theta = 1$ would indicate that contributions are 100% deductible against taxable income, as is currently the policy in many countries. Alternatively, a negative value of θ would indicate that charitable contributions are taxed. Finally, $\tau_i \geq 0$ is a lump-sum tax imposed on individual i, with the proceeds going to charity. Therefore, total charitable contributions G can be written as $G = g_i + G_{-i} + \sum \tau_i$, where G_{-i} denotes total contributions by all individuals other than individual i.

Assuming that the budget constraint (2.2) binds at an optimum, it can be solved for c_i and substituted into the utility function (2.1). It is also assumed (i.e., we make the Nash conjecture) that each individual takes the charitable contributions of everyone else as given when solving programme (2.1) – (2.2). The first-order conditions on g_i and l_i for an interior maximum can then be written as:

$$u'(wl_i - t(wl_i - \theta g_i) - \tau_i - g_i)(\theta t - 1) + v'(\lambda(g_i - \alpha \overline{g}_{-i}) + (1 - \lambda)G) = 0 \tag{2.3}$$

$$u'(wl_i - t(wl_i - \theta g_i) - \tau_i - g_i)(1 - t)w - z'(l_i) = 0 \tag{2.4}$$

Given that all individuals are identical, equations (2.3) and (2.4) can be rewritten as:

$$u'(wl - t(wl - \theta g) - \tau - g)(\theta t - 1) + v'(\lambda(1 - \alpha)g + (1 - \lambda)n(g + \tau)) = 0 \tag{2.5}$$

$$u'(wl - t(wl - \theta g) - \tau - g)(1 - t)w - z'(l) = 0 \tag{2.6}$$

where, since all individuals are identical, the i subscript is no longer required.

3 Crowding Out

One of the key issues addressed in the literature is the extent to which tax-financed charitable contributions by the government crowd out private contributions. The purpose of this section is to examine how crowding out is affected by the introduction of the competitive warm-glow motive for giving, as well as the tax-deductibility of charitable contributions.

Suppose $\langle g, l, w, t, \theta, \tau, \lambda, \alpha, n \rangle$ is a solution to equations (2.5) and (2.6). Then by the Implicit Function Theorem there exist functions $g = g(w, t, \theta, \tau, \lambda, \alpha, n)$ and $l = l(w, t, \theta, \tau, \lambda, \alpha, n)$ that solve equations (2.5) and (2.6). Moreover, it is shown in the Appendix that:

$$\frac{\partial g(\cdot)}{\partial \tau} = \frac{-u''(c)(\theta t - 1)z''(l) - v''(\cdot)(1-\lambda)n\left[u''(c)(1-t)^2 w^2 - z''(l)\right]}{-u''(c)(\theta t - 1)^2 z''(l) + v''(\cdot)\left[\lambda(1-\alpha) + (1-\lambda)n\right]\left[u''(c)(1-t)^2 w^2 - z''(l)\right]} \tag{3.1}$$

where $u''(c) = u''(wl - t(wl - \theta g) - \tau - g)$ and $v''(\cdot) = v''(\lambda(1-\alpha)g + (1-\lambda)n(g+\tau))$.

Consider first the case when charitable contributions are not tax deductible (i.e., suppose $\theta = 0$). Then using equation (3.1) we obtain:

Remark 1 *If $\theta = 0$, then $\lim\limits_{\lambda \to 0} \frac{\partial g(\cdot)}{\partial \tau} = -1$; that is, crowding out is complete.*

Remark 2 *If $\theta = 0$, then $\lim\limits_{\alpha \to 0} \frac{\partial g(\cdot)}{\partial \tau} \in (-1, 0)$; that is, crowding out is incomplete.*

Remarks 1 and 2 are not new results. Remark 1 is the well-known result that crowding out is dollar-for-dollar when there is only the public good motive for giving.[3] Remark 2 is the main result of Andreoni [1989, 1990] that crowding out is incomplete when there are both warm-glow and public good motives for giving. Our first result relates to the implications of the competitive warm-glow motive for giving:

Proposition 1 *If $\theta = 0$, then $\lim\limits_{\alpha \to 1} \frac{\partial g(\cdot)}{\partial \tau} = -1$; that is, crowding out becomes complete as the competitive element of the warm-glow motive for giving intensifies.*

The intuition behind Proposition 1 is as follows. An increase in lump-sum taxation that is used to finance the government's contribution to charity causes each individual to reduce their own contribution, since a characteristic of the public good motive for giving is that individuals are indifferent as to the source of the contribution (they care only about the level of contributions). Furthermore, each individual's lower contribution attenuates the negative externality that individual giving imposes on others through the competitive warm-glow motive, which allows individuals to further reduce their charitable contribution. In the limiting case in which the warm-glow motive is purely competitive (i.e., as $\alpha \to 1$), crowding out becomes complete.

Now consider the case when charitable contributions are tax deductible, i.e., suppose

[3]See in particular Bergstrom et al. [1986], and Andreoni [2006] for a discussion of the literature and some related "neutrality" results.

$\theta \in (0, \frac{1}{t})$.[4] Then using equation (3.1) we obtain:

Proposition 2 *If* $\theta \in (0, \frac{1}{t})$, *then* $\lim_{\lambda \to 0} \frac{\partial g(\cdot)}{\partial \tau} < -1$; *that is, crowding out becomes greater than dollar-for-dollar as the weight on the public good motive for giving increases.*

Proposition 3 *If* $\theta \in (0, \frac{1}{t})$, *then* $\lim_{\alpha \to 0} \frac{\partial g(\cdot)}{\partial \tau} < 0$; *that is, crowding out can be greater than, equal to, or less than dollar-for-dollar as the competitive element of the warm-glow motive for giving disappears.*

Proposition 4 *If* $\theta \in (0, \frac{1}{t})$, *then* $\lim_{\alpha \to 1} \frac{\partial g(\cdot)}{\partial \tau} < -1$; *that is, crowding out becomes greater than dollar-for-dollar as the competitive element of the warm-glow motive for giving intensifies.*

Propositions 2, 3, and 4 can be read in comparison with Remarks 1, 2, and Proposition 1, respectively. The comparison reveals that the tax deductibility of charitable contributions acts to strengthen the tendency for tax-financed charitable contributions by the government to crowd out private contributions. The intuition is as follows. An increase in lump-sum taxation to finance the government's contribution to charity will again cause individuals to reduce their own contribution due to the public good effect. And since charitable contributions are tax deductible, each individual's lower contribution will, *ceteris paribus*, increase their income tax liability. The resulting (negative) income effect further reduces each individual's charitable contribution, thus reinforcing the crowding-out effect.

4 Optimal Tax/Subsidy on Charitable Contributions

The fact that charitable contributions have positive external effects makes a case for subsidisation, since the market level of contributions will typically be lower than the socially-optimal level (see, e.g., Kaplow [1995, 1998]). This is one of the reasons why charitable contributions are granted a favourable tax treatment in many countries. However, the existence of a competitive warm-glow motive for giving weakens the case for subsidisation, since it implies that charitable contributions also have negative external effects. In light of these countervailing forces, the purpose of this section is to derive an

[4] If $\theta \geq 1/t$, then the first-order conditions (2.3) and (2.5) cannot be satisfied.

expression for the optimal tax/subsidy on charitable contributions.

To this end, consider the following planning problem in order to derive the socially-optimal allocation. The social planner will choose consumption c, the contribution to charity g, and labour supply l to maximise the utility of a representative individual:

$$u(c) + v(\lambda(1-\alpha)g + (1-\lambda)ng) - z(l) \tag{4.1}$$

subject to the budget constraint:

$$c + g \leq (1-t)wl \tag{4.2}$$

Some comments on programme (4.1) – (4.2) are in order. First, the planner will internalise both the negative externality from the competitive warm-glow motive for giving and the positive externality from the public good motive. This explains the nature of the argument of the $v(\cdot)$ function. Second, the tax/subsidy θ on charitable contributions is absent, since the planner is able to directly determine the level of private contributions. Third, since it is assumed that the income tax rate t is exogenously determined, it is taken as given by the planner.[5] Fourth, since we are not concerned here with charitable contributions by the government, the lump-sum tax τ is set equal to zero.

Assuming that the budget constraint (4.2) is binding, it can be solved for c and substituted into the utility function (4.1). The first-order conditions on g and l for an interior maximum are:

$$-u'((1-t)wl - g) + v'(\lambda(1-\alpha)g + (1-\lambda)ng)(\lambda(1-\alpha) + (1-\lambda)n) = 0 \tag{4.3}$$

$$u'((1-t)wl - g)(1-t)w - z'(l) = 0 \tag{4.4}$$

[5] Thus the analysis of taxation in this paper is one of "tax reform" rather than "optimal taxation", since it is implicitly assumed that the income tax and the tax/subsidy on charitable contributions are chosen in a piecemeal manner. While the optimal tax approach is the most common in the taxation literature, the tax reform approach is considered a better description of actual government behaviour. See for instance Feldstein [1976] and Guesnerie [1977, 1995] for a discussion of these issues.

Equations (4.3) and (4.4) can be manipulated to yield the following marginal rates of substitution between consumption, charitable contributions, and labour that hold at a social optimum:

$$MRS_{\widehat{g}\widehat{c}} = \frac{v'(\lambda(1-\alpha)\widehat{g} + (1-\lambda)n\widehat{g})}{u'(\widehat{c})} = \frac{1}{\lambda(1-\alpha) + (1-\lambda)n} \tag{4.5}$$

$$MRS_{\widehat{l}\widehat{c}} = \frac{z'(\widehat{l})}{u'(\widehat{c})} = (1-t)w \tag{4.6}$$

$$MRS_{\widehat{g}\widehat{l}} = \frac{v'(\lambda(1-\alpha)\widehat{g} + (1-\lambda)n\widehat{g})}{z'(\widehat{l})} = \frac{1}{(1-t)w(\lambda(1-\alpha) + (1-\lambda)n)} \tag{4.7}$$

where MRS_{ij} denotes the marginal rate of substitution of commodity i for commodity j, and the notation $\widehat{i}$ is used to denote the socially-optimal level of commodity i.

Similarly, equations (2.5) and (2.6) can be manipulated to yield the following marginal rates of substitution that hold in the market solution (with $\tau = 0$):

$$MRS_{gc} = \frac{v'(\lambda(1-\alpha)g + (1-\lambda)ng)}{u'(c)} = 1 - \theta t \tag{4.8}$$

$$MRS_{lc} = \frac{z'(l)}{u'(c)} = (1-t)w \tag{4.9}$$

$$MRS_{gl} = \frac{v'(\lambda(1-\alpha)g + (1-\lambda)ng)}{z'(l)} = \frac{1-\theta t}{(1-t)w} \tag{4.10}$$

The optimal tax/subsidy on charitable contributions can be found by setting its level to minimise the difference between the market allocation and the socially-optimal allocation. That is, choose θ to minimise:

$$\frac{1}{2}(MRS_{gc} - MRS_{\widehat{g}\widehat{c}})^2 + \frac{1}{2}(MRS_{lc} - MRS_{\widehat{l}\widehat{c}})^2 + \frac{1}{2}(MRS_{gl} - MRS_{\widehat{g}\widehat{l}})^2 \tag{4.11}$$

It is shown in the Appendix that the optimal tax/subsidy on charitable contributions is equal to:

$$\widehat{\theta} = \frac{\lambda(1-\alpha) + (1-\lambda)n - 1}{t(\lambda(1-\alpha) + (1-\lambda)n)} \tag{4.12}$$

It is also shown in the Appendix that $\widehat{\theta}$ yields $MRS_{gc} = MRS_{\widehat{g}\widehat{c}}$, $MRS_{lc} = MRS_{\widehat{l}\widehat{c}}$, and $MRS_{gl} = MRS_{\widehat{gl}}$, so that $\widehat{\theta}$ eliminates all marginal distortions associated with the external effects of charitable contributions.

Using equation (4.12) we obtain the following results:

Proposition 5 $\lim_{\lambda \to 1} \widehat{\theta} = \frac{-\alpha}{t(1-\alpha)} < 0$; *that is, it is optimal to tax charitable contributions as the weight on the competitive warm-glow motive for giving increases.*

Proposition 6 $\lim_{\lambda \to 0} \widehat{\theta} = \frac{n-1}{tn} > 0$; *that is, it is optimal to subsidise charitable contributions as the weight on the public good motive for giving increases.*

Proposition 7 $\lim_{\alpha \to 0} \widehat{\theta} = \frac{(1-\lambda)(n-1)}{t(\lambda+(1-\lambda)n)} > 0$; *that is, it is optimal to subsidise charitable contributions as the competitive element of the warm-glow motive for giving disappears.*

The intuition behind Propositions 5, 6, and 7 is quite simple. Proposition 5 shows that it becomes optimal to tax charitable contributions when the competitive warm-glow motive for giving sufficiently dominates the public good motive, the reason being that the negative externality associated with the competitive warm-glow motive will dominate the positive externality associated with the public good motive. Likewise, Propositions 6 and 7 show that it is optimal to subsidise charitable contributions when the public good motive for giving sufficiently dominates the competitive warm-glow motive and/or the competitive element of the warm-glow motive is sufficiently small.

Propositions 5, 6, and 7 establish that either a tax or subsidy on charitable contributions can be optimal. Our final proposition shows that it can be optimal for charitable contributions to be more than 100% deductible against taxable income:

Proposition 8 $\lim_{n \to \infty} \widehat{\theta} = \frac{1}{t} > 1$; *that is, it is optimal for charitable contributions to become more than 100% tax deductible as the number of individuals increases.*

The proof of Proposition 8 follows from an application of L'Hopital's Rule to equation (4.12). To interpret Proposition 8, consider equations (4.5) and (4.7). These equations show that as $n \to \infty$, the socially-optimal allocation has $MRS_{\widehat{gc}} \approx 0$ and $MRS_{\widehat{gl}} \approx 0$. The intuition is that the planner must decide how to allocate income between private consumption and charitable contributions. But since charitable contributions are a public good, there tends to be a higher utility payoff from favouring charitable contributions. And since this payoff is increasing in the number of individuals, the planner will increasingly favour charitable contributions as the number of individuals increases. In order to induce the market to achieve this socially-optimal allocation, the subsidy on charitable contributions must be increased towards its maximum possible level, i.e., $1/t - \varepsilon$ where ε is some infinitesimally small positive number.

5 Closing Remarks

Traditional models of private contributions to a public good (such as a charity), as exemplified by Bergstrom et al. [1986], conclude that tax-financed contributions by the government completely crowd out private contributions. In light of the empirical evidence that suggests crowding out is incomplete, it has been suggested (e.g., Andreoni [1989, 1990]) that the addition of a warm-glow motive for giving helps reconcile the results from theoretical models with the empirical evidence. However, this paper has shown that if the warm-glow motive contains a competitive element, then the theory predicts that crowding out becomes complete as the competitive element intensifies. To the extent that one accepts adding a competitive element to the warm-glow motive as plausible, it follows that the warm-glow motive may not be the best way of reconciling theory with fact. Instead, other motives for giving, such as the theory of impact philanthropy advanced by Duncan [2004], may be better explanations. We have also shown that the tax-deductibility of charitable contributions—which is a feature of many real-world tax codes—works in favour of the crowding-out hypothesis, and that the competitive warm-glow motive for giving implies that it can be optimal to tax charitable contributions.

6 Appendix

Derivation of Equation (3.1)

The Hessian associated with equations (2.5) and (2.6) is:

$$H = \begin{bmatrix} u''(c)(\theta t - 1)^2 + v''(\cdot)\left[\lambda(1-\alpha) + (1-\lambda)n\right] & u''(c)(\theta t - 1)(1-t)w \\ u''(c)(\theta t - 1)(1-t)w & u''(c)(1-t)^2 w^2 - z''(l) \end{bmatrix} \tag{A.1}$$

where $u''(c) = u''(wl - t(wl - \theta g) - \tau - g)$ and $v''(\cdot) = v''(\lambda(1-\alpha)g + (1-\lambda)n(g+\tau))$. The determinant of H is given by:

$$| H | = -u''(c)(\theta t - 1)^2 z''(l) + v''(\cdot)\left[\lambda(1-\alpha) + (1-\lambda)n\right]\left[u''(c)(1-t)^2 w^2 - z''(l)\right] > 0 \tag{A.2}$$

Since $| H | \neq 0$, it follows from the Implicit Function Theorem and Cramer's Rule that $\partial g(\cdot)/\partial\tau = - | A | \,/\, | H |$, where:

$$A = \begin{bmatrix} -u''(c)(\theta t - 1) + v''(\cdot)(1-\lambda)n & u''(c)(\theta t - 1)(1-t)w \\ -u''(c)(1-t)w & u''(c)(1-t)^2 w^2 - z''(l) \end{bmatrix} \tag{A.3}$$

and:

$$| A | = u''(c)(\theta t - 1) z''(l) + v''(\cdot)(1-\lambda)n\left[u''(c)(1-t)^2 w^2 - z''(l)\right] > 0 \tag{A.4}$$

Equations (A.2) and (A.4) can then be combined to yield equation (3.1). ■

Derivation of Equation (4.12)

It follows from equations (4.5) – (4.10) that choosing θ to minimise:

$$\frac{1}{2}(MRS_{gc} - MRS_{\widehat{gc}})^2 + \frac{1}{2}(MRS_{lc} - MRS_{\widehat{lc}})^2 + \frac{1}{2}(MRS_{gl} - MRS_{\widehat{gl}})^2 \tag{A.5}$$

is equivalent to choosing θ to minimise:

$$Z = \frac{1}{2}\left(1 - \theta t - \frac{1}{\lambda(1-\alpha) + (1-\lambda)n}\right)^2 + \frac{1}{2}\left(\frac{1-\theta t}{(1-t)w} - \frac{1}{(1-t)w(\lambda(1-\alpha) + (1-\lambda)n)}\right)^2 \tag{A.6}$$

which in turn is equivalent to choosing θ to minimise:

$$Z = \left(\frac{1}{2} + \frac{1}{2(1-t)^2 w^2}\right)\left(1 - \theta t - \frac{1}{\lambda(1-\alpha) + (1-\lambda)n}\right)^2 \tag{A.7}$$

The first-order condition corresponding to equation (A.7) is:

$$\frac{\partial Z(\cdot)}{\partial\theta} = 2\left(\frac{1}{2} + \frac{1}{2(1-t)^2 w^2}\right)\left(1 - \theta t - \frac{1}{\lambda(1-\alpha) + (1-\lambda)n}\right)(-t) = 0 \tag{A.8}$$

Solving equation (A.8) for θ yields equation (4.12).

Finally, it follows directly from equations (4.6) and (4.9) that $MRS_{lc} = MRS_{\widehat{lc}}$, and it follows from equation (A.7) that $\widehat{\theta}$ yields $Z = 0$. Hence $MRS_{gc} = MRS_{\widehat{gc}}$ and $MRS_{gl} = MRS_{\widehat{gl}}$. ■

References

[1] Andreoni, J [1988], "Privately Provided Public Goods in a Large Economy: The Limits of Altruism", *Journal of Public Economics*, 35, 57-73.

[2] Andreoni, J [1989], "Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence", *Journal of Political Economy*, 97, 1447-1458.

[3] Andreoni, J [1990], "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving", *Economic Journal*, 100, 464-477.

[4] Andreoni, J [2006], "Philanthropy", *Handbook of the Economics of Giving, Altruism and Reciprocity*, Vol. 2, 1201-1269.

[5] Andreoni, J. and R. Petrie [2004], "Public Goods Experiments Without Confidentiality: A Glimpse into Fund-Raising", *Journal of Public Economics*, 88, 1605-1623.

[6] Atkinson, A [2009], "Giving Overseas and Public Policy", *Journal of Public Economics*, 93, 647-653.

[7] Bergstrom, T., Blume, L. and H. Varian [1986], "On the Private Provision of Public Goods", *Journal of Public Economics*, 29, 25-49.

[8] Blumkin, T. and E. Sadka [2007], "A Case for Taxing Charitable Donations", *Journal of Public Economics*, 91, 1555-1564.

[9] Diamond, P [2006], "Optimal Tax Treatment of Private Contributions for Public Goods With and Without Warm Glow Preferences", *Journal of Public Economics*, 90, 897-919.

[10] Duncan, B [2004], "A Theory of Impact Philanthropy", *Journal of Public Economics*, 88, 2159-2180.

[11] Feldstein, M [1976], "On the Theory of Tax Reform", *Journal of Public Economics*, 6, 77-104.

[12] Glazer, A. and K. Konrad [1996], "A Signaling Explanation for Charity", *American Economic Review*, 86, 1019-1028.

[13] Guesnerie, R [1977], "On the Direction of Tax Reform", *Journal of Public Economics*, 7, 179-202.

[14] Guesnerie, R [1995], *A Contribution to the Pure Theory of Taxation*, Cambridge University Press.

[15] Harbaugh, W [1998a], "What do Donations Buy? A Model of Philanthropy Based on Prestige and Warm Glow", *Journal of Public Economics*, 67, 269-284.

[16] Harbaugh, W [1998b], "The Prestige Motive for Making Charitable Transfers", *American Economic Review*, 88, 277-282.

[17] Kaplow, L [1995], "A Note on Subsidising Gifts", *Journal of Public Economics*, 58, 469-477.

[18] Kaplow, L [1998], "Tax Policy and Gifts", *American Economic Review*, 88, 283-288.

[19] Rege, M. and K. Telle [2004], "The Impact of Social Approval and Framing on Cooperation in Public Good Situations", *Journal of Public Economics*, 88, 1625-1644.

[20] Roberts, R [1984], "A Positive Model of Private Charity and Public Transfers", *Journal of Political Economy*, 92, 136-148.

[21] Romano, R. and H. Yildirim [2001], "Why Charities Announce Donations: A Positive Perspective", *Journal of Public Economics*, 81, 423-447.

[22] Saez, E [2004], "The Optimal Treatment of Tax Expenditures", *Journal of Public Economics*, 88, 2657-2684.

[23] Sugden, R [1982], "On the Economics of Philanthropy", *Economic Journal*, 92, 341-350.

[24] Warr, P [1982], "Pareto Optimal Redistribution and Private Charity", *Journal of Public Economics*, 19, 131-138.