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THREE ESSAYS ON THE PRIVATE PROVISION OF PURE PUBLIC GOODS

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Amornrat Apinunmahakul

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ABSTRACT

THREE ESSAYS ON THE PRIVATE PROVISION OF PURE PUBLIC GOODS

Essay One: ***Equity and Financing of Pure Public Goods via Lotteries*****:** In this study, I consider a two-part tariff lottery game where provision of a pure public good is financed from the net proceeds of ticket sales. When participation in the game is obligatory (that is, the Government can charge all citizens a fixed participation fee, but citizens choose how many lottery tickets to acquire), then by choosing the fixed fee (or participation fee) appropriately, the first-best outcome can be implemented. At a subgame perfect Nash equilibrium, financing provision of the public good via a lottery mechanism solves the preference revelation problem. In equilibrium, when citizens purchase lottery tickets to maximize their expected utility, they pay their Lindahl price for the consumption of the public good. The public good is provided at the first-best level. When participation is completely voluntary, the lottery pot must be increased in order to attract the participation of those citizens who derive low marginal benefit from the provision of the public good. Although the first-best level of provision of the public good may not be reached, the two-part tariff lottery game provides at least as much of the public good as a simple raffle.

Essay Two: ***Strategic Interaction and Charitable Fund-raising*****:** This study uses a game theoretical model to consider an economy where two public goods can be provided by different types of charities - either by one 'United Charity' or two specialized 'stand-alone' charities. An important feature of the analysis is the explicit consideration given to the strategic aspects of inter-charity competition. The study contrast the provision of the pure public goods in three dimensions, i.e., institutional frameworks, objective functions for charities, and the fund-raising structure. One significant result is that -if charities are benevolent and donor-designation is honoured by the United Charity, the institutional structure and the timing of fund-raising campaigns *do not* matter; in contrast, both the institutional structure and the timing of fund-raising campaigns matter if charities maximize donation incomes.

Essay Three: ***Canadian Charitable Giving: Cash versus Playing Charitable Lotteries*****:** Using a bivariate Tobit model, this empirical study analyzes Canadian giving behaviour by examining donations of cash versus indirect giving via the purchase of charitable-run lotteries, charitable bingos and casinos, as well as the buying of goods whose proceeds are used to finance charitable activities. The paper uses the survey of Giving, Volunteering and Participating (SGVP) conducted by Statistics Canada (and several other agencies) in 1997. In addition to looking at the relationship between direct and indirect charitable giving, this study also make predictions regarding how much will be donated either directly or indirectly with changes in tax rates, government expenditures, household income, as well as a variety of personal and household characteristics.

Contents

Essay three: Canadian Charitable Giving: Cash versus Playing Charitable Lotteries

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Introduction
Three Essays on the Private Provision of Pure Public Goods

Every day throughout Canada, individual citizens receive mailings asking them to donate to charitable causes, or to purchase lottery tickets which will support registered charities. Endless phone-call solicitation is a fact of life. And in the run up to the end of year, individuals are regularly reminded that December 31st is the deadline for making charitable donations that will generate income tax credits for the current fiscal year. As all of these examples reflect, fund-raising activity on the part of charitable organizations has become a part of Canadian life.

According to a 1997 Statistics Canada survey,[1] during the one year period between November 1, 1996 and October 31, 1997, 21 million Canadians – 88 percent of the population aged 15 and over – made cash donations of 4.51 billion dollars to support charitable and non-profit organizations through

[1]The full name of the survey is the National Survey of Giving, Volunteering and Participating (SGVP), which was conducted as a supplement to the Labour Force Survey in 1997. The SGVP data file contains a representative sample of 18,301 Canadians aged 15 and over. The survey is Statistics Canada's collaborative project with the Canadian Centre for Philanthrophy, Canadian Heritage, Health Canada, the Kahanoff Foundation's Non-Profit Sector Research Initiative, and Volunteer Canada. I am very grateful to Statistics Canada for allowing me access to the non-public datafile of this survey, which makes the empirical analysis in essay three possible.

various methods of fund-raising ranging from direct mail, telephone, special events, door to door solicitation, donations via payroll reduction, earning from capital or endowment, bequests, and so on. Furthermore, an additional 1.28 billion dollars were donated in the form of sponsoring charitable lotteries, bingos, casinos, as well as purchasing charity-product sales. With the magnitude of donations flowing into the non-profit sector, it is not surprising that the number of charities is growing over time as well. Day and Devlin (1997) reports that the number of registered charities in Canada has increased from 23,656 in 1969 to 74,024 registered charities in 1997 or 213 percent over the course of 27 years.

Surprisingly, the growth of charitable donations and of the activity of registered charities has not attracted much attention from economists. The theoretical framework generally applied to studying the voluntary provision of public goods deals with situations in which individuals decide on the allocation of their endowment of wealth between private consumption and contributions to the provision of public goods without any government intervention. In the classic models of the voluntary provision of public goods (e.g., Bergstrom, Blume and Varian (1987)), it is argued that the level of provision of the public good will be inefficiently low, due to the phenomenon of free riding. By the definition nature of pure public goods, it is impossible to exclude non contributors from deriving consumption benefits from the public good once it has been provided. In the absence of tax or transfer programs that may otherwise influence personal decision-making, individual consumers will rationally choose to under-contribute, knowing that they are able to free-ride on the contributions of other citizens to finance the provision of the public good. This relatively pessimistic view of the potential capacity of the charitable sector to fund its activities from donor contributions nonetheless seems somewhat at odds with the high observed amounts of charitable donations, whether in the form of direct cash gifts or indirectly through the purchase of charitable lottery tickets; it is also at odds with the level of competition amongst charities for fund-raising dollars. The success of charities and other non-profit organizations in raising billions of dollars of funds for the provision of public goods suggests that certain key elements influencing donor decision making are neglected by the standard models of the voluntary provision of public goods.

There are also a number of important empirical problems that have been neglected by researchers. Firstly, although the determinants of charitable giving have been analyzed by econometricians over the past decades, starting with Taussig's (1967) ground-breaking study, most existing research – which relies almost exclusively on American data[2] – has focussed on the price and income elasticity of charitable contributions. It was not until the 1980s that empirical studies of charitable giving took account of other determinants of cash donations. For example, Brown and Lankford (1992) and Duncan (1999) examine the relationship between cash giving and volunteering time; Roberts (1984), Abrams and Schmitz (1984), Kingma (1989), Khanna and Sandler (2000) study the relationship between private donations and government spending. However, the relationship between giving in cash and playing charitable lotteries has never been investigated before.

Although lotteries have a long history of use as a mechanism for financing the provision of public goods,[3] this practise has been strongly criticized by many economists in the past, who have argued that lotteries are an inequitable and inefficient mechanism for redistributing income.[4] It has been found that although high income groups spend more in absolute dollar terms on lottery tickets than lower income classes, the ratio of lottery expenditure to total income decreases as income increases. Certainly, expenditures on

[2]See the review of the literature in the introduction of essay three.
[3]See more about the history of lotteries in Morgan (1997).
[4]A review of several empirical analyses can be found in Mikesell (1989).

lottery tickets and other forms of legal gambling activity have increased dramatically in the past 25 years. Indeed, Bloskie (1995) reports that the lottery expenditure of 8 percent from 1981 to 1994 is the fourth highest growth rate of personal expenditure in Canada. It should be noted that in Canada, the first national lottery was used to support the 1976 Olympic Games (Marshell, 1996). The federal government granted permission to provincial and the territorial governments to run their own lotteries in 1979. Government net revenue from lotteries increased from 1.3 billion dollars in 1985 to 3 billion dollars in 1995 with another 2 billion dollars from bingos and video lottery terminals (VLTs). Strikingly, the National Council of Welfare calculates that an additional 1.3 billion dollars were also raised by charitable gambling (National Council of Welfare, 1996); lottery revenue is certainly an increasingly important source of revenue for many charities that in the past relied largely on cash donations. However, no empirical study has investigated the relationship between charitable gambling and charitable contributions.

As the above discussion makes clear, there are many issues worthy of attention by researchers in the area of charitable giving. This dissertation tries to fill some of these gaps by developing three essays on the private provision of public goods. The first two essays are theoretical analyses while the third essay is an empirical study. We now provide a brief summary of each chapter.

Essay one extends the standard theoretical model of the private provision of pure public good. Considering the fact that, in reality, many charities raise considerable funds through lotteries, it is clearly of interest to examine the impact of lottery design on the capacity of a non-profit firm to finance provision of a public good in a Pareto efficient fashion. Morgan (1997) studies the use of lotteries to fund the provision of pure public goods, and shows that the level of provision will be increased by adding on a lottery to a traditional subscription game. However, under his lottery scheme, the total level of provision of the public good will still be too low. In this paper, we consider a variation on the standard lottery design, and study a lottery game with a two-part tariff – that is, participants purchase the right to play the lottery, as well as lottery tickets. It is shown that if the participation fee and the size of the prize pool are determined appropriately, all citizens are willing to participate in the lottery, and will purchase a quantity of lottery tickets so that any given individual's expenditure is equal to his or her Lindahl price for the public good. The first-best level of provision of the public good is thus attained. The analysis also considers situations in which consumers are 'reluctant gamblers', and shows that a first-best level of provision can be obtained even when participation constraints must be taken into account as long as all citizens are sufficiently wealthy. Otherwise, the public good will be underprovided, although a two-part tariff for the lottery scheme leads to an increase in provision of the public good with respect to the level provided under a simple raffle.

Essay two develops a game theoretical analysis of the intensive competition amongst charities for donor dollars. There are thousands of charities competing for limited donor dollars. The competitive nature of the fund-raising environment means that individual charities must expend greater resources to attract donor dollars; advertising campaigns and donor recognition events are just two examples of the expenditures that must be incurred by charitable organizations seeking to attract donor dollars. Of course, since 'development expenditures' must be financed out of dollars collected, *ceteris paribus* higher advertising and other such ancillary expenses implies less revenue will remain at the end of the day to finance the provision of the public good. Another reality is that donor decision making is generally influenced by the fact that the public goods provided by competing charities may be viewed as complements or substitutes for each other. Many donors will allocate some part of their budget to supporting health charities, and may allocate some other portion to environmental charities. The strategic interaction between the fund-raising campaigns conducted by the Heart and Stroke Foundation and the Canadian Cancer Society is thus crucially different from the strategic interaction that exists between the campaigns conducted by the Multiple Schlerosis Society and Greenpeace. The model developed in essay two reflects these stylized facts, as it investigates the impact of strategic interaction in an economy with two charities, and in which the public goods provided by each charity are considered to be either complements or substitutes by donors. The study addresses the issue of whether fund-raising should be made by one United Charity or several specialized stand-alone charities (we consider both when the two stand-alone charities determine their advertising campaigns simultaneously and when they are conducted sequentially.) A striking result is that if charities seek to maximize social welfare, institutional structure does not matter, whereas if charities seek to maximize their net donation income, then whether or not money is collected via a United Charity or via independent competitive charities affects the amount collected.

Essay three is an empirical study which addresses the fact that donors may contribute to financing the activities of charitable organizations directly by making cash donations, or indirectly by purchasing charitable lotteries, participating in charitable bingos, casinos, or attending charitable events and the like. This paper analyses whether these two ways of giving are substitutes for each other or complements to each other. The paper also examines whether or not the decision to give to charities directly and/or indirectly is taken jointly or separately.

To date, no one has examined the determinants of indirect giving in an empirical study. This paper is not only the first one to address this gap in the literature, but is also the first study to analyze how "social capital" can influence giving behaviour. The social capital variables in this study include the length of time individuals have resided at the same abode, whether they live in a rural community, a small town, or a city, whether they were born in Canada, and their civic mindedness as reflected in whether or not they voted in the past federal, provincial, or municipal elections. The paper also includes variables indicating how many hours individuals spend on watching television as an indicator of their awareness (or not) of the outside world, or exposure to the advertisements for fund-raising. This paper is also the first study that analyses the relationship between charitable donations and government spending in Canada.

The study estimates direct and indirect giving equations using both the bivariate probit and bivariate Tobit models; it is the first study on charitable giving in Canada to apply these methods. The main results from the regression analysis are that individuals make decisions as to whether and how much to give to charities directly and indirectly in a joint manner, and, the decisions as to whether to participate in these activities are considered to be complementary to each other. Government expenditures strongly crowd out private contributions in Canada – the estimated conditional elasticity of charitable contributions is approximately -2. Social capital plays an important role in determining both the decision to contribute and how much to contribute to charity. Secular givers are quite sensitive to the tax-price of donations – with an elasticity measure about 1.50 per cent, whereas, those who give to places of worship are not affected by changes in the tax-price. The study also finds that income is one of the most important determinants of both direct and indirect giving. The income elasticity of direct donations appears to be about 0.80, which is certainly in line with most of the empirical studies in the area. Interestingly, indirect giving is less sensitive to changes income in comparison to direct giving, with an income elasticity of about 0.60.

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Essay One
Financing the Provision of Pure Public Goods via Lotteries

1 Introduction

When Samuelson (1954) first presented formal conditions for the efficient provision of pure public goods, he identified two questions that have been at the heart of the research agenda in public economics ever since; namely, how can (and should) public goods be financed, and how can citizens be induced to voluntarily reveal their tastes for these goods. Efforts to address the first issue – the appropriate distribution of the fiscal burden associated with the provision of public goods – have of course inspired much of modern taxation theory (and debates over the virtues of such concerns as horizontal and vertical equity, considerable thoughtful reflection by economist-philosophers (e.g., Van Parijs (1995)), and of course the extensive literature on the theory of pricing of public sector services, including that which deals directly with Lindahl (1919) (or benefit-principle) pricing. Finding means to induce citizens to reveal their demand for public goods has also proven to be a considerable challenge, with work on the Clarke-Groves-Vickery mechanisms (Green & Laffont (1979)) and, more recently, the serial cost sharing mechanism (Moulin (1994)) being merely two examples of the different approaches that have been taken to addressing this issue.

While some public goods – such as national defense – are typically provided by the public sector, others – such as much medical research – are often provided on a voluntary basis by the private sector. Thus a third fecund line of research has been the analysis of the voluntary provision of public goods, which was first studied by Olson (1965). The key issues of interest have been whether or not voluntary mechanisms will generate efficient levels of provision of the public good, and whether or not public policy instruments may be used to influence the equilibrium outcomes. A classic analysis is that of Bergstrom, Blume & Varian (1986), who apply the tools of non-cooperative game theory to the analysis of a subscription game: in a setting of complete information, each consumer is required to decide how much income to voluntarily contribute to financing the provision of the public good. All participants move simultaneously, and it is shown that at the Nash equilibrium of this game an inefficiently low level of the public good is provided. Essentially, this is because any individual contributor perceives himself as the marginal financier, bearing the entirety of the burden of any increase in the level of provision of the public good. It will typically be the case that, at equilibrium, only a subset of citizens will contribute to financing the provision of the public good, and the others free ride.

Considerable effort has subsequently been devoted to identifying ways of improving the performance of the subscription mechanism. Not surprisingly, much work (see, for example, Boadway, Pestieau & Wildasin (1989), Bilodeau and Slivinski (1996)) has focused on the usefulness of appropriate public policy instruments. Their conclusions are mixed, as the effectiveness of particular measures is generally affected by whether or not citizens fully understand the public sector budget constraint. The design of the voluntary contributions game has also been considered in detail – researchers have examined whether the results are affected if citizens make contributions sequentially rather than simultaneously, or over time rather than in a static context (Fershtman & Nitzan (1991), Gradstein (1992), Varian (1994)).

A particularly interesting recent extension to the Bergstrom-Blume-Varian model is that of Morgan (1997), who combines the standard voluntary contributions model with a lottery. He proves that when the opportunity to win a fixed-prize raffle is offered to the contributors to the subscription game, it is possible to obtain a level of provision of the public good that is superior to the level provided at the equilibrium of the classic voluntary contribution game. Furthermore, the level of provision can come very close to the first-best outcome if the prize amount is sufficiently large, but the level of provision cannot reach the social optimum. In this study, we extend Morgan's approach by introducing a lottery mechanism that is set up as a two part tariff. Consumers who participate in the lottery (and thus help to finance the provision of the public good) must first purchase a ticket giving them the right to participate. We examine the design of the lottery in different informational environments. In particular, we consider an environment in which the Lottery Corporation has full information about the aggregate distribution of preferences, but the tastes of individual consumers are unknown – that is, there is a sorting problem. We prove that when the revenue generated from the fixed fee is used to finance the prize pool, the level of the public good provided by a two-part lottery game is higher than by Morgan's fixed-prize raffle. When certain curvature conditions are met, the two-part lottery will provide the first-best level of the public good. The two-part lottery is thus superior to both the fixed-prize raffle and the standard voluntary provision model.

2 The Model

We consider an economy with two goods: a pure private good, x, and a pure public good, G. The private good is a non-produced good; consumers have a strictly positive endowment of this good, which can be used directly for consumption, or to purchase lottery tickets. The funds collected through the sale of lottery tickets are used to finance both the production of the public good and also a prize pool, which is awarded to the winner of the lottery. The public good is produced from the private good under a constant returns to scale production technology. The level of production of the public good is thus equal to total spending on lottery tickets, less whatever is set aside to fund the prize pool. Denoting lottery tickets bought by consumer i by l^i and the diversion of lottery funds to the prize pool by J, we have that

$$G = \sum_i l^i - J. \tag{1}$$

Notice that the amount of ticket revenue to be diverted to the prize pool J is fixed, and does not depend upon the number of tickets sold. As compared to Morgan (1997), an important feature of this model is the design of the lottery scheme. In this paper we consider a lottery where the pricing structure is in fact a two-part tariff: lottery participants must pay a fixed participation fee of T^i to acquire the right to purchase tickets, and they may additionally purchase any number of tickets l^i. We assume that all of the fixed fees collected are used to fund the prize pool.[1] The total prize pool is thus defined as:

$$P = \sum_i T^i + J \tag{2}$$

In contrast, Morgan (1997) considers a lottery mechanism where ticket purchases finance both the provision of the public good and a prize pool, that is, the fixed fee is set equal to zero.

The design of the lottery scheme is the purview of the Lottery Corporation. In particular, depending upon the information available to the Lottery Corporation, it may decide to charge a uniform fixed fee; i.e., $T^i \in \{0, T\}$ and $T^i = T$ if $l^i > 0$, or a personalized fee. The optimal fee structure is

[1] In particular, the fixed fee can be set to zero; and the prize pool must be strictly positive for the lottery scheme to increase the level of provision of the public good. However, we show later on that the fixed fee is actually an important element in prized pool that motivates consumers to contribute to the provision of the public good at the optimal level.

determined endogenously at equilibrium, by analyzing the decision problem of the lottery corporation.

The prize pool of the lottery is entirely allocated to a single winner. Each ticket purchased by a lottery participant is associated with an entry in the lottery, one of which is drawn at random in the final stage of the game. A participant's likelihood of winning the lottery is therefore equal to the number of tickets they hold as a proportion of the total number of tickets sold, or

$$\pi^i = \frac{l^i}{\sum_{j=1}^{N} l^j} \tag{3}$$

where π^i is the probability that participant i wins the prize pool and N is the number of consumers in the economy. Observe, therefore, that the probability that a given lottery participant actually wins depends only on the number of tickets that they purchase relative to the total number of tickets purchased, and does not depend directly on the total number of participants in the lottery.

Consumers have quasi-linear utility functions defined over consumption of both the private and the public goods.[2] Consumers are differentiated both with respect to income, and the strength of their 'taste' for the public good, $V^i(G)$. A particular individual's welfare can therefore be expressed as

$$U^i = x^i + V^i(G). \tag{4}$$

Observe that for this utility function, $\frac{-dx^i}{dG} |_{dU^i=0} = V^{i'}(G)$ and so, given the constant returns to scale technology for production of the public good, the Samuelson condition for efficient provision of the public good requires that $\sum_i V^{i'}(G) = 1$.

We use the tools of non-cooperative game theory to analyze individual behaviour in this model. Specifically, we assume that in the first stage, the Lottery Corporation can design the rules of the lottery and then, in the second stage, consumers choose how many tickets to purchase. After consumers take this decision, the public good is produced (using the net proceeds from the lottery), and a winner is determined.[3] The solution concept is that of

[2]On the limitations of using quasi-linear models when considering lottery finance of pure public goods, see Duncan (1998).

[3]In fact, the results obtained below depend on the total size of the prize pool, but not on the number of prizes awarded. In particular, the prize pool can be divided into an arbitrary number of prizes, as long as each participant's chance of winning every prize offered depends only on the number of tickets they purchased as a proportion of all tickets sold. Thus, in particular, it is possible for one individual to win the entire prize pool. For

subgame-perfect Nash equilibrium, and so the game is solved using backward induction.

3 Stage Two: The Consumer's Problem

As the solution concept used is that of subgame-perfect equilibrium, we first examine the decision problem faced by consumers in stage two of the game. The problem faced by consumers is to allocate their endowment, ω^i, between purchasing lottery tickets and consumption of the private good. Whereas expenditure on the private good generates certain benefits, the benefits associated with the purchase of lottery tickets are uncertain, because the purchaser does not know whether or not s/he will win the lottery. Consumer i's optimization problem is thus expressed as:

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ease of exposition, however, we will continue to refer to 'a winner', when in fact it would be appropriate to talk about 'the winners.'

$$\max_{T^i, l^i} U^i(x, G) = x^i + V^i(G) \tag{5}$$

$$\text{subject to } \omega^i = x^i + l^i + T^i \text{ with probability of loss } 1 - \frac{l^i}{\sum_j l^j}$$

$$\text{and } \omega^i + J + \sum_j T^j = x^i + l^i + T^i \text{ with probability of win } \frac{l^i}{\sum_j l^j}$$

$$G = \sum_j l^j - J.$$

We can rewrite the above optimization problem in terms of an expected utility function as follows:

$$\max_{l^i} EU^i(x^i, G) = \omega^i - l^i - T^i + V^i(G) + \left(\frac{l^i}{\left(\sum_j l^j\right)}\right)(J + \sum_j T^j) \tag{6}$$

Below we show that optimal lottery design requires that the Lottery Corporation set the participation fee T^i so that each consumer will choose to purchase lottery tickets at the subgame-perfect Nash equilibrium. If consumer i purchases a lottery ticket, then the first-order necessary condition with respect to l^i is:

$$-1 + V^{i\prime}(G) + \left(\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2}\right)\left(J + \sum_j T^j\right) = 0. \qquad (7)$$

We shall define l^{i*} to be the solution to the above programme. Notice that the introduction of the lottery scheme means that, as compared to the standard Bergstrom-Blume-Varian (1986) analysis, there is a third additional term influencing the consumer's decision to support the provision of the public good. This third term is positive, and is equal to consumer $i's$ marginal chance to win the prize as s/he purchases an additional ticket, i.e.,the partial derivative of $\left(\frac{l^i}{\sum_j l^j}\right)\left(J + \sum_j T^j\right)$ with respect to l^i. It is, therefore, equal to consumer $i's$ expected additional income from winning the lottery. Importantly, the addition of the lottery mechanism affects the comparative statics of the consumer's donation decision. Whereas in the standard model the consumer perceives the marginal cost of an additional unit of the public good as being equal to \$1, the integration of the lottery element lowers the marginal cost of contributions, and also means that more consumers are likely to wish to participate. Notice also that, due to the assumed quasi-linearity of the utility function, $dl^{i*}/d\omega^i = 0$ for that range of participation fees where $l^{i*} > 0$.

As noted earlier, as compared to Morgan (1997) the key innovation of the approach taken here is that we consider a lottery mechanism that is designed as a two-part tariff. Whereas Morgan funds the prize pool entirely out of ticket sales, in this paper the prize pool is funded firstly from participation fees, and may then be 'topped up' out of ticket sales. Obviously, an immediate issue that arises is whether or not funding the prize pool out of revenue generated through collecting participation fees is equivalent to skimming off some proportion of total ticket sales. In fact, it is straightforward to show that these two approaches to funding the prize pool are not equally effective.

Proposition 1 *The increase in the level of provision of the public good resulting from an incremental increase in T^i is greater than the increase in the level of provision of the public good resulting from an equal incremental increase in J.*

Proof: To prove this assertion, we first sum the first order condition (7) over all consumers:

$$-N + \sum_j V^{j\prime}(G) + \left(\frac{N-1}{\sum_j l^j}\right)\left(J + \sum_j T^j\right) = 0. \tag{8}$$

Recalling that $G = \sum_j l^j - J$, (8) can be rewritten as:

$$-N + \sum_j V^{j\prime}(G) + \left(\frac{N-1}{G+J}\right)\left(J + \sum_j T^j\right) = 0. \tag{9}$$

Totally differentiating this expression with respect to G, J and T^i yields the following expressions:

$$\frac{dG}{dT^i} = \frac{\left(\frac{N-1}{G+J}\right)}{-\sum_j V^{i\prime\prime}(G) + \left(\frac{N-1}{(G+J)^2}\right)\left(J + \sum_j T^j\right)} > 0 \tag{10}$$

$$\frac{dG}{dJ} = \frac{\left(\frac{N-1}{G+J}\right) - \left(\frac{N-1}{(G+J)^2}\right)\left(J + \sum_j T^j\right)}{-\sum_j V^{i\prime\prime}(G) + \left(\frac{N-1}{(G+J)^2}\right)\left(J + \sum_j T^j\right)} > 0 \tag{11}$$

and it is immediate from comparing these two inequalities that $\frac{dG}{dT^i} > \frac{dG}{dJ}$.∎

In addition, equation (11) can be rewritten as

$$\frac{dG}{dJ} = \frac{\left(\frac{N-1}{G+J}\right)\left\{1 - \frac{(J+\sum_j T^j)}{(G+J)}\right\}}{-\sum_j V^{i\prime\prime}(G) + \left(\frac{N-1}{(G+J)^2}\right)\left(J + \sum_j T^j\right)} \tag{12}$$

which implies that $\frac{dG}{dJ} > 0$ if and only if $G > \sum_j T^j$. However, if $G \leq \sum_j T^j$, then $\frac{dG}{dJ} \leq 0$, which implies that if the total amount collected from fixed fees is greater than or equal to G, the Corporation cannot increase the level of provision of the public good by diverting additional funds from ticket sales to increase the size of the prize pool. In the interpretation of Proposition 1, to increase the level of provision of the public good it will be more effective to increase the participation fee rather than to divert additional funds from total spending on lottery tickets to the prize pool. This will be of relevance in identifying the optimal policy for the Lottery Corporation. It is interesting to note that one can show that

$$\frac{d\sum l^j}{dT^i} = \frac{\left(\frac{N-1}{\sum l^j}\right)}{-\sum_j V^{i''}(G) + \left(\frac{N-1}{(\sum l^j)^2}\right)\left(J + \sum_j T^j\right)} > 0 \tag{13}$$

$$\frac{d\sum l^j}{dJ} = \frac{-\sum_j V^{i''}(G) + \left(\frac{N-1}{\sum l^j}\right)}{-\sum_j V^{i''}(G) + \left(\frac{N-1}{(\sum l^j)^2}\right)\left(J + \sum_j T^j\right)} > 0 \tag{14}$$

therefore, $\frac{d\sum_j l^j}{dJ} > \frac{d\sum_j l^j}{dT^i} > 0$, that is, a \$1 increase in J will increase total purchases of lottery tickets by more than will a \$1 increase in T^i. However, because *ceteris paribus* an increase in J decreases the level of provision of the public good, whereas an increase in T^i has no direct impact on the level of G, it turns out that the level of provision of the public good actually rises more when incremental increases in the prize pool are funded out of increased participation fees rather than by diverting a larger proportion of ticket revenue to the prize pool. Notice that if $\sum l^j = J + \sum_j T^j$, or $G = \sum_j T^j$ (for $G = \sum l^j - J$), then $\frac{d\sum_j l^j}{dJ} = 1$, and if $G \leq \sum_j T^j$ then $\frac{d\sum_j l^j}{dJ} \leq 1$, which is similar to the above result; i.e., when the level of public good provided is smaller than the total amount of fixed fees, the Corporation cannot use the fixed-prize to induce consumers to purchase any more tickets

In addition, notice that if there is no participation fee; i.e., $T^i = 0$, $\forall i$, then consumer $i's$ first-order condition in (7) is the same as in Morgan (1997). Participation fees from all bettors, $\sum_j T^j$, thus reduce bettor $i's$ marginal cost of provision to be lower than that of the fixed-prize raffle. Therefore, if consumer i is a bettor in the fixed-prize raffle, s/he will also be a bettor in the two-part tariff lottery since the bettor now has a lower marginal cost of contribution. Moreover, some consumers who chose not to participate under Morgan's raffle regime will now decide to purchase tickets under the two-part lottery scheme as their cost of contribution has been lowered. This thus leads to the following proposition:

Proposition 2 *The level of the public good financed by the two-part tariff lottery (denoted by G^T) is a Pareto improvement with respect to the fixed-prize raffle (denoted by G^R), and the classical voluntary provision mechanism (denoted by G^V) respectively; i.e., $G^T > G^R > G^V$.*

Proof: We can rewrite consumer $i's$ first-order condition, (7) as follows:

$$V^{i\prime}(G) = 1 - \left(\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2} \right) \left(J + \sum_j T^j \right) \tag{15}$$

when $\left(J + \sum_j T^j\right) = 0$, we have the classical voluntary provision model. If $J \neq 0$,but $\sum_j T^j = 0$, we have the fixed-prize raffle. Since this last term in (15) lowers consumer $i's$ marginal cost of contribution and has the greatest value when both J and $\sum_j T^j \neq 0$. The lower the marginal cost of contribution, the higher consumers will contribute, and thus the more public good will be provided. The result thus immediately follows.∎

The results in this study and in Morgan (1997) are of course critically dependent on the assumed risk neutrality of consumers. This feature of the utility function means that the individual consumer's decision with respect to the number of lottery tickets to purchase depends only on two factors: the private marginal benefit of an additional unit of the public good and the marginal impact on the individual's chance of winning the prize pool. Increasing the prize pool by charging a participation fee thus increases the purchase of lottery tickets, as it increases the benefits of winning. If consumers were risk averse, it cannot be assumed that the increased expected benefits of winning would compensate for the increase in the variability of income. We show in the appendix that when consumers are risk averse, a lottery game can be designed that is superior to the classical voluntary provision model, although the two-part lottery can only be shown to be weakly superior to the simple raffle.

4 Stage One: The Lottery Corporation's Problem

Given the analysis of the consumer's decision problem in stage two, it is now appropriate to consider the problem faced by the Lottery Corporation in stage one. We assume that the Lottery Corporation wishes to design the lottery to maximize social welfare; this assumption is appropriate if it assumed that the Corporation is publicly owned, but would obviously be inappropriate were the lottery operated by a private charity (in which case it would presumably seek to maximize the budget of the charity). In designing the lottery, the two instruments available to the corporation are T^i, the participation fee to be paid by consumer i, and J, the amount of ticket revenue to be siphoned off to fund the prize pool rather than the provision of the public good.

A key issue is the quality of the information available to the Lottery Corporation. In this section, we will assume that the Corporation has complete information about the distribution of aggregate preferences, but may not necessarily have complete information about individual preferences. That is, the Corporation may be faced with an informational environment in which adverse selection is a potential problem. We assume a Benthamite social welfare function W, and so the Lottery Corporation's problem can be expressed as:

$$
\begin{aligned}
\max_{J,T} W &= \sum_j \omega^j - \sum_j l^{j*} - \sum_j T^j + \sum_j V^j(G) + (J + \sum_j T^j) \quad (16) \\
&\quad \text{subject to } G = \sum_j l^{j*} - J \\
&\quad l^{i*} \text{ solves the ith consumer's optimisation problem.} \quad (17)
\end{aligned}
$$

The first-order necessary conditions for the Corporation are:

$$
\frac{\partial W}{\partial J} = -\frac{\partial \sum_j l^{j*}}{\partial J} + \sum_j V^{j\prime}(G)\left(\frac{\partial \sum_j l^{j*}}{\partial J} - 1\right) + 1 = 0 \qquad (18)
$$

$$
\frac{\partial W}{\partial T} = \frac{\partial \sum_j l^{j*}}{\partial T}\left(\sum_j V^{j\prime}(G) - 1\right) = 0 \qquad (19)
$$

Rewriting equation (18), we see that when J is chosen optimally, it must be true that

$$
\left(\frac{\partial \sum_j l^{j*}}{\partial J} - 1\right)\left(\sum_j V^{j\prime}(G) - 1\right) = 0. \qquad (20)
$$

Thus, recalling that the Samuelson condition requires that $\sum_j V^{ij}(G) = 1$, we observe that when J is chosen optimally either the optimal level of the public good must be provided in equilibrium, or $\frac{d\sum_j l^{j*}}{dJ} = 1$, or both conditions must be true simultaneously. So, if an inefficient level of the public good were to be provided (as is the case with Morgan's model) it must be true that, at the margin, all additional funds collected are diverted to funding the prize pool and there is no net increase in the level of provision of the public good. This observation explains Morgan's result that lotteries cannot be used to implement the first-best level of provision of the public good, since in his model the prize pool must be funded out of ticket revenue, and there is no possibility of using participation fees to cover some portion of the total cost of the prize pool.

Turning to equation (19), and recalling that $\frac{d\sum_j l^j}{dT} > 0$, we note that (19) cannot be satisfied unless the optimal level of the public good is provided. In other words, as long as the outcome of stage two is such that consumers spend too little on lottery tickets, resulting in underprovision of the public good, the Lottery Corporation can increase social welfare by cranking up the participation fee, and by so doing will increase the aggregate level of provision of the public good. Notice, however, that if (19) is satisfied, then

(18) is satisfied for any J. That is, social welfare is now independent of J and so we shall restrict ourselves to the case where the prize pool is entirely financed out of the participation fees, and all spending on lottery tickets is used to fund the provision of the public good. In addition, from equation (12), we show that if $G = \sum_j T^{j^*}$, $\frac{dG}{dJ} = 0$ and from equation (20) we know that if $\sum_j V^{ij}(G) \neq 1$, then $\frac{d\sum_j l^{j^*}}{dJ} = 1$. These results imply that if the public good is not provided at the socially optimal level, any incremental increase of fixed prize will cause the total amount of ticket revenue to increase on a one to one basis, so that the level of public good is unchanged. It is therefore better if the Lottery Corporation uses participation fees to finance the prize pool, rather than revenue diverted from ticket sales.

Proposition 3 *When the prize pool is funded entirely out of participation fees, then at a subgame-perfect Nash equilibrium the Lottery Corporation sets participation fees such that* $\sum_j T^j = G^*$.

Proof: Summing the first-order condition (7) over all consumers, we observe that

$$-N + \sum_j V^{ii}(G) + \left(\frac{(N-1)\sum_j l^{j*}}{\left(\sum_j l^{j*}\right)^2} \right) \left(J + \sum_j T^{j^*} \right) = 0. \quad (21)$$

Note that at any subgame-perfect equilibrium, (19) must be satisfied, and therefore a first-best level of the public good must be provided. Notice that since there are constant returns to scale in the provision of the public good, $\sum_j V^{ii}(G) = 1$ when the public good G is provided optimally. Recalling also that if $J = 0$ then $\sum_j l^j = G$, we can therefore rewrite (21) as follows:

$$\begin{aligned} -(N-1) + \left(\frac{(N-1)\sum_j l^{j*}}{\left(\sum_j l^{j*}\right)^2} \right) \left(J + \sum_j T^{j^*} \right) &= 0 \\ -(N-1) + \left(\frac{N-1}{G^*} \right) \left(\sum_j T^{j^*} \right) &= 0 \quad (22) \end{aligned}$$

and it is immediately evident that (22) is satisfied when $\sum_j T^{j^*} = G^*$ ∎

Proposition 4 *When the Lottery Corporation sets $T^i = T = G^*/N$, the optimal level of the public good is provided at the subgame-perfect Nash equilibrium of the Lottery Game, and each citizen pays their Lindahl price for consumption of the public good.*

Proof: By construction, $\sum_j T^j = G^*$, $J^* = 0$ and so $G = \sum_j l^{j*}$. From (7) we have that

$$-1 + V^{i\prime}(G^*) + \left(\frac{G^* - l^{i*}}{(G^*)^2}\right) G^* = 0 \tag{23}$$

and so after straightforward manipulations we obtain that

$$l^{i*} = V^{i\prime}(G^*)G^*. \tag{24}$$

Q.E.D.∎

What proposition 4 establishes, therefore, is that *even when the Lottery Corporation is faced with a problem of adverse selection*, as long as the aggregate value of participation fees levied is equal to total expenditure on the public good, citizens will choose to reveal their demands for the public good by expending on the purchase of tickets an amount equal to their Lindahl price.

As one might suspect, however, one should hesitate before sounding the trumpets. As the thoughtful reader may realize, it is yet to be shown that consumers will voluntarily choose to participate in the lottery. As is always the case in models of the voluntary provision of public goods, each citizen has the option of 'playing the lottery', or free-riding. A particular consumer will choose to participate if and only if their expected utility when they participate exceeds their expected utility were they to free-ride. In particular, we observe that if all other participants choose $l^i = l^{i*}$ then

$$\begin{aligned} EU^i(\text{participates}) &\geq EU^i(\text{not participate}) \Longleftrightarrow \\ \omega^i - l^{i*} - T^{i*} + V^i(G^*) + \frac{l^{i*}}{\sum_j l^{j*}} \sum_j T^{j*} &\geq \omega^i + V^i(G^* - l^{i*}). \end{aligned} \tag{25}$$

Note that we can restrict attention to $l^i = l^{i*}$ since, if individual i participates in the lottery game, their contribution level will be determined by (23). Using the equilibrium conditions for the Lottery Corporations's decision, we can rewrite (25) as

$$EU^i(\text{participates}) \geq EU^i(\text{not participate}) \Longleftrightarrow V^i(G^*) - V^i(G^* - l^{i*}) \geq T^{i*}. \tag{26}$$

To summarize the results of the above analysis, if all consumers participate in the lottery, then even under imperfect information about individual preferences the Lottery Corporation can implement a first-best outcome in which all citizens pay their Lindahl price for the public good by charging a uniform participation fee equal to the per capita level of provision of the public good. All citizens will participate if condition (26) is satisfied for all consumers, or if all individuals can be coerced, via the tax system, to pay the participation fee T. Once T has been paid, and is fully reimbursed in an expected sense to consumers via the prize pool, all citizens will choose to purchase a quantity of lottery tickets of a total value equal to their Lindahl price for the public good.

5 Optimal provision when some consumers are reluctant gamblers

If the participation constraint (25) is not verified for $T = G^*/N$, and the Lottery Corporation does not have the power to tax citizens, then in solving its lottery design problem it must take the participation constraint into account. In essence, the participation constraint fails to hold when the benefits associated with the lottery are not big enough: they are reluctant to gamble unless the gains associated with winning are really big. This means that the Lottery Corporation will have to find other means of 'sweetening the pot', and the most obvious route to doing so is to divert some proportion of ticket sale revenue to funding the prize pool, rather than relying exclusively on participation fees. In this section, we consider the Lottery Corporation's problem when individuals must be enticed to participate in the Lottery and so the Corporation must use both J and T to fund the prize pool.

To obtain greater insight into the lottery corporation's problem, it is useful to consider the first-order necessary conditions for the bettors (the contributors) and non-bettors (the free riders) in greater detail. Since each individual can choose whether or not s/he wants to purchase any lottery ticket, consumer $i's$ first-order condition as expressed in (7) is satisfied as an equality for all individuals with $l^i > 0$. However, if $l^i = 0$, consumer $i's$ first-order condition is:

$$-1 + V^{i\prime}(G) + \left(\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2} \right) \left(J + \sum_j T^j \right) < 0. \qquad (27)$$

From equation (27), we are able to prove the following proposition.

Proposition 5 *If the public good G is not socially desirable, then G will not be provided by the lottery mechanism*

Proof: Given that there are B' consumers who are non-bettors, then aggregating over (27) for this sub-group of the population we obtain that:

$$-B' + \sum_{i=1}^{B'} V^{i\prime}(G) + \left(\frac{(B'-1)\left(\sum_{j=1}^{B'} l^j\right)}{\left(\sum_{j=1}^{B'} l^j\right)} \right) \frac{\left(J + \sum_{j=1}^{B'} T^j\right)}{\left(\sum_{j=1}^{B'} l^j\right)} < 0 \quad (28)$$

$$-B' + \sum_{i=1}^{B'} V^{i\prime}(G) + (B'-1) \frac{\left(J + \sum_{j=1}^{B'} T^j\right)}{\left(\sum_{j=1}^{B'} l^j\right)} < 0 \quad (29)$$

If we have $\sum_{j=1}^{B'} l^j = J + \sum_{j=1}^{B'} T^j$ (or $G = \sum_{j=1}^{B'} l^j = \sum_{j=1}^{B'} T^j$, when $J = 0$), then $\sum_{i=1}^{B'} V^{i\prime}(G) < 1$; that is, public good G is not desirable for the non-bettors since their marginal benefit from the provision is less than the marginal cost. However, if $B' = N$, then $\sum_{i=1}^{N} V^{i\prime}(G) < 1$; i.e., given that N is the total population, *public good G is not socially desirable, and will not be provided by the lottery mechanism.*[4] Q.E.D.∎

If citizens are sufficiently wealthy, then by increasing the size of the prize

[4] Actually, this result is similar to Morgan (1997) when $\sum_{j=1}^{B'} T^j = 0$, therefore, socially non-desirable public good will never be provided by either fixed-prize raffle (when the participation fee is zero) or the two-part tariff lottery (when the participation fee is nonnegative.)

pool sufficiently it is possible to attain the first-best even when citizens are reluctant gamblers. Recall that for citizens to participate, it must be true that

$$\begin{aligned} EU^i(\text{participate}) &\geq EU^i(\text{not participate}) && (30)\\ \omega^i - l^i - T + V^i(G) + \frac{l^i}{\sum_j l^j}P &\geq \omega^i + V^i(G - l^i) && (31)\end{aligned}$$

where $P = J^u + NT$ and J^u is the fixed prize with the uniform tax T (i.e., fixed participation fee) therefore

$$V^i(G) - V^i(G - l^i) \geq l^i - \left(\frac{l^i}{\sum l^j}\right) P + T \tag{32}$$

We observe from the weak concavity of $V^i(G)$ that

$$\frac{V^i(G) - V^i(G - l^i)}{l^i} \geq V^{i'}(G) \tag{33}$$

and from the bettor's first-order condition we have that

$$-1 + V^{ii}(G) + \left(\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2} \right) P = 0$$

or

$$V^{ii}(G) = 1 - \left(\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2} \right) P. \tag{34}$$

Substituting (34) into (33), we get

$$V^i(G) - V^i(G - l^i) \geq l^i - \left(\frac{l^i}{\sum l^j} \right) P + \frac{(l^i)^2 P}{(\sum l^j)^2}. \tag{35}$$

Since (35) is always true, compare (32) with (35). For (32) to hold, we should set

$$T \leq \frac{(l^i)^2 P}{(\sum l^j)^2}. \tag{36}$$

Since $P = J^u + NT$, the participation constraint for consumer i to purchase tickets is therefore

$$J^u \geq \frac{T\left(\sum l^j\right)^2}{\left(l^i\right)^2} - NT. \tag{37}$$

Since the lowest demand consumer will buy the smallest amount of tickets, represented by l^{L*}, and the Corporation has this information, the Corporation therefore can calculate J^u to ensure that every consumer will participate and (37) is satisfied as an equality. We now can consider the Corporation's maximizing problem:

$$\begin{aligned} Max\ W &= \sum \omega^j - \sum l^{j*} - NT + \sum V^j(G) + (J^u + NT) \qquad (38) \\ G &= \sum l^{j*} - J^u \\ J^u &= \frac{T\left(\sum l^{j*}\right)^2}{\left(l^{L*}\right)^2} - NT \end{aligned}$$

The first-order necessary condition for the corporation's problem is:

$$\begin{aligned}\frac{\partial W}{\partial T} &= -\sum \frac{\partial l^{j*}}{\partial T} + \sum V^{i'}(G)\left(\sum \frac{\partial l^{j*}}{\partial T} - X + N\right) + X - N = 0 \\ &= \left(\sum V^{i'}(G) - 1\right)\left(\frac{\partial l^{j*}}{\partial T} - X + N\right) = 0 \end{aligned} \tag{39}$$

where

$$X = \left(\frac{2T\sum l^{j*}}{(l^{L*})^2}\right)\sum \frac{\partial l^{j*}}{\partial T} + \frac{(\sum l^{j*})^2}{(l^{L*})^2} - \left(\frac{2T\left(\sum l^{j*}\right)^2}{(l^{L*})^3}\right)\frac{\partial l^{L*}}{\partial T}$$

As long as $\left(\sum \frac{\partial l^{j*}}{\partial T} - X + N\right) \neq 0$ then $\left(\sum V^{i'}(G) - 1\right) = 0$, i.e., the provision of public good attains its optimum.

Now consider consumer i's marginal utility on public good in (34) together with the fact that $P = J^u + NT$ where $J^u = \frac{T\left(\sum l^{j*}\right)^2}{(l^{L*})^2} - NT$, we obtain

$$V^{i'}(G) = 1 - \left(\frac{\sum l^{j*} - l^{i*}}{(\sum l^{j*})^2}\right)\left(\frac{(\sum l^{j*})^2 T}{(l^{L*})^2}\right)$$

$$l^{i*} = \sum l^{j*} - \left[\frac{(l^{L*})^2}{T}\left(1 - V^{i'}(G)\right)\right] \tag{40}$$

However, summing consumers' marginal utility on public good in (34) also gives us

$$\sum V^{i'}(G) = N - \left(\frac{(N-1)\sum l^{j*}}{(\sum l^{j*})^2}\right) P$$

As (39) is satisfied as an equality, we know that $\sum V^{i'}(G) = 1$. Consequently,

$$P = \sum l^{j*} \tag{41}$$

equation (41) implies that the total prize pool is actually equal to the total amount bet, which means that our lottery pot is a fair gamble. Substituting equation (36) into equation (41), we obtain

$$\sum l^{j*} = \frac{(l^{L*})^2}{T} \tag{42}$$

Substituting (42) into (40) together with the fact that $\sum l^{j*} = G^* + J^u$, we finally obtain that

$$l^{i*} = V^{i'}(G^*)G^* + V^{i'}(G^*)J^u.$$

$V^{i'}(G^*)G^*$ is the Lindahl price for the consumption of public good. In the previous model where there is no fixed prize, i.e. $J^u = 0$, consumers buy tickets equal to their Lindahl price for the consumption of public good as long as consumers' utility functions are not overly concave in G. But when consumers are reluctant gamblers the Corporation has to use the fixed prize, J^u, to make the lottery more attractive to consumers. Since J^u in this case is big enough that even the lowest demand consumer is willing to purchase some tickets, $V^{i'}(G^*)J^u$ is therefore the extra number of tickets that consumer i buys because of the attractiveness of the fixed prize.

As the thoughtful reader will notice, no consideration in the above analysis is given to the individual bettor's income constraint. The problem with the solution presented above is that, in some circumstances, when the prize pool is enriched to the point that all citizens would wish to participate, the amount that enthusiastic gamblers wish to parry exceeds their income. This is clearly not feasible. Consequently, when income constraints must be taken into account, the Lottery Corporation is faced with a second-best problem, since it cannot increase the prize pool to the level necessary to entice all citizens to participate. This means that, even when the pool is selected optimally, the first-best level of provision will not be achieved, although it is trivial to check that, for any prize pool in which part of the prize comes from participation fees, the level provided is weakly greater under the two-part lottery than that provided by Morgan's simple raffle, which in turn exceeds the level provided under the straight subscription model. Further, for those who do participate in the lottery scheme, the analysis provided above continues to be valid.

6 An Example

The purpose for this section is to give an concrete illustration of the lottery financing public good model which we have discussed above. For simplicity, consider an economy with 3 consumers. Each of them is distinguished by their level of wealth ω^i, and their preferences over the public good $V^i(G)$. Suppose that $V^i(G) = \alpha^i G^{1/2}$, where $\alpha^i = 1/i, i = \{1, 2, 3\}$ and $G = \sum l^j - J$.

6.1 Case One: Coercive Lottery

The corporation sets $J = 0$, $T = G/N$ so that $P = NT = 3T$ and $G = \sum l^j = 3T$. From the consumer's first-order condition:

$$-1 + V^{i\prime}(G) + \left(\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2} \right) P = 0. \tag{43}$$

given $V^i(G) = \alpha^i G^{1/2}$ thus the marginal utility for the consumption of public good $V^{i'}(G) = \frac{\alpha^i}{2}(G)^{-1/2}$ where $i = \{1, 2, 3\}$. Using the fact that $\sum l^{j*} = G^*$ and substituting each consumer's marginal utility into (43), we then obtain

$$\begin{aligned} l^{1*} &= \frac{(G^*)^{1/2}}{2} \\ l^{2*} &= \frac{(G^*)^{1/2}}{4} \\ l^{3*} &= \frac{(G^*)^{1/2}}{6} \end{aligned}$$

note that $l^{i*} = V^{i'}(G^*)G^*$, $\forall\ i \in \{1, 2, 3\}$, which is each consumer's Lindahl price for the consumption of the public good. Solving the three equations simultaneously, we then find the optimal tickets that each consumer will purchase, i.e. $l^{1*} = \frac{11}{24} \cong 0.46$, $l^{2*} = \frac{11}{48} \cong 0.23$, and $l^{3*} = \frac{11}{72} \cong 0.15$.

6.2 Case Two: Voluntary Lottery with Uniform Tax

The Corporation now sets $T = \frac{(l^3)^2}{\sum l^j}$ (applying the optimal solution stated as (42), together with the fact that consumer 3 is the one with the lowest demand for the public good in this example.) T thus ensure that everyone will participate and the provision of public good G^* is at the social optimal level. In addition, we also learn from (38) that $J^u = \frac{T(\sum l^{j*})^2}{(l^{L*})^2} - 3T$, or $P = J^u + 3T = \frac{T(\sum l^{j*})^2}{(l^{L*})^2} = \sum l^{j*}$ (from equation (41))

In this uniform tax case, since $V^{i'}(G) = \frac{\alpha^i}{2}(G)^{-1/2}$ where $G = (\sum l^j - J^u)$. Thus with the value of J^u we obtain $V^{i'}(G) = \frac{\alpha^i}{2}(\sum l^j - \frac{T(\sum l^{j*})^2}{(l^{3*})^2} + 3T)^{-1/2} = \frac{\alpha^i}{2}(3T)^{-1/2}$. Substituting each consumer's marginal utility into (43), we then obtain:

$$
\begin{aligned}
\frac{1}{4}(\frac{\sum l^j}{3\,(l^3)^2}) - \frac{(l^1)^2}{(\sum l^j)^2} &= 0 \\
\frac{1}{16}(\frac{\sum l^j}{3\,(l^3)^2}) - \frac{(l^2)^2}{(\sum l^j)^2}. &= 0 \\
\frac{1}{36}(\frac{\sum l^j}{3\,(l^3)^2}) - \frac{(l^3)^2}{(\sum l^j)^2}. &= 0
\end{aligned}
$$

Solving the above equations simultaneously, we then find the optimal tickets that each consumer will buy under the uniform tax, i.e. $l^{1*} \cong 4.62, l^{2*} \cong 2.31$, and $l^{3*} \cong 1.54$. Notice that with all the known values of l^{i*} we then can find the value of $V^{i'}(G)J^u$, $\forall i$. For example, $V^{1'}(G)J^u = \frac{1}{2}(3T)^{-1/2}\left(\frac{T(\sum l^{j*})^2}{(l^{L*})^2} - 3T\right) \cong (\frac{1}{2}(0.84)^{-1/2}(7.63) = 4.15$, which is the approximate value of l^{1*} in this case minus l^{1*} in the previous case. Since l^{1*} in the previous case or case one is the Lindahl price for consumer 1, the difference between the two or the value of $V^{1'}(G)J^u$ is thus the extra ticket that consumer 1 purchases because of the attractiveness of the fixed prize J^u, and this is the same for consumers 2 and 3 as well.

7 Conclusion

Our study extends Morgan (1997) by introducing a lottery mechanism that is set up as a two part tariff. We are able to find a tax system such that the provision of public good attains the first-best optimum. Although lotteries have become a popular means for the financing of public goods, only a particular lottery design will lead to efficient provision. A two part tariff is one of the efficient mechanisms that we found but has never been used by any fund-raisers before. Thus we would recommend that the Lottery Corporation or charities that raise funds by means of lotteries consider the possibility of implementing the two part tariff lottery.

In addition, the model that we use here is a simultaneous-move game with a quasi-linear utility function. In order to consider income redistribution effects, further study should try to drop this assumption. Moreover, our study has only one lottery pot in the model, but in reality there exist many charities that run lotteries at the same time. Competition among lottery pots that affect consumers' contribution decisions should be considered in the future. A number of charities also run lotteries with two drawings. Thus two stage lottery games deserve to be considered as well.

8 Appendix A: Lottery Mechanism with General Utility Function

$$\max_{l^i} U^i(x, G) \tag{44}$$

$$\text{subject to } \omega^i = x^i + l^i + T^i \text{ with probability of loss } 1 - \frac{l^i}{\sum_j l^j}$$

$$\text{and } \omega^i + J + \sum_j T^j = x^i + l^i + T^i \text{ with probability of win } \frac{l^i}{\sum_j l^j}$$

$$G = \sum_j l^j - J.$$

where $U^i(\cdot)$ is Von Neumann Morgenstern (VNM) utility function with $U^i_{xx} < 0, U^i_{xG} \geq 0, U^i_{GG} < 0$. We can rewrite the above optimization problem as an expected utility function as follows:

$$\begin{aligned} \max_{l^i} EU^i(x^i, G) \quad = \quad & \left[1 - \frac{l^i}{\sum_j l^j}\right] U^i(\omega^i - l^i - T^i, \sum_j l^j - J) + \\ & \left[\frac{l^i}{\sum_j l^j}\right] U^i(\omega^i + J + \sum_j T^j - l^i - T^i, \sum_j l^j - J) \end{aligned} \tag{45}$$

given that $U^i(\omega^i - l^i - T^i, \sum_j l^j - J) = U^i(loss)$ and $U^i(\omega^i + J + \sum_j T^j - l^i - T^i, \sum_j l^j - J) = U^i(win)$. The first order condition for consumer i is:

$$
\begin{aligned}
\frac{\partial EU^i}{\partial l^i} &= 0 = -\left[\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2}\right] U^i(loss) + \left[1 - \frac{l^i}{\sum_j l^j}\right]\left[-U^i_x(loss) + U^i_G(loss)\right] \\
&\quad + \left[\frac{\sum_j l^j - l^i}{\left(\sum_j l^j\right)^2}\right] U^i(win) + \left[\frac{l^i}{\sum_j l^j}\right]\left[-U^i_x(win) + U^i_G(win)\right]
\end{aligned}
$$

In order to prove that the lottery mechanism increases the level of provision of the public good and that a fixed fee instrument is better than a fixed prize, we have to deal with the second derivative of both the utilities of winning and losing. Without specific functional form, we do not know the magnitude of $U^i_{xx}(loss)$, $U^i_{xG}(loss)$, $U^i_{GG}\ (loss)$ as well as $U^i_{xx}(win)$, $U^i_{xG}(win)$, $U^i_{GG}\ (win)$, we thus cannot determine the sign for $\frac{\partial G}{\partial T}$ and $\frac{\partial G}{\partial T}$. However, we can simply show that the lottery mechanism can increase the level of the voluntary contribution for the provision of the public good by assuming that consumers are identical. Accordingly we get:

$$
\begin{aligned}
\frac{\partial EU^i}{\partial l^i} &= 0 = -\left[\frac{(N-1)}{Nl}\right]\left[U^i(loss) - U^i(win)\right] - \\
&\left[U^i_x(win) - U^i_G(win)\right] + \\
&(N-1)\left[U^i_x(loss) - U^i_G(loss)\right]
\end{aligned}
$$

Totally differentiating the above expression with respect to dl, dJ, and dT give us the following result:

$$
N\frac{dl}{dJ} = \frac{X_J}{Y} > 0
$$

where

$$
\begin{aligned}
X_J &= \left[\frac{N-1}{Nl}\right]\left[-U^i_G(loss) - U^i_x(win) + U^i_G(win)\right] - \\
&\left[U^i_{xx}(win) - 2U^i_{xG}(win) + U^i_{GG}(win)\right] + \\
&(N-1)\left[-U^i_{xG}(loss) + U^i_{GG}(loss)\right]
\end{aligned}
$$

$$
\begin{aligned}
Y &= \left[\frac{N-1}{Nl^2}\right]\left[U^i(loss) - U^i(win)\right] \\
&- \left[\frac{N-1}{Nl}\right]\left[-U_x^i(loss) + N\left(U_G^i(loss)\right) + U_x^i(win) - N\left(U_G^i(win)\right)\right] \\
&- \left[-U_{xx}^i(win) + (N-1)\,U_{xG}^i(win) - N\left(U_{GG}^i(win)\right)\right] \\
&- (N-1)\left[-U_{xx}^i(loss) + (N+1)\,U_{xG}^i(loss) - N\left(U_{GG}^i(loss)\right)\right]
\end{aligned}
$$

given that $U_G^i(win) = U_G^i(loss)$; i.e. whether the bettor i wins or losses in lottery, s/he can still enjoy the same amount of public good provided by the Lottery Corporation. Using this result together with the properties of the second derivative of the VNM utility function, we can then conclude that $\frac{dl}{dJ} > 0$. By the same token we can show that

$$
N\frac{dl}{dT} = \frac{X_T}{Y} > 0
$$

where

$$
\begin{aligned}
X_T &= \left[\frac{N-1}{Nl}\right]\left[-U_x^i(loss) - (N-1)\,U_x^i(win)\right] + \\
&\quad [N-1]\left[U_{xx}^i(win) - U_{xG}^i(win) - U_{xx}^i(loss) + U_{xG}^i(loss)\right]
\end{aligned}
$$

$$
\begin{aligned}
Y &= \left[\frac{N-1}{Nl^2}\right]\left[U^i(loss) - U^i(win)\right] \\
&\quad - \left[\frac{N-1}{Nl}\right]\left[-U_x^i(loss) + N\left(U_G^i(loss)\right) + U_x^i(win) - N\left(U_G^i(win)\right)\right] \\
&\quad - \left[-U_{xx}^i(win) + (N-1)\,U_{xG}^i(win) - N\left(U_{GG}^i(win)\right)\right] \\
&\quad - (N-1)\left[-U_{xx}^i(loss) + (N+1)\,U_{xG}^i(loss) - N\left(U_{GG}^i(loss)\right)\right]
\end{aligned}
$$

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Essay Two
Strategic Interaction and Charitable Fund-raising

1 Introduction

Non-profit organizations or charities provide a large number of public goods and services including health and medical services, education, museum exhibits, shelters for homeless people such as refugees, battered spouses, runaway teenagers, wildlife and environmental protection and research, sports programs such as baseball for disabled children, hockey leagues for youth, churches and other religious services. Sharpe (1994) reported that registered charities play a significant role in Canada's economy. He estimated that close to 70,000 organizations have been registered as charities with Revenue Canada with total revenue of $86 billion, or about 12 to 13 percent of Canada's Gross Domestic Product. With such an enormous number of organizations seeking to contribute to the common weal, and with financial resources often inversely proportional to the grandeur of their goals, many charities have become extremely inventive and determined in the pursuit of fund-raising strategies, which range from phone call solicitation, to running lotteries, to rummage sales, auctions and concerts. Larger charities often undertake significant advertising campaigns, through which they seek both to inform donors about their activities and plead for new funds. Since the competition for donor dollars is intense, many charities spend a significant proportion of their donation income on advertising and other fund-raising expenses, a reality that is a source of concern for many donors since this means that a smaller proportion of the money they donate will end up being used for charitable activity.

Given the intensely competitive nature of the environment in which charitable organizations must operate it is somewhat surprising that there is a relative paucity of existing research focusing on the nature and consequences of strategic interaction between rival charities. One issue which has attracted attention is that of the desirability of collecting funds via a single United Fund versus specialized separate charities. Rose-Ackerman (1980) studies a United Fund, which collects money and subsequently disburses it to specialized charities. Fund-raising via a United Fund is considered to be advantageous because it allows for a reduction in the cost of the fund-raising campaign. As well, relying on a United Fund provides a solution to the agency problem arising between donors and charities, because the United Fund can take on the role of auditing and monitoring of the specialized charities which are the ultimate recipients of the funds donated, and in that role can assure donors that their money is being well spent. However, Rose-Ackerman (1980) argues that in reality the United Charities actually have very limited power to appeal to donors to give them the money rather than to a specific charity, since by giving directly to specialized charities donors can ensure that their contributions are used to support those organizations whose goals they wish to promote. Additionally, those specialized charities which have acquired good reputations amongst givers have strong bargaining power, enabling them to negotiate a greater share of the total funds collected, since they can creditably threaten to leave the United Charity to run their own campaigns.

Relatedly, but using the tools of non-cooperative game theory, Bilodeau (1992) directly addresses the efficiency of financing charitable activity via 'United Funds' versus stand-alone charities. He considers a non-cooperative game in which consumers choose to donate their money either to specific charities or to the United Fund. From the standpoint of consumers, it is typically utility-maximizing to donate their money directly to their favourite charities rather than to the United Fund; this result is due largely to the fact that there is typically a fixed attribution rule determining how funds collected are to be split amongst the member charities, and this attribution rule may not reflect consumer preferences. If, however, the United Fund is the last mover, it can offset individual donations by reallocating funds amongst charities to ensure that no charity receives too much or too little. Nevertheless, if the United Fund's earmarked contribution rule contrasts distinctly with individual preferences, it will lower the overall level of contributions, and thus the overall impact of the United Fund's activity on social welfare is uncertain. This may be the reason why the United Fund nowadays allows donors to designate their contributions in order to attain a higher level of fund-raising. In a subsequent study, Bilodeau and Slivinski (1997) considers consumers' contribution decision when there is a competition between specialized charities and the diversified charity and where, additionally, the individual donor can influence the allocation of donations by founding a charity himself. With two public goods in the model, Bilodeau and Slivinski (1997) predicts that the level of public good should be higher with two specialized charities rather than one single diversified charity. This result is consistent with Bilodeau (1992) in the sense that the diversified charity can increase the overall level of contributions by honoring donors' wishes about the way in which their contributions are to be used.

A number of papers explicitly explore the issue of the cost of fund-raising, and whether or not these costs are influenced by the competitive environment in which charities must operate. Rose-Ackerman (1982) presents a model to explain charities' advertising behavior. She concludes that advertising is not only excessive in the absence of entry barriers, but also that charities with heavy fund-raising will become larger while charities which do less fund-raising will contract. She argues that a monopoly United Fund will be superior to a system of rival charities if and only if either (i) demand for public goods is inelastic and charities are different in terms of services and costs of provision or (ii) demand is elastic but costs of provision are similar, and fund-raising expenses are high for individual charities. Andreoni (1998) considers the role of 'development directors', who launch fund-raising campaigns only once they have first secured large initial contributions from 'leadership givers'. He considers an economy in which the cost function for the provision of public good is characterized by both fixed and variable costs, and in which fund-raising is costly. The charity thus uses government grants or donations from leadership givers to overcome the fixed cost of the public good provision before launching the public campaign. Andreoni finds that a relatively small amount of initial seed money can attract enormous subsequent donation income.

One obvious weakness of the literature discussed above, however, is that the literature makes relatively short shrift of the fact that consumer preferences are of course defined over the entire set of goods and services provided by charitable organizations, and that they will typically choose not to concentrate all of their charitable giving on a single organization, but will spread their donations over a number of worthy groups. One consequence of this reality is that fund-raising campaigns undertaken by one charity can have either a positive or negative impact on the donations received by other charities. For example, the success of the advertising campaign promoting the Heart Research Foundation Lottery is liable to have a negative impact on the General Hospital Lottery (since consumers may take the view that they have 'already given') but may have a positive impact on the fund-raising campaigns of other medical research institutes (by increasing donors' interest in supporting medical research).

In contrast with the existing literature, the research presented here explicitly models the interaction between consumer preferences, on the one hand,

and the strategic rivalry between charities, on the other, and is specifically concerned with analyzing how these factors affect both the level of donations and the level of fund-raising expenses (advertising). To this end, we build a game-theoretic model in which we can compare the efficiency of the provision of pure public goods in alternative institutional settings, that is, by a United Fund and by two stand-alone charities. We also investigate the objective function of the charities by contrasting social welfare maximizing charities with income maximizing charities. We find that the objective function of the charity does have a significant influence on the charity behaviour in a strategic environment; while the welfare maximizing charities always choose the same level of advertising whether the public goods are provided by single United Fund or two stand-alone charities, advertising expenditures by the income maximizing charities, however, are different significantly when the public goods are provided by different institutions; i.e., the United Fund, stand-alone charities that run their advertising campaigns simultaneously and those in the sequential setting.

Our study proceeds as follows. Section two presents the model. Section three considers the planning problem, and establishes a benchmark for efficient provision of the public goods. Section four considers an economy in which provision of the public goods is assured by a benevolent united charity model, which respects donor preferences with respect to the attribution of donations. This institutional framework can be contrasted with that considered in section five, where each public good is provided by a specialized charitable organization. In section six, we investigate the income maximizing charities and contrast the equilibrium outcomes with those of the benevolent charities in section three and four. Section seven concludes.

2 The Model

We consider an economy with N consumers, indexed by i, and two charities, indexed by j. The work of the charities is funded by donations solicited from consumers. We use g_1^i and g_2^i to denote the amount of money that individual i contributes to each of the charities. Each charity undertakes two activities, both of which have the characteristics of pure public goods: an advertising campaign $(A_j, j = 1, 2)$, to provide consumers with information about its activities, and a physical good (or service) $(G_{j,}\ j = 1, 2)$. Numerous examples of 'informative advertising' by charities can be cited: advertisements to attract funds to help people in Kosovo or to feed starving children in Ethiopia; campaigns to support medical research into various kinds of diseases such as cancer, heart attacks, multiple sclerosis, etc. Charities produce G_j using a concave production technology which is assumed to have the following specific functional form:

$$G_j = \log(\sum_{i=1}^{N} g_j^i - A_j) \qquad \text{...............}; \ j = 1, 2 \tag{1}$$

where $\sum_{i=1}^{N} g_j^i$ is the total donation income received by charity j; in other words, they are the inputs for the production of G_1 and G_2, while A_1 and A_2 measure the costs incurred by charities in running their fund-raising campaigns, which we shall refer to as advertising expenditures. Since charities are non-profit organizations, they use all their income less advertising expenses to fund the provision of their public good.

Consumers are distinguished from one another by their level of wealth but are otherwise identical. Consumers have an initial endowment of the private good which they must allocate either to donations or to their own private consumption (x^i). Since the public goods provided by the charities are pure public goods, free-riding is of course an option, and non-contributors will therefore enjoy the same levels of consumption of both information and of G_1 and G_2 as do contributors. Consumer i's budget constraint thus can be presented as follows:

$$\omega^i = x^i + g_1^i + g_2^i \tag{2}$$

where the level of contributions must be non-negative; i.e. $g_1^i \geq 0$, $g_2^i \geq 0$.

Consumers have quasi-linear utility functions defined as follows:

$$
\begin{aligned}
U^i &= x^i + \Psi(A_1, A_2)(G_1) + \Phi(A_1, A_2)(G_2) + \alpha(G_1)(G_2) \\
&= \omega^i - g_1^i - g_2^i + \Psi(A_1, A_2)\log(\sum_{i=1}^{N} g_1^i - A_1) + \\
&\quad \Phi(A_1, A_2)\log(\sum_{i=1}^{N} g_2^i - A_2) + \alpha\log(\sum_{i=1}^{N} g_1^i - A_1)\log(\sum_{i=1}^{N} g_2^i - A_2). \quad (3)
\end{aligned}
$$

It is useful to spend some time discussing the specification of the utility function in some detail.[1] $\Psi(\cdot)$ and $\Phi(\cdot)$ describe the way in which the informative advertising campaigns undertaken by charities provide consumption benefits for consumers. In practise, this is a sort of 'warm glow' effect: when the fund-raising campaign by the United Way lists the services that were funded the previous year with the fruits of the donations collected, donors derive greater pleasure from contributing a dollar than when they simply know that the United Way has been funding 'good works'. Furthermore, they are more likely to feel enthusiastic about publicly describing themselves as 'supporters

[1]As in most modelling exercises, there is a trade-off between the generality of the specification of the economic environment and the sharpness of the results obtained. With a significantly more general specification of the utility function, it is possible to establish that the general flavour of the results presented below is maintained; i.e., that the outcome of the charitable giving game is not efficient, but one cannot establish whether there is too much or too little advertising by charities.

of the United Way', which everyone knows about, than of a local shelter for recovering alcoholics (however worthy) which has no public profile. We assume that Ψ_1 and Φ_2, which is the marginal direct informational benefit of advertising, is positive. Notice that $\Psi(\cdot)$ and $\Phi(\cdot)$ are general functions; in particular, it may be the case that $\Psi(0,0) = \Phi(0,0) = 1$, although this is not required for subsequent analysis.

Advertising spending by any given charity affects the success of the fund-raising campaigns of their counterparts. For example, the two great art museums of Paris – the Museé du Louvre and the Museé d'Orsay – both compete to attract funds from donors interested in supporting the public availability of fine collections of paintings and sculptures. And whereas there is a natural division of the donor population that reflects the periods of art represented in each collection (pre-19th century for the Louvre; pre-20th century for the Orsay), many true art lovers will wish to support both institutions. Should the development department at the Louvre launch a campaign articulated around the theme 'Restore the Mona Lisa', it is likely that the Orsay will have a tough year: many donors are likely to decide to give more of their money to the Louvre, since they will feel particularly good about having helped to finance the restoration of such a celebrated work of art. In this case, Ψ_2 and Φ_1 are negative. But it is equally possible that advertising by one charity may raise the profile of related charities, thus making it easier for them to attract funding. For example, publicity funded by the Sierra Club about the adverse effects of acid rain may benefit 'Save the Rainforest'. In this case, Ψ_2 and Φ_1 would be positive.

The last term in the utility function is a non-linear interaction term, and reflects the interaction in terms of consumption between the two public goods. Here the key parameter is the sign of α: if α is negative this implies that the existence of one public good has negative effect on the consumption of the other. – e.g., the Musée du Louvre versus the Musée d'Orsay. In contrast, if α is positive, then an increase in the level of provision of one public good increases the benefits the consumer derives from the other; e.g., as may be the case for a Waterfowl protection fund and a Wetlands charity. In the analysis below we will show that α crucially affects consumers decisions about their donations, as well as the levels of advertising chosen by the charities.

3 Establishing A Benchmark: the Planning Problem

In this section, we study the solution to the optimization problem faced by a Benthamite social planner; this allocation will be used as the benchmark for our subsequent analysis. This is an appropriate specification of the planning problem in view of the quasi-linearity of consumer preferences, and the fact that consumers differ only with respect to wealth. Maximizing social welfare function is thus equivalent to maximizing the utility function of a representative consumer as follows:

$$\begin{aligned}\max_{g_1,g_2,A_1,A_2} W &= \omega - g_1 - g_2 + \Psi(A_1, A_2)\log(Ng_1 - A_1) + \\ &\quad \Phi(A_1, A_2)\log(Ng_2 - A_2) + \\ &\quad \alpha \log(Ng_1 - A_1)\log(Ng_2 - A_2). \qquad (4)\end{aligned}$$

The Planner thus obtains the following first-order necessary conditions:

$$\frac{\partial W}{\partial g_1} = -1 + \frac{N\Psi(A_1, A_2)}{(Ng_1 - A_1)} + \frac{N\alpha \log(Ng_2 - A_2)}{(Ng_1 - A_1)} = 0 \tag{5}$$

$$\frac{\partial W}{\partial g_2} = -1 + \frac{N\Phi(A_1, A_2)}{(Ng_2 - A_2)} + \frac{N\alpha \log(Ng_1 - A_1)}{(Ng_2 - A_2)} = 0 \tag{6}$$

$$\begin{aligned} \frac{\partial W}{\partial A_1} &= 0 = \Psi_1 \log(Ng_1 - A_1) + \Phi_1 \log(Ng_2 - A_2) \\ &\quad - \frac{\Psi(A_1, A_2)}{(Ng_1 - A_1)} - \frac{\alpha \log(Ng_2 - A_2)}{(Ng_1 - A_1)} \\ &= \Psi_1 \log(Ng_1 - A_1) + \Phi_1 \log(Ng_2 - A_2) - \frac{1}{N} = 0 \end{aligned} \tag{7}$$

and,

$$\begin{aligned} \frac{\partial W}{\partial A_2} &= 0 = \Psi_2 \log(Ng_1 - A_1) + \Phi_2 \log(Ng_2 - A_2) \\ &\quad - \frac{\Phi}{(Ng_2 - A_2)} - \frac{\alpha \log(Ng_1 - A_1)}{(Ng_2 - A_2)} \\ &= \Psi_2 \log(Ng_1 - A_1) + \Phi_2 \log(Ng_2 - A_2) - \frac{1}{N} = 0 \end{aligned} \tag{8}$$

The system of equations (5) - (8) implicitly define the optimal levels of each of the choice variables. We shall denote by g_1^*, g_2^*, A_1^*,and A_2^* the solution to this system of equations.

Notice that equations (5) and (6) describe the appropriate version of the Samuelson (1954) conditions for the efficient provision of pure public goods. Re-arranging these expressions we obtain:

$$N\left[\frac{\Psi(A_1^*, A_2^*)}{(Ng_1^* - A_1^*)} + \frac{\alpha \log(Ng_2^* - A_2^*)}{(Ng_1^* - A_1^*)}\right] = 1 \tag{9}$$

$$N\left[\frac{\Phi(A_1^*, A_2^*)}{(Ng_2^* - A_2^*)} + \frac{\alpha \log(Ng_1^* - A_1^*)}{(Ng_2^* - A_2^*)}\right] = 1 \tag{10}$$

where the right-hand side of each of equations (9) and (10) measures the marginal cost of provision of the relevant public good. It is equal to one since this is the utility cost of foregoing an additional unit of private consumption. The left-hand side of each of equations (9) and (10) measures the social marginal benefit to the economy of the last unit provided of the relevant public good, which is of course exactly N times the marginal benefit received by the representative consumer. Notice also that there are two terms on the left-hand sides of equations (9) and (10), and specifically the crucial role of the sign of the interaction term: *ceteris paribus*, a lower level of g_1, g_2 will be optimal if α is negative than if α is positive.

Turning now to the issue of appropriate levels of advertising expenditure, we rewrite equations (7) and (8) as follows:

$$N\left[\Psi_1 \log(Ng_1^* - A_1^*) + \Phi_1 \log(Ng_2^* - A_2^*)\right] = 1 \tag{11}$$

$$N\left[\Psi_2 \log(Ng_1^* - A_1^*) + \Phi_2 \log(Ng_2^* - A_2^*)\right] = 1 \tag{12}$$

As before, these equations are the appropriate statements of the Samuelson conditions, but this time with respect to informative advertising. The right-hand sides of (11) and 12) again reflect the marginal cost of production; i.e., a dollar increase in advertising expenditure reduces private consumption by a dollar. The left-hand sides reflect the social marginal benefit of this advertising; i.e., the marginal increase in the 'warm glow' effect. It is immediately evident that if advertising by one charity adversely affects the success of the fund-raising campaign undertaken by its counterpart ($\Phi_1, \Psi_2 < 0$) then the optimal levels of advertising are smaller than they would be in a 'single charity' world, and vice versa if the spill-over effects are positive. Notice also that optimal levels of advertising are generally positive, since this generates consumption benefits.

4 Benevolent United Charity

In this section we examine the level of donations elicited and the levels of advertising expenditure chosen when production of the public goods is the responsibility of a single charitable organization – in effect, a United Way. These outcomes are compared to our benchmark model above. It is shown that even when consumers choose the first-best level of donations, strategic considerations will induce the United Way to choose a different level of advertising expenditures than would be chosen by a Benthamite social planner. Subsequently, we compare and contrast the outcomes under this institutional environment with those which arise when each public good is funded by a separate charitable organization.

It is assumed that the United Way is a benevolent charity. That is, in choosing its level of advertising expenditure for each of its charitable activities, the United Way seeks to maximize social welfare, and thus has exactly the same objective as the Planner. Obviously, alternative objective functions could have been considered – for example, maximizing the output of the charity, maximizing the benefit-cost ratio, minimizing cost, maximizing revenue, etc. In this section, however, we consider a truly benevolent charity, because we wish to establish whether or not outcomes will be efficient in the 'best of all' possible decentralized worlds. We also give consumers the right to control how their donations are allocated to each of the United Way's charitable activities; i.e., the United Way cannot arbitrarily divide total donations received between the two charities.[2]

We model the interaction between the single benevolent charity and consumers as a two-stage non-cooperative game. In the first stage, the United Way runs a campaign informing consumers about the public goods funded by the United Way and asking them to contribute to this year's campaign.

[2]Nor would it want to: no increase in social welfare could be obtained by allocating funds in a way inconsistent with donor wishes. As pointed out by Bilodeau (1992) and Bilodeau and Slivinski (1997), if united charities employ fixed formulae for apportioning funds received, a system of stand-alone charities may be more efficient. Thus, in this model, the existence of a fixed apportionment rule cannot be identified as a potential source of inefficiency for a United fund.

In the second stage, consumers decide how much to contribute to each of the physical public goods produced by the charity; the United Way collects the donations and uses all donations g_j^i (less advertising expenses incurred for that good) for production of G_j. Everyone then receives their payoff and the game ends. The equilibrium concept used is that of subgame perfect Nash equilibrium, and so the game is solved using backward induction.

4.1 Stage two: Consumer i chooses the optimal level of donations

In stage two, consumers must choose how much to donate to each of the charitable activities funded by the United Way. This decision is taken *after* the United Way has run its advertising campaign, and thus A_1, A_2 are parameters of the consumer's decision problem. Maximizing consumer i's utility function with respect to g_1^i and g_2^i yields the following first-order necessary conditions:

$$\frac{\partial U^i}{\partial g_1^i} = -1 + \frac{\Psi(A_1, A_2)}{(\sum_{i=1}^N g_1^i - A_1)} + \frac{\alpha \log(\sum_{i=1}^N g_2^i - A_2)}{(\sum_{i=1}^N g_1^i - A_1)} = 0 \qquad (13)$$

$$\frac{\partial U^i}{\partial g_2^i} = -1 + \frac{\Phi(A_1,\ A_2)}{(\sum_{i=1}^{N} g_2^i - A_2)} + \frac{\alpha \log(\sum_{i=1}^{N} g_1^i - A_1)}{(\sum_{i=1}^{N} g_2^i - A_2)} = 0 \qquad (14)$$

We define $\widetilde{g_1^i}$ and $\widetilde{g_2^i}$ as the implicit solutions for consumer i 's strategic choice variables derived from solving the preceding first-order conditions given the levels of advertising expenditure A_1, A_2 chosen by the United Way in stage one. Rewriting the first-order conditions, we obtain:

$$\frac{\Psi\left(A_1,\ A_2\right)}{\left(\sum_{i=1}^{N} \widetilde{g_1^i} - A\right)} + \frac{\alpha \log\left(\sum_{i=1}^{N} \widetilde{g_2^i} -\ A_2\right)}{\left(\sum_{i=1}^{N} \widetilde{g_1^i} - A_1\right)} \ = \ 1 \qquad (15)$$

$$\frac{\Phi\left(A_1,\ A_2\right)}{\left(\sum_{i=1}^{N} \widetilde{g_2^i} -\ A_2\right)} + \frac{\alpha \log\left(\sum_{i=1}^{N} \widetilde{g_1^i} - A_1\right)}{\left(\sum_{i=1}^{N} \widetilde{g_2^i} -\ A_2\right)} \ = \ 1 \qquad (16)$$

Since individuals take their decisions independently, the right-hand side of each of equations (15) and (16) is simply the marginal cost of provision as perceived by the individual. As it is well-known in similar subscription models of voluntary provision of public goods, this is equal to one since the individual foregoes a unit of the private good to produce an additional unit of G_j. Individuals thus equate the private marginal cost of provision

– a unit of foregone private good – to his/her own marginal benefit from an additional unit of consumption of G_j. As we saw above in studying the planning model, the marginal benefit from consumption is composed of two effects – the direct benefit of an additional unit of consumption of the public good plus (or minus) the marginal impact on the interaction term.

For subsequent analysis it is useful to study the sensitivity of consumer donation decisions to the changes in the level of advertising for each good. Recalling that consumers are identical, we can totally differentiate each of equations (13) and (14) with respect to $\widetilde{g}_1$, $\widetilde{g}_2$, A_1, A_2 and, applying Cramer's Rule, obtain the following comparative statics results:

$$\frac{d\widetilde{g}_1}{dA_1} = \frac{1}{N} + \frac{\Psi_1}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} + \frac{\frac{\alpha\Phi_1}{(N\widetilde{g}_2 - A_2)}}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} \quad (17)$$

$$= \frac{1}{N} + \frac{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)\Psi_1 + (N\widetilde{g}_1 - A_1)\alpha\widetilde{\Phi_1}}{N\left[(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2) - \alpha^2\right]} \quad (18)$$

$$\frac{d\widetilde{g}_2}{dA_1} = \frac{\Phi_1}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} + \frac{\frac{\alpha\Psi_1}{(N\widetilde{g}_1 - A_1)}}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} \quad (19)$$

$$= \frac{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)\Phi_1 + (N\widetilde{g}_2 - A_2)\alpha\Psi_1}{N\left[(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2) - \alpha^2\right]} \quad (20)$$

$$\frac{d\widetilde{g}_1}{dA_2} = \frac{\Psi_2}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} + \frac{\frac{\alpha\Phi_2}{(N\widetilde{g}_2 - A_2)}}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} \tag{21}$$

$$= \frac{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)\Psi_2 + (N\widetilde{g}_1 - A_1)\alpha\Phi_2}{N\left[(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2) - \alpha^2\right]} \tag{22}$$

$$\frac{d\widetilde{g}_2}{dA_2} = \frac{1}{N} + \frac{\Phi_2}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} + \frac{\frac{\alpha\Psi_2}{(N\widetilde{g}_1 - A_1)}}{N\left[1 - \frac{\alpha^2}{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)}\right]} \tag{23}$$

$$= \frac{1}{N} + \frac{(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2)\Phi_2 + (N\widetilde{g}_2 - A_2)\alpha\Psi_2}{N\left[(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2) - \alpha^2\right]} \tag{24}$$

Note that the denominator $[(N\widetilde{g}_1 - A_1)(N\widetilde{g}_2 - A_2) - \alpha^2]$ is the Jacobian term, which must be positive if the second-order conditions are to be satisfied. A sufficient condition for this to be true is that $(N\widetilde{g}_1 - A_1) > |\alpha|$ and $(N\widetilde{g}_2 - A_2) > |\alpha|$, which will be the case (along the equilibrium path) if α is 'small enough' in absolute value relative to the level of the G_j.[3] Notice also that if α, Ψ_2 and Φ_1 are negative, $\frac{d\widetilde{g}_1}{dA_1} > 0$, $\frac{d\widetilde{g}_2}{dA_2} > 0$, $\frac{d\widetilde{g}_2}{dA_1} < 0$, and $\frac{d\widetilde{g}_1}{dA_2} < 0$; i.e., an increment in advertising with respect to either public good increases

[3] Obviously, without putting strong restrictions on the domain with respect to g and A, this cannot be true for all possible (g, A) pairs.

donations received to finance provision of that public good, while decreasing donations received for financing provision of the other public good. In contrast, if α, Ψ_2 and Φ_1 are positive, then $\frac{d\tilde{g_1}}{dA_1}, \frac{d\tilde{g_2}}{dA_2}, \frac{d\tilde{g_2}}{dA_1}, \frac{d\tilde{g_1}}{dA_2}$ are all positive, and so an increase in advertising for one public good increases both own-donations, and donations made to the other charity. In contrast, if the sign of α is opposite to those of Ψ_2 and Φ_1 then the sign of the comparative statics effect is uncertain.

Looking more closely at the interpretation of the first-order conditions, and assuming that α, Ψ_2 and Φ_1 all have the same sign, what is striking about equation (18) is that when the United Way increases its advertising budget by one dollar, aggregate donations directed to funding provision of the public good G_1 always increase by more than one dollar. The first term reflects the fact that if the charity increases its advertising by one dollar, donors in aggregate must respond by increasing their gifts by an equal amount if they are to maintain the amount of public good provided. The second term is the direct (or positive) advertising effect since Ψ_1 is the marginal benefit to the donor of a marginal increase in advertising for the public good, whereas the third term reflects the marginal change in the importance of the consumption externality. A similar interpretation can be provided for equations (20), (22), and (24).

4.2 Stage one: choosing the level of advertising for each public good.

Recall that we have assumed that the United Way in this model seeks to maximize social welfare. Therefore, the decision problem for the United Way can be expressed as follows:

$$\begin{aligned}
\underset{A_1,A_2}{Max}\,\Pi &= \omega - \widetilde{g}_1 - \widetilde{g}_2 + \Psi(A_1,A_2)\log(N\widetilde{g}_1 - A_1) + \\
&\quad \Phi(A_1,A_2)\log(N\widetilde{g}_2 - A_2) + \alpha\log(N\widetilde{g}_1 - A_1)\log(N\widetilde{g}_2 - A_2)
\end{aligned}$$

$$\begin{aligned}
\frac{\partial \Pi}{\partial A_1} &= 0 = \Psi_1\log(N\widetilde{g}_1 - A_1) + \Phi_1\log(N\widetilde{g}_2 - A_2) \\
&\quad -\frac{\Psi(A_1,A_2)}{(N\widetilde{g}_1 - A_1)} - \frac{\alpha\log(N\widetilde{g}_2 - A_2)}{(N\widetilde{g}_1 - A_1)} \\
&\quad +\frac{d\widetilde{g}_1}{dA_1}\left[-1 + \frac{N\Psi(A_1,A_2)}{(N\widetilde{g}_1 - A_1)} + \frac{N\alpha\log(N\widetilde{g}_2 - A_2)}{(N\widetilde{g}_1 - A_1)}\right] \\
&\quad +\frac{d\widetilde{g}_2}{dA_1}\left[-1 + \frac{N\Phi(A_1,A_2)}{(N\widetilde{g}_2 - A_2)} + \frac{N\alpha\log(N\widetilde{g}_1 - A_1)}{(N\widetilde{g}_2 - A_2)}\right]
\end{aligned}$$

and,

$$\begin{aligned}
\frac{\partial \Pi}{\partial A_2} &= 0 = \Psi_2 \log(N\widetilde{g}_1 - A_1) + \Phi_2 \log(N\widetilde{g}_2 - A_2) \\
& -\frac{\Phi(A_1, A_2)}{(N\widetilde{g}_2 - A_2)} - \frac{\alpha \log(N\widetilde{g}_1 - A_1)}{(N\widetilde{g}_2 - A_2)} \\
+ & \frac{d\widetilde{g}_1}{dA_2}\left[-1 + \frac{N\Psi(A_1, A_2)}{(N\widetilde{g}_1 - A_1)} + \frac{N\alpha \log(N\widetilde{g}_2 - A_2)}{(N\widetilde{g}_1 - A_1)}\right] \\
+ & \frac{d\widetilde{g}_2}{dA_2}\left[-1 + \frac{N\Phi(A_1, A_2)}{(N\widetilde{g}_2 - A_2)} + \frac{N\alpha \log(N\widetilde{g}_1 - A_1)}{(N\widetilde{g}_2 - A_2)}\right]
\end{aligned}$$

Using the first-order conditions for the consumer's choice problem ((15) and (16)), we can simplify the United Way's first-order conditions as follows:

$$\begin{aligned}
\frac{\partial \Pi}{\partial A_1} &= 0 = \Psi_1 \log(N\widetilde{g}_1 - A_1) + \Phi_1 \log(N\widetilde{g}_2 - A_2) \\
& -1 + [N-1]\left(\frac{d\widetilde{g}_1}{dA_1} + \frac{d\widetilde{g}_2}{dA_1}\right)
\end{aligned} \tag{25}$$

$$\begin{aligned}
\frac{\partial \Pi}{\partial A_2} &= 0 = \Psi_2 \log(N\widetilde{g}_1 - A_1) + \Phi_2 \log(N\widetilde{g}_2 - A_2) \\
& -1 + [N-1]\left(\frac{d\widetilde{g}_1}{dA_2} + \frac{d\widetilde{g}_2}{dA_2}\right).
\end{aligned} \tag{26}$$

At the solution to its optimization problem, the perceived social-welfare maximizing levels of advertising expenditure, $(\widetilde{A_1}, \widetilde{A_2})$, satisfy (25) and (26) and equate the social marginal benefit of an additional unit of advertising expenditure on the public good with the social marginal cost, as is clear from the expressions below:

$$\Psi_1 \log(N\widetilde{g_1} - \widetilde{A_1}) + \Phi_1 \log(N\widetilde{g_2} - \widetilde{A_2}) + (N-1)\left(\frac{d\widetilde{g_1}}{d\widetilde{A_1}} + \frac{d\widetilde{g_2}}{d\widetilde{A_1}}\right) = 1 \quad (27)$$

$$\Psi_2 \log(N\widetilde{g_1} - \widetilde{A_1}) + \Phi_2 \log(N\widetilde{g_2} - \widetilde{A_2}) + (N-1)\left(\frac{d\widetilde{g_1}}{d\widetilde{A_2}} + \frac{d\widetilde{g_2}}{d\widetilde{A_2}}\right) = 1 \quad (28)$$

The right-hand sides of equations (27) and (28) measure the marginal costs of an incremental increase in advertising expenditure, whereas the left-hand sides measure the net marginal benefits. Observe that the net marginal benefit is comprised of three effects. $\Psi_1 \log(N\widetilde{g_1} - \widetilde{A_1})$ is the net marginal benefit of increasing A_1 on the consumption benefits derived from G_1; this effect is always positive. $\Phi_1 \log(N\widetilde{g_2} - \widetilde{A_2})$ is the equivalent marginal effect of the increase in A_1 on the consumption benefits associated with G_2; the sign of this effect will depend on whether $\Phi_1 > 0$ or $\Phi_1 < 0$; if this effect is positive (negative), it will of course increase (decrease) the chosen level of advertising. The last term $(N-1)\left(\frac{d\widetilde{g_1}}{dA_1} + \frac{d\widetilde{g_2}}{dA_1}\right)$ turns out to be the most interesting (for the purposes of this analysis), and reflects the way in which the behaviour of the charity is affected by strategic considerations, and specifically by the donations game in stage two.

Substituting equations (17) and (19) into equation (25), as well as equations (21) and (23) into equation (26), we obtain:

$$\begin{aligned} \frac{\partial \Pi}{\partial A_1} &= 0 = \Psi_1 \log(N\widetilde{g_1} - \widetilde{A_1}) + \Phi_1 \log(N\widetilde{g_2} - \widetilde{A_2}) \\ &\quad -\frac{1}{N} + \left(\frac{N-1}{N}\right)\widetilde{K_1} \end{aligned} \tag{29}$$

where $\widetilde{K_1} = \left[\frac{(N\widetilde{g_1}-\widetilde{A_1})(N\widetilde{g_2}-\widetilde{A_2})(\Psi_1+\Phi_1)+(N\widetilde{g_1}-\widetilde{A_1})\alpha\Phi_1+(N\widetilde{g_2}-\widetilde{A_2})\alpha\Psi_1}{\left\{(N\widetilde{g_1}-\widetilde{A_1})(N\widetilde{g_2}-\widetilde{A_2})-\alpha^2\right\}}\right]$, and

$$\begin{aligned} \frac{\partial \Pi}{\partial A_2} &= 0 = \Psi_2 \log(N\widetilde{g_1} - \widetilde{A_1}) + \Phi_2 \log(N\widetilde{g_2} - \widetilde{A_2}) \\ &\quad -\frac{1}{N} + \left(\frac{N-1}{N}\right)\widetilde{K_2} \end{aligned} \tag{30}$$

where $\widetilde{K_2} = \left[\frac{(N\tilde{g}_1-\widetilde{A_1})(N\tilde{g}_2-\widetilde{A_2})(\Psi_2+\Phi_2)+(N\tilde{g}_1-\widetilde{A_1})\alpha\Phi_2+(N\tilde{g}_2-\widetilde{A_2})\alpha\Psi_2}{\left\{(N\tilde{g}_1-\widetilde{A_1})(N\tilde{g}_2-\widetilde{A_2})-\alpha^2\right\}}\right]$.

Notice that this last term does not appear in the analysis of the Planner's problem, above. This suggests that equilibrium outcomes will differ when charities act in a strategic environment. This hypothesis is investigated in greater detail, below, when equilibrium outcomes under different institutional settings are compared.

5 Benevolent Stand-alone Charities

In the real world, 'United Funds' are never solely responsible for the provision of public goods in a given community. Typically there are many charities that run their fund-raising campaigns independently (the Alzheimer's Society in February, the Cancer Society in March, etc.). It is therefore of interest to examine whether or not equilibrium outcomes are affected by the institutional separation that typically exists between public goods providers. However, once there is more than one player in the game, it is natural to suspect that the order of play may matter, and in particular that equilibrium outcomes when charities undertake their advertising campaigns simultaneously may differ from those that arise when they advertise sequentially.

In this section the two public goods are provided by two specialized stand-alone charities. Charity 1 is responsible for A_1 and G_1 and Charity 2 for A_2 and G_2. We first will consider benevolent simultaneous move charities, then analyze the benevolent sequential model later.

5.1 Benevolent simultaneous model

If both stand-alone charities in this model are benevolent, and thus seek to maximize social welfare, then they each have the same objective function as the Planner (and thus also of the benevolent United charity). In stage one, each charity solicits donations by running their own advertising campaigns separately and simultaneously. In stage two, consumers then decide how much donations they would contribute to each charity. Subgame-perfect Nash equilibrium of this game thus can be derived using backward induction.

It can easily be checked that this game is essentially identical to that of the benevolent United Charity. Consider first consumer $i's$ maximizing problem in stage two. Consumer i in this model will choose the optimal level of donations for charities given the levels of A_1, A_2 chosen by each charity in stage one. For any given pair of advertising expenditures, the first-order conditions for the consumer's decision problem are identical to those which were derived above, and thus the consumer will select the same donation pair g_1^i, g_2^i.

Turning next to the decision problem for the charity, then if each charity is benevolent it will take account of the impact of its own advertising on total donations received by its rival. It can be verified that the first-order necessary conditions for A_1 for charity 1, and A_2 for charity 2, are in fact identical to those derived above for the United Charity. Consequently, any subgame perfect Nash equilibrium of the United Charity game is also a subgame perfect Nash equilibrium of the benevolent simultaneous charity model. Here, since charities share the same objectives, there are no costs - and no benefits- to working collaboratively through a United Fund, versus independently-sponsored fund-raising campaigns.

5.2 Benevolent sequential model

In this sub-section, the two public goods are again provided by two benevolent stand-alone charities, but they will approach consumers sequentially. In stage one, Charity 1 approaches consumers first, choosing advertising expenditure A_1. In stage two, Charity 2 runs its campaign. Then, in stage three, consumers decide how much they wish to support the provision of G_1, and G_2. Once again, the appropriate equilibrium concept for this game is subgame perfect Nash equilibrium, and the game is therefore solved using backward induction. Notice, once again, that since consumers are choosing their donations g_1^i, g_2^i *after* the charities have chosen A_1 and A_2, therefore, the consumer's decision problem is identical to that analyzed above with respect to the benevolent United Charity, and thus that the consumer's optimal donation decision is not directly affected by the change in the institutional environment. For it to be argued that 'institutions matter' it is therefore necessary to show that the change in the institutional environment affects the behavior of the charities.

5.2.1 Stage two: choosing A_2

Recall that Charity 2 is the 'second mover', and chooses its advertising expenditure only after Charity 1 has run its campaign. Since it assumed that each charity is benevolent, and knowing how consumers will react in stage three. Charity $2's$ decision problem can be expressed as:

$$\underset{A_2}{Max}\,\Pi_2 = \omega^i - N\widehat{g_1} - N\widehat{g_2} + N \begin{bmatrix} \Psi(A_1, A_2)\log(N\widehat{g_1} - A_1) + \\ \Phi(A_1, A_2)\log(N\widehat{g_2} - A_2) + \\ \alpha \log(N\widehat{g_1} - A_1)\log(N\widehat{g_2} - A_2) \end{bmatrix}$$

The first-order necessary condition for Charity 2 is:

$$\Psi_2 \log(N\widehat{g_1} - A_1) + \Phi_2 \log(N\widehat{g_2} - A_2) + (N-1)\left(\frac{d\widehat{g_1}}{dA_2} + \frac{d\widehat{g_2}}{dA_2}\right) = 1 \quad (31)$$

We define $\widehat{A_2}$ as the optimal advertising made by Charity 2. Notice that this first-order condition is essentially identical to that of the benevolent United Charity for A_2; the interpretation for (31) is the same as (28) in the United Charity model. In particular, for a given A_1, the level of A_2 chosen by charity 2 is the same as would be chosen by the United Fund. We can therefore re-write (31) as (30) in the United charity model.

$$\Psi_2 \log(N\widehat{g_1} - \widehat{A_1}) + \Phi_2 \log(N\widehat{g_2} - \widehat{A_2}) - \frac{1}{N} + \left(\frac{N-1}{N}\right)\widehat{K_2} = 0 \quad (32)$$

where $\widehat{K_2} = \left[\frac{(N\widehat{g_1}-\widehat{A_1})(N\widehat{g_2}-\widehat{A_2})(\Psi_2+\Phi_2)+(N\widehat{g_1}-\widehat{A_1})\alpha\Phi_2+(N\widehat{g_2}-\widehat{A_2})\alpha\Psi_2}{\left\{(N\widehat{g_1}-\widehat{A_1})(N\widehat{g_2}-\widehat{A_2})-\alpha^2\right\}}\right]$.

The decision problem of Charity 1 will turn out to be crucially influenced by the way in which Charity 2 responds to changes in advertising by Charity 1. It is therefore useful to study the sensitivity of the level of advertising $\widehat{A_2}$ to the changes in the level of advertising A_1 by totally differentiating equation (32) with respect to $\widehat{g_1}$, $\widehat{g_2}$, A_1, $\widehat{A_2}$ and applying Cramer's Rule. This gives rise to the following expressions:

$$\frac{d\widehat{A_2}}{dA_1} = \frac{-\left[\begin{array}{c}\Psi_{21}\log(N\widehat{g_1}-\widehat{A_1})+\Phi_{21}\log(N\widehat{g_2}-\widehat{A_2})+ \\ X+\left(\frac{N-1}{N}\right)\widehat{K_X}\end{array}\right]}{\left[\Psi_{22}\log(N\widehat{g_1}-\widehat{A_1})+\Phi_{22}\log(N\widehat{g_2}-\widehat{A_2})+Y+\left(\frac{N-1}{N}\right)\widehat{K_Y}\right]} \tag{33}$$

where

$$
\begin{aligned}
X &= \frac{(N\widehat{g_1} - \widehat{A_1})\Phi_1\Phi_2 + (N\widehat{g_2} - \widehat{A_2})\Psi_1 + \alpha\Psi_1\Phi_2 + \alpha\Psi_2\Phi_1}{\left\{(N\widehat{g_1} - \widehat{A_1})(N\widehat{g_2} - \widehat{A_2}) - \alpha^2\right\}} \\
Y &= \frac{(N\widehat{g_1} - \widehat{A_1})(\Phi_2)^2 + (N\widehat{g_2} - \widehat{A_2})(\Psi_2)^2 + 2(\alpha\Psi_2\Phi_2)}{\left\{(N\widehat{g_1} - \widehat{A_1})(N\widehat{g_2} - \widehat{A_2}) - \alpha^2\right\}} \\
\widehat{K_X} &= \frac{d\widehat{K_2}}{dA_1} + \frac{d\widehat{K_2}}{dg_1}\frac{dg_1}{dA_1} + \frac{d\widehat{K_2}}{dg_2}\frac{dg_2}{dA_1} \\
\widehat{K_Y} &= \frac{d\widehat{K_2}}{dA_2} + \frac{d\widehat{K_2}}{dg_1}\frac{dg_1}{dA_2} + \frac{d\widehat{K_2}}{dg_2}\frac{dg_2}{dA_2}
\end{aligned}
$$

To interpret these results, note that the denominator of equation (33) is the second derivative of Charity 2's objective function with respect to its own strategic variable, and must be negative if the second-order conditions are to be satisfied. It can be checked that this will be true if the advertising information function for each public good is strictly concave in its own advertising expenditure and both Y and $\widehat{K_Y}$.are negative. The sign of $\frac{d\widehat{A_2}}{dA_1}$ thus then depends on the sign of the numerator $\left\{\Psi_{21}\log(N\widehat{g_1} - \widehat{A_1}) + \Phi_{21}\log(N\widehat{g_2} - \widehat{A_2}) + X + \left(\frac{N-1}{N}\right)\widehat{K_X}\right.$ which in turn depends on the sign of Ψ_{21}, Φ_{21}, X and $\widehat{K_Y}$. Therefore, the sign of $\frac{d\widehat{A_2}}{dA_1}$ depends on both the magnitude and the signs of both the first- and second-order derivatives of Φ and Ψ, and is generally uncertain. Notice that if Ψ_{21}, Φ_{21}, X and $\widehat{K_Y}$ are all negative (positive), $\frac{d\widehat{A_2}}{dA_1}$ is negative (positive).

This means that A_1 and A_2 are strategic substitutes (complements); an increase in pledges to fund provision of G_1 crowds out (crowds in) advertising expenditure by the second charity.

5.2.2 Stage one: choosing A_1

Finally, we turn to the decision problem faced by Charity 1 in the first period of the game – recognizing that Charity 1's decision will be influenced by the way in which it anticipates Charity 2's decision as well as how donors will react to changes in its advertising expenditure. Since the charity is benevolent, its decision problem can be expressed as:

$$\begin{aligned}\underset{A_1}{Max}\, \Pi_1 &= \omega^i - \widehat{g_1} - \widehat{g_2} + \Psi(A_1, \widehat{A_2}) \log(N\widehat{g_1} - A_1) + \\ & \Phi(A_1, \widehat{A_2}) \log(N\widehat{g_2} - \widehat{A_2}) + \alpha \log(N\widehat{g_1} - A_1) \log(N\widehat{g_2} - \widehat{A_2})\end{aligned}$$

The optimal level of advertising expenditure is thus found as a solution to

$$\begin{aligned}
\frac{\partial \Pi_1}{\partial A_1} &= 0 = \Psi_1 \log(N\widehat{g_1} - A_1) + \Phi_1 \log(N\widehat{g_2} - \widehat{A_2}) \\
&-\frac{\Psi(A_1, \widehat{A_2})}{(N\widehat{g_1} - A_1)} - \frac{\alpha \log(N\widehat{g_2} - \widehat{A_2})}{(N\widehat{g_1} - \widehat{A_1})} \\
&+\frac{d\widehat{g_1}}{dA_1}\left\{-1 + \frac{N\Psi(A_1, A_2)}{(N\widehat{g_1} - A_1)} + \frac{N\alpha \log(N\widehat{g_2} - \widehat{A_2})}{(N\widehat{g_1} - A_1)}\right\} + \\
&\frac{d\widehat{g_2}}{dA_1}\left\{-1 + \frac{N\Phi(A_1, A_2)}{(N\widehat{g_2} - A_2)} + \frac{N\alpha \log(N\widehat{g_1} - \widehat{A_1})}{(N\widehat{g_2} - A_2)} + \right\} \\
&+\frac{dA_2}{dA_1}\left\{\begin{array}{c}
\Psi_2 \log(N\widehat{g_1} - A_1) + \Phi_2 \log(N\widehat{g_2} - \widehat{A_2}) - \\
\frac{\Phi(A_1, A_2)}{(N\widehat{g_2} - A_2)} - \frac{\alpha \log(N\widehat{g_1} - \widehat{A_1})}{(N\widehat{g_2} - A_2)} \\
\frac{d\widehat{g_1}}{dA_1}\left\{-1 + \frac{N\Psi(A_1, A_2)}{(N\widehat{g_1} - A_1)} + \frac{N\alpha \log(N\widehat{g_2} - \widehat{A_2})}{(N\widehat{g_1} - A_1)}\right\} \\
\frac{d\widehat{g_2}}{dA_1}\left\{-1 + \frac{N\Phi(A_1, A_2)}{(N\widehat{g_2} - A_2)} + \frac{N\alpha \log(N\widehat{g_1} - \widehat{A_1})}{(N\widehat{g_2} - A_2)} + \right\}
\end{array}\right\} \qquad (34)
\end{aligned}$$

Notice that the term in the last bracket is the first-order condition of Charity 2 maximizing problem, it is thus equal to zero. Repeated application of the envelope theorem allows us to rewrite (34) as:

$$\Psi_1 \log(N\widehat{g_1} - A_1) + \Phi_1 \log(N\widehat{g_2} - \widehat{A_2}) + (N-1)\left(\frac{d\widehat{g_1}}{dA_1} + \frac{d\widehat{g_2}}{dA_1}\right) = 1 \quad (35)$$

We shall define $\widehat{A_1}$ as the optimal level of advertising for Charity 1, as implicitly defined by the above first-order condition. Note that Charity one first-order condition is identical with both United Charity and Charity 1 in the simultaneous model. Thus, this analysis suggests that if charities are benevolent, and if donor-designation is honoured by the United Charity, together with the fact that donors are the last movers, institutional structure does not matter.

6 Income Maximizing Charities

There has been considerable attention devoted to the issue of the appropriate specification of the objective function for non-profit firms, with a number of authors suggesting that charities are not particularly concerned by the broader 'social good', but more narrowly with the scale of provision of their own services. Thus, to highlight the importance of the objective function of the charity in influencing charity behaviour in a strategic environment, we next consider income-maximizing charitable organizations.

6.1 Income maximizing United Charity

We again consider, successively, a United Charity, as well as stand-alone charities which choose advertising expenditures either simultaneously or sequentially, starting here with the analysis of the United Charity. As before, it chooses both A_1^{inc} and A_2^{inc} before approaching consumers for donations, and honors donor-designation in producing G_1 and G_2. From the point of view of consumers, the change in the objective of the charity does not directly affect the structure of their optimization problem (that is, it may affect the values of A_1^{inc} and A_2^{inc}, but not the way consumers trade off additional donations to non-profit organizations against increased consumption of the private good); consumers thus respond to the advertising campaign in the same manner as they did before when charities maximized social welfare. This means that we do not need to again study consumer decision making, and can focus directly on strategic behaviour of the charities.

At the beginning of the first stage, anticipating donor behaviour in stage two, the decision problem of the income-maximizing United Charity can be expressed as follows:

$$\underset{A_1^{inc},A_2^{inc}}{Max}\ \Pi^{inc} = (N\widetilde{g_1^{inc}} - A_1^{inc}) + (N\widetilde{g_2^{inc}} - A_2^{inc})$$

and the first-order necessary conditions for advertising expenditures A_1^{inc} and A_2^{inc} are therefore:

$$\begin{aligned}
\frac{\partial \Pi^{inc}}{\partial A_1^{inc}} &= N\left(\frac{d\widetilde{g_1^{inc}}}{dA_1^{inc}} + \frac{d\widetilde{g_2^{inc}}}{dA_1^{inc}}\right) - 1 = 0 \\
\frac{\partial \Pi^{inc}}{\partial A_2^{inc}} &= N\left(\frac{d\widetilde{g_1^{inc}}}{dA_2^{inc}} + \frac{d\widetilde{g_2^{inc}}}{dA_2^{inc}}\right) - 1 = 0
\end{aligned}$$

Denote by $\widetilde{A_1^{inc}}$ and $\widetilde{A_2^{inc}}$ a pair of advertising expenditures levels which solves the above system of equations. To interpret these equations, we re-write them as:

$$N\left(\frac{d\widetilde{g_1^{inc}}}{dA_1^{inc}} + \frac{d\widetilde{g_2^{inc}}}{dA_1^{inc}}\right) = 1 \tag{36}$$

$$N\left(\frac{d\widetilde{g_1^{inc}}}{dA_2^{inc}} + \frac{d\widetilde{g_2^{inc}}}{dA_2^{inc}}\right) = 1 \tag{37}$$

The right-hand sides of (36) and (37) measure the marginal cost of an increase in advertising expenditure. The left-hand side of each equation measures the marginal increase in donor-designated revenues when advertising for each public good increases. Not surprisingly, therefore, an income-maximizing United Charity chooses advertising expenditures which equalize marginal revenue and marginal cost. Notice that, due to the fact that advertising about charitable activity 1 affects donations for charitable activity 2, the global impact of advertising is considered when selecting appropriate advertising levels. Recall from our analysis above that the direct effect $(\widetilde{\frac{dg_1^{inc}}{dA_1^{inc}}}, \widetilde{\frac{dg_2^{inc}}{dA_2^{inc}}})$ is always positive, but that the cross-effect may be positive or negative.

We can contrast the optimal level of advertising chosen here with that chosen by the benevolent United Charity above. To this end, we rewrite the benevolent United Charity's first-order conditions from section 4.2 here.

$$\left\{\begin{array}{c}\Psi_1 \log(N\widetilde{g_1} - \widetilde{A_1}) + \\ \Phi_1 \log(N\widetilde{g_2} - \widetilde{A_2}) - \\ \left(\frac{d\widetilde{g_1}}{d\widetilde{A_1}} + \frac{d\widetilde{g_2}}{d\widetilde{A_1}}\right)\end{array}\right\} + N\left(\frac{d\widetilde{g_1}}{d\widetilde{A_1}} + \frac{d\widetilde{g_2}}{d\widetilde{A_1}}\right) = 1 \tag{38}$$

$$\left\{\begin{array}{c}\Psi_2 \log(N\widetilde{g_1} - \widetilde{A_1}) + \\ \Phi_2 \log(N\widetilde{g_2} - \widetilde{A_2}) - \\ \left(\frac{d\widetilde{g_1}}{d\widetilde{A_1}} + \frac{d\widetilde{g_2}}{d\widetilde{A_1}}\right)\end{array}\right\} + N\left(\frac{d\widetilde{g_1}}{d\widetilde{A_2}} + \frac{d\widetilde{g_2}}{d\widetilde{A_2}}\right) = 1 \tag{39}$$

Notice that since the consumer's decision problem is identical for all of the models considered in this paper, the last term on the left-hand side of (38) and (39) is the same as the left-hand side of (36) and (37). Thus, whether or not the income-maximizing charity advertises more or less than the welfare-maximizing charity depends on the bracketed term of (38) and (39). If the term $\left\{\Psi_1 \log(N\widetilde{g_1} - \widetilde{A_1}) + \Phi_1 \log(N\widetilde{g_2} - \widetilde{A_2}) - \left(\frac{d\widetilde{g_1}}{d\widetilde{A_1}} + \frac{d\widetilde{g_2}}{d\widetilde{A_1}}\right)\right\}$ in (38) is positive, this implies that $N\left(\frac{d\widetilde{g_1}}{d\widetilde{A_1}} + \frac{d\widetilde{g_2}}{d\widetilde{A_1}}\right) < 1$, and therefore $N\left(\frac{d\widetilde{g_1^{inc}}}{d\widetilde{A_1^{inc}}} + \frac{d\widetilde{g_2^{inc}}}{d\widetilde{A_1^{inc}}}\right) = 1 > N\left(\frac{d\widetilde{g_1}}{d\widetilde{A_1}} + \frac{d\widetilde{g_2}}{d\widetilde{A_1}}\right)$. However, (36) can be rewritten by using the comparative statics results similar to those obtained in (18) and (20) as follows:

$$\frac{\left[\begin{array}{c}\left\{(\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}})(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}})\right\}(\Psi_1 + \Phi_1)+ \\ \alpha\left\{(\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}})\Phi_1 + (\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}})\Psi_1\right\}\end{array}\right]}{\left\{(\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}})(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}}) - \alpha^2\right\}} = 0$$

$$\frac{\left[\begin{array}{c}(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}})\Psi_1\left\{(\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}}) + \alpha\right\}+ \\ (\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}})\Phi_1\left\{(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}}) + \alpha\right\}\end{array}\right]}{\left\{(\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}})(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}}) - \alpha^2\right\}} = 0 \qquad (40)$$

The denominator term $\left\{(\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}})(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}}) - \alpha^2\right\}$ is the Jacobian term and must be positive for the second-order conditions for consumer maximizing problem to be satisfied. This implies that there cannot be an interior solution to the decision problem of the United Charity unless Ψ_1 and Φ_1 have opposite signs. We assumed earlier that the direct effect of advertising is positive (i.e., Ψ_1 and Φ_2 are positive) so the above equations cannot be satisfied unless

$$(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}})\Psi_1\left\{(\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}}) + \alpha\right\} + (\widetilde{Ng_1^{inc}} - \widetilde{A_1^{inc}})\Phi_1\left\{(\widetilde{Ng_2^{inc}} - \widetilde{A_2^{inc}}) + \alpha\right\} = 0 \qquad (41)$$

or

$$(N\widetilde{g_2^{inc}} - \widetilde{A_2^{inc}})\Psi_1 \left\{(N\widetilde{g_1^{inc}} - \widetilde{A_1^{inc}}) + \alpha\right\} = -(N\widetilde{g_1^{inc}} - \widetilde{A_1^{inc}})\Phi_1 \left\{(N\widetilde{g_2^{inc}} - \widetilde{A_2^{inc}}) + \alpha\right\}. \tag{42}$$

Undertaking a similar exercise with respect to the first-order conditions for the benevolent United Charity, we obtain that:

$$(N\widetilde{g_2} - \widetilde{A_2})\Psi_1 \left\{(N\widetilde{g_1} - \widetilde{A_1}) + \alpha\right\} < -(N\widetilde{g_1} - \widetilde{A_1})\Phi_1 \left\{(N\widetilde{g_2} - \widetilde{A_2}) + \alpha\right\}. \tag{43}$$

Observe that if the $(\widetilde{A_1^{inc}}, \widetilde{A_2^{inc}})$ pair that solves (42) is substituted into (43), then this would induce the same (g_1, g_2), and therefore (43) would not be satisfied; in general, however, this comparison does not permit us to establish whether advertising will be higher or lower when the United Charity is benevolent or income-maximizing.

6.2 Income maximizing Stand-alone Charities

As before, we will consider two alternative institutional structures: stand-alone charities which choose advertising expenditures simultaneously, and stand-alone charities which choose advertising expenditures sequentially. Unlike when charities are benevolent, the analysis below shows that when charities maximize net donation income, the institutional structure matters.

6.2.1 Simultaneous advertising by income maximizing Stand-Alone Charities

We now consider an environment in which the public good is provided by two separate charities and in which both charities compete simultaneously to attract donations. The objective function for each charity can be expressed as follow:

$$\underset{A_j^{inc}}{Max}\Pi^{inc} = (N\widehat{g_j^{inc}} - A_j^{inc}) \qquad \text{where } j = 1, 2$$

Therefore, the first-order necessary condition for each charity is

$$\frac{\partial \Pi^{inc}}{\partial A_j^{inc}} = N\left(\frac{d\widehat{g_j^{inc}}}{dA_j^{inc}}\right) - 1 = 0 \qquad , j = 1, 2 \qquad (44)$$

$$\text{or,} \quad \frac{\partial \Pi^{inc}}{\partial A_j^{inc}} = N\left(\frac{d\widehat{g_j^{inc}}}{dA_j^{inc}}\right) = 1 \qquad , j = 1, 2 \qquad (45)$$

We denote by $\widehat{A_1^{inc}}$ and $\widehat{A_2^{inc}}$ as the optimal levels of advertising chosen by charities 1 and 2 respectively. (45) implies that an income-maximizing charity j increases the level of adverting until a dollar of additional advertising expenditure generates a dollar increase in charity $j's$ marginal revenue; of course, unlike the United Charity, they neglect to take account of the impact of their own advertising on the donation income of their rival; as is discussed below, this may mean that advertising expenditures by income-maximizing stand-alone charities may be greater or less than those undertaken by an income-maximizing United Charity.

The first-order conditions of the simultaneous move benevolent charities are similar to those of the benevolent United Charity in (38) and (39). In particular, the necessary conditions for the two benevolent charities' decision problem can be expressed as:

$$\left\{ \begin{array}{c} \Psi_1 \log(N\widehat{g_1} - \widehat{A_1}) + \Phi_1 \log(N\widehat{g_2} - \widehat{A_2}) - \\ \frac{d\widehat{g_1}}{d\widehat{A_1}} + (N-1)\frac{d\widehat{g_2}}{d\widehat{A_1}} \end{array} \right\} + N\left(\frac{d\widehat{g_1}}{d\widehat{A_1}}\right) = 1 \quad (46)$$

$$\left\{ \begin{array}{c} \Psi_2 \log(N\widehat{g_1} - \widehat{A_1}) + \Phi_2 \log(N\widehat{g_2} - \widehat{A_2}) - \\ \frac{d\widehat{g_2}}{d\widehat{A_2}} + (N-1)\frac{d\widehat{g_1}}{d\widehat{A_2}} \end{array} \right\} + N\left(\frac{d\widehat{g_2}}{d\widehat{A_2}}\right) = 1 \quad (47)$$

Contrasting (45) with (46) and (47), we notice that benevolent charities take into account the net marginal consumption benefit which consumers derive from advertising (the term in the {} brackets on the left-hand sides) when choosing the optimal level of advertising, whereas income maximizing charities focus only on the additional income that charities can make from the additional advertising.

We saw above that the institutional structure had no impact on advertising (and therefore on equilibrium outcomes) when charities were benevolent. Clearly, this is not the case when charities maximize net donation income, and it is therefore useful to try to compare the equilibrium outcomes when stand-alone charities advertise simultaneously with outcomes when charitable activities are undertaken by a United Charity. It is useful to recall the first-order necessary conditions:

$$\text{for the United Charity:} \quad \frac{\partial \Pi^{inc}}{\partial A_1^{inc}} = N\left(\frac{d\widetilde{g_1^{inc}}}{dA_1^{inc}} + \frac{d\widetilde{g_2^{inc}}}{dA_1^{inc}}\right) - 1 = 0$$

$$\frac{\partial \Pi^{inc}}{\partial A_2^{inc}} = N\left(\frac{d\widetilde{g_1^{inc}}}{dA_2^{inc}} + \frac{d\widetilde{g_2^{inc}}}{dA_2^{inc}}\right) - 1 = 0$$

$$\text{for the stand-alone charities with simultaneous moves:} \quad \frac{\partial \Pi^{inc}}{\partial A_1^{inc}} = N\left(\frac{d\widehat{g_1^{inc}}}{dA_1^{inc}}\right) - 1 = 0$$

$$\frac{\partial \Pi^{inc}}{\partial A_2^{inc}} = N\left(\frac{d\widehat{g_2^{inc}}}{dA_2^{inc}}\right) - 1 = 0.$$

Since the United Charity chooses both $(\widetilde{A_1^{inc}}, \widetilde{A_2^{inc}})$, it is evident that one cannot talk properly of 'reaction functions' for this charity. However, one can conduct a conceptual experiment, and represent what the reaction functions of the United Charity would be if, for example, the level of advertising for one of its charitable activities to be selected exogenously. These 'quasi-reaction functions', represented in the diagram below, can then be compared to those of the stand-alone charities. Recall from the analysis above that $\frac{d\widetilde{g_1^{inc}}}{dA_1^{inc}} > 0$, $\frac{d\widetilde{g_2^{inc}}}{dA_1^{inc}} < 0$ (when α, Ψ_2, Φ_1 are negative.) Hence, for a given A_2^{inc} (respectively, A_1^{inc}) it is clear that the reaction function for the simultaneous Charity must lie to the northeast (respectively, southeast) of the reaction function for the United Charity. It is also possible to consider the relative slopes of these functions. Thus, for the United Charity, it is straightforward to calculate that

$$\frac{\partial A_1^{inc}}{\partial A_2^{inc}} = \frac{-\left[\frac{\partial\left(\frac{dg_1^{\widetilde{inc}}}{dA_1^{inc}}\right)}{\partial A_2^{inc}} + \frac{\partial\left(\frac{dg_2^{\widetilde{inc}}}{dA_1^{inc}}\right)}{\partial A_2^{inc}}\right]}{\left[\frac{\partial\left(\frac{dg_1^{\widetilde{inc}}}{dA_1^{inc}}\right)}{\partial A_1^{inc}} + \frac{\partial\left(\frac{dg_2^{\widetilde{inc}}}{dA_1^{inc}}\right)}{\partial A_1^{inc}}\right]} \tag{48}$$

whereas for Charity 1 in the simultaneous move game, we find that

$$\frac{\partial A_1^{inc}}{\partial A_2^{inc}} = \frac{-\left[\frac{\partial\left(\frac{dg_1^{\widetilde{inc}}}{dA_1^{inc}}\right)}{\partial A_2^{inc}}\right]}{\left[\frac{\partial\left(\frac{dg_1^{\widetilde{inc}}}{dA_1^{inc}}\right)}{\partial A_1^{inc}}\right]}. \tag{49}$$

Equivalent expressions can be calculated in a straightforward fashion for $\partial A_2^{inc}/\partial A_1^{inc}$. Notice that the denominator of $\partial A_1^{inc}/\partial A_2^{inc}$ in both settings is the second derivative of the charities 'objective function with respective to A_1^{inc} which should be negative for the second-order conditions of income maximizing to be satisfied. The sign of $\partial A_1^{inc}/\partial A_2^{inc}$ thus depends on the numerator terms, which is the second cross derivative of the objective function with respective to A_2^{inc} and can be either positive or negative as long as the Hessian matrix is negative semi-definite. Unfortunately, economic theory offers no insight into the sign of any of the individual terms in these expressions, as they involve cross-derivatives and third derivatives. Notice, however, that if all are negative, and if cross-effects are smaller than direct effects, then this suggests that the reaction function for the United Charity would be steeper than that of the stand-alone charities. This scenario is reflected in the Figure 1 (a) below. In this case, the United Charity chooses smaller $\widetilde{A_1^{inc}}$ than the stand-alone charity. The opposite is true when the reaction functions have positive slope as in Figure 1 (b).

6.2.2 Sequential advertising by income maximizing Stand-alone Charities

The game in this section is similar to the benevolent sequential move model, i.e., the non-cooperative three stage game. In stage one, Charity 1 moves first by running the advertising campaign A_1,then Charity 2, in stage two, moves second by choosing the level of advertising A_2. Finally, consumers decide in stage three how much to donate to each charity. Once again, since consumers move last, their decisions are taken in the same fashion as outlined above, when analyzing the benevolent United Charity. This allows us to concentrate on the decisions of the charitable organizations.

Turning to stage two, from the point of view of charity 2, the decision-making environment looks the same as in the simultaneous setting, i.e., it chooses its optimal level of advertising, given A_1, and anticipating the reaction of donors in the subsequent stage. For a given A_1, therefore, the level of advertising chosen by Charity 2 is the same as in the simultaneous moves game, as the same first-order necessary condition must be satisfied:

$$\frac{\partial \Pi_2}{\partial A_2^{inc}} = N \left(\frac{d\widehat{\widehat{g_2^{inc}}}}{dA_2^{inc}} \right) - 1 = 0 \tag{50}$$

where $\widehat{\widehat{g_2^{inc}}}$ is the optimal level of donation for G_2 that consumer chose in stage three, and bears the same interpretation as provided above. We denote the optimal level of advertising for Charity 2 by $\widehat{\widehat{A_2}}$ Also, as above, we have that

$$\frac{dA_2^{inc}}{dA_1^{inc}} = \frac{-\left[\frac{\partial\left(\frac{d\widehat{\widehat{g_2^{inc}}}}{dA_2^{inc}}\right)}{\partial A_1^{inc}}\right]}{\left[\frac{\partial\left(\frac{d\widehat{\widehat{g_2^{inc}}}}{dA_2^{inc}}\right)}{\partial A_2^{inc}}\right]} \tag{51}$$

which may in general have positive or negative slope, since economic theory provides no insight into the sign of the above expressions. What is important to underscore, however, is that any differences that arise between equilibrium outcomes in the simultaneous and sequential settings are to do with the way in which the change in the institutional environment affects the behaviour of Charity 1.

The optimization problem of Charity 1 can be expressed as:

$$\underset{A_1^{inc}}{Max} \;\; \Pi_1 = N\widehat{\widehat{g_1^{inc}}} - A_1^{inc}$$

Charity 1 chooses the optimal level of advertising by maximizing the above objective function with respect to A_1^{inc} as follows:

$$\frac{\partial \Pi_1}{\partial A_1^{inc}} = N\left(\frac{\partial \widehat{\widehat{g_1^{inc}}}}{\partial A_1^{inc}} + \frac{\partial \widehat{\widehat{g_1^{inc}}}}{\partial A_2^{inc}}\frac{dA_2^{inc}}{dA_1^{inc}}\right) - 1 = 0 \tag{52}$$

Denote $\widehat{\widehat{A_1^{inc}}}$ as the solution for Charity 1 maximizing problem. (52) can be rewritten as

$$N\left(\frac{\partial \widehat{\widehat{g_1^{inc}}}}{\partial A_1^{inc}}\right) + N\left(\frac{\partial \widehat{\widehat{g_1^{inc}}}}{\partial A_2^{inc}}\frac{dA_2^{inc}}{dA_1^{inc}}\right) = 1 \tag{53}$$

The right-hand side of (53) is the marginal cost of advertising A_1^{inc} which is equal to one. The left-hand side of (53) is the marginal revenue of Charity 1 which is composed of two terms: the direct effect of an increase in A_1^{inc} on donor giving to Charity 1, and the indirect effect via the impact of a change in A_1^{inc} on advertising by Charity 2, and the subsequent impact of giving to Charity 1 due to an change in advertising expenditure by its rival. As compared to the simultaneous game, Charity 1 clearly will choose a different optimal level of A_1; whether or not the optimal advertising expenditure is increased or decreased - and whether or not there is a first-mover advantage - depends upon the signs of $\frac{\partial \widehat{\widehat{g_1^{inc}}}}{\partial A_2^{inc}} \frac{dA_2^{inc}}{dA_1^{inc}}$. Recall from our discussion of comparative statics with respect to the donor game that dg_i/dA_j may be either positive or negative; in particular, it is negative if the derivative of the information function with respect to advertising and α are all negative, whereas it will be positive if these derivatives and α are all positive. Therefore, the second term will be positive if $\frac{\partial \widehat{\widehat{g_1^{inc}}}}{\partial A_2^{inc}}$ and $\frac{dA_2^{inc}}{dA_1^{inc}}$ have the same sign, and negative otherwise. Recall that $\frac{\partial \widehat{\widehat{g_1^{inc}}}}{\partial A_1^{inc}} > 0$, therefore, if the second term is positive, then the reaction function for Charity 1 must shift to the left as compared to the simultaneous game; the opposite is true if both the second term is negative. In the later setting, then, there is a first-mover advantage; whereas, in the former situation, there is a first-mover disadvantage. This is illustrated in the Figure 2.

7 Conclusions

The analysis above examines strategic interaction between rival charities in a variety of institutional settings. It is shown that when charities are benevolent, the institutional setting does not affect equilibrium outcomes: regardless of whether charities cooperate, to form a United Way, or act simultaneously or sequentially, the same expenditures will be made on advertising, and the same outcomes will ensue. In contrast, if charities seek to maximize net donation income (that is, donation income net of advertising expense), then institutions do matter, and the advertising levels chosen by a United Charity will generally differ from those chosen by stand-alone charities which must commit to advertising expenditures simultaneously, or in a sequential setting. Somewhat surprisingly, however, it is not in general possible to determine which institutional framework will generate the highest advertising expenditures, as this depends crucially on the slope of the reaction functions for the charities, which is in general indeterminate; it has also been shown that in a sequential setting, it may or may not be advantageous to be the first mover.

The analysis presented does not compare equilibrium outcomes with respect to social welfare or efficiency, and focuses exclusively on positive issues. This choice is deliberate, and reflects the fact that such comparisons are somewhat delicate to interpret. In effect, although advertising expenditures are viewed as informative, and therefore as generating consumption benefits for individuals, there is a sense in which it may be argued that advertising is modifying individual preferences; in particular, the marginal utility which a consumer derives from G_1 and G_2 clearly depends upon advertising expenditure. This makes normative analysis difficult, and so it has seemed appropriate to centre the analysis on positive issues of strategic interaction.

A number of potentially interesting directions for future research can be identified. Despite the fact that specific functional forms were assumed for both the utility and production functions, it was not possible to obtain easily interpretable conditions under which the comparative statics results could be signed. It would certainly be worthwhile and interesting to develop a simulation analysis, to investigate these strategic effects more closely. Also, in terms of purely theoretical research, it would be useful to develop a version of the sequential game which allowed for imperfect information.

8 References

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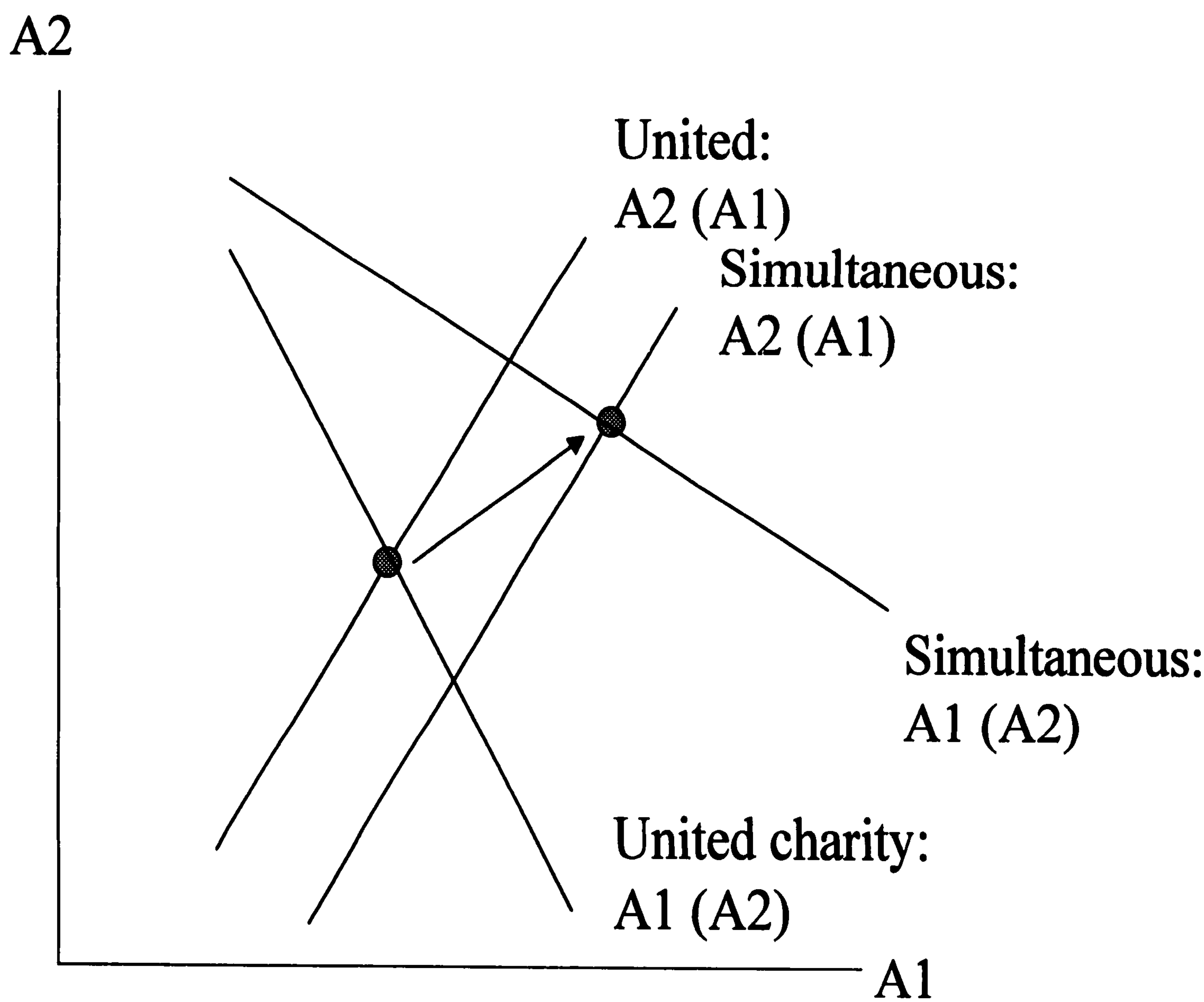
A2
United:
A2 (A1)
Simultaneous:
A2 (A1)
Simultaneous:
A1 (A2)
United charity:
A1 (A2)
A1

Figure 1 (a)

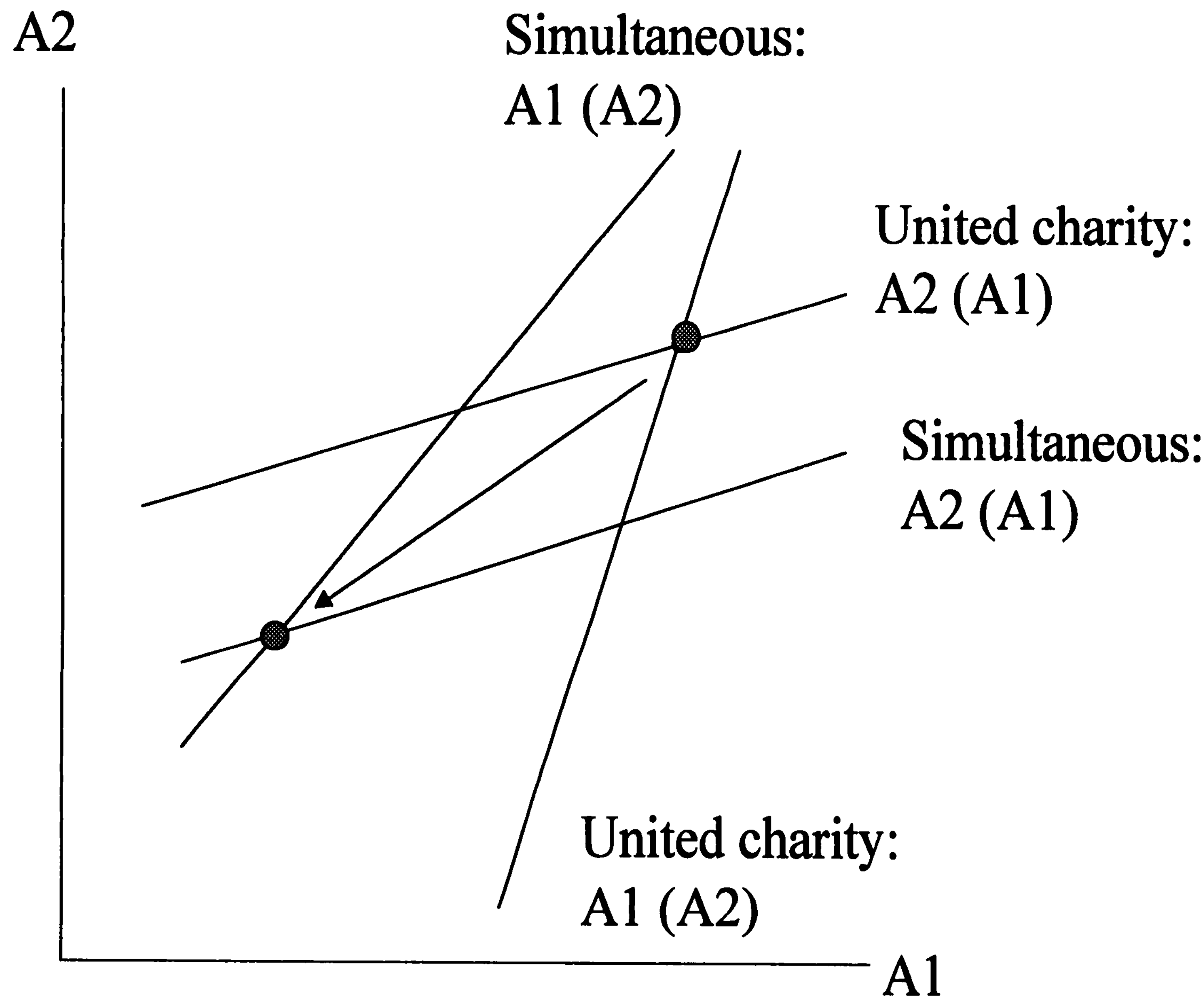
A2
Simultaneous:
A1 (A2)
United charity:
A2 (A1)
Simultaneous:
A2 (A1)
United charity:
A1 (A2)
A1

Figure 1 (b)

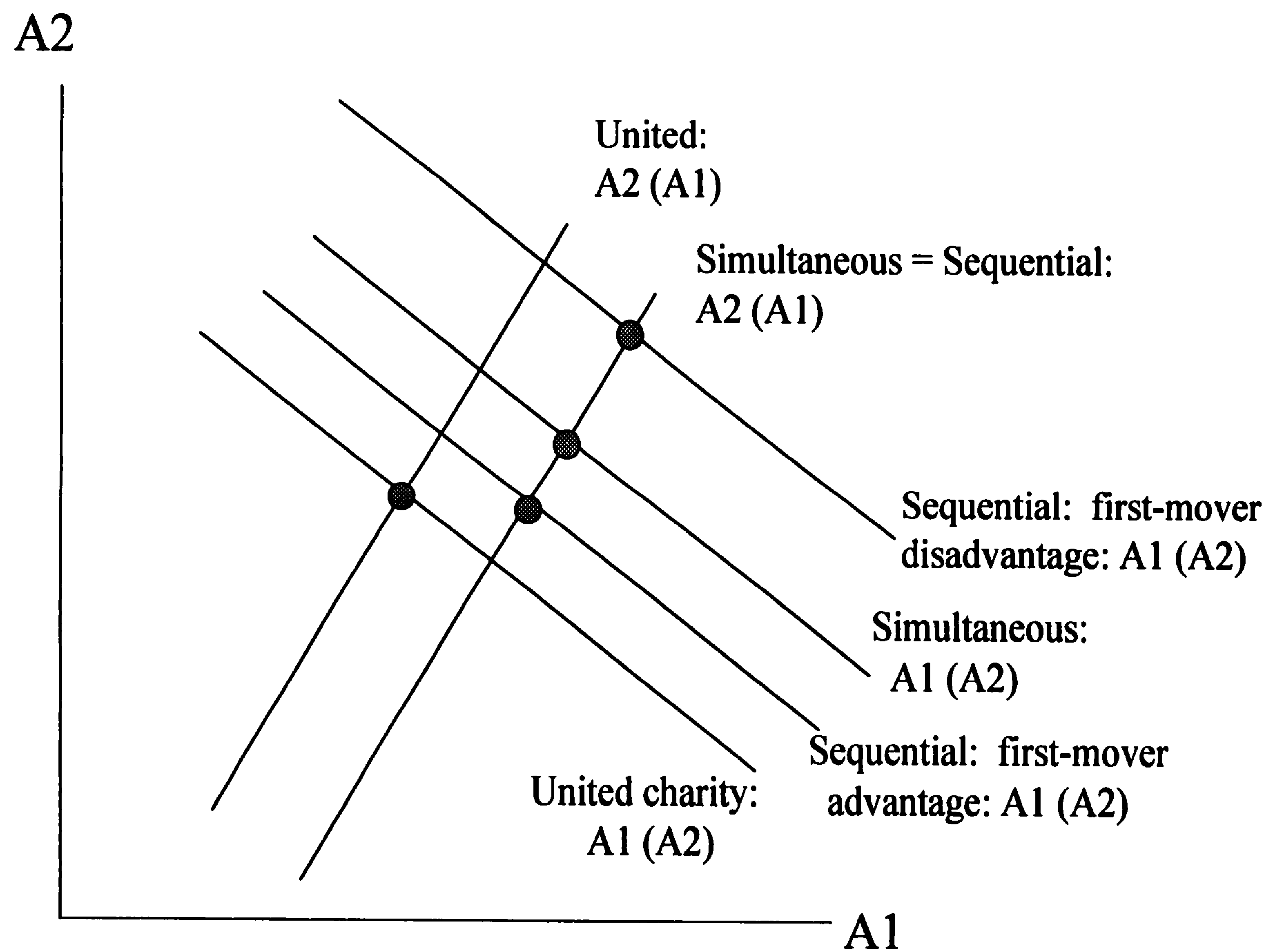
A2
United:
A2 (A1)
Simultaneous = Sequential:
A2 (A1)
Sequential: first-mover
disadvantage: A1 (A2)
Simultaneous:
A1 (A2)
Sequential: first-mover
advantage: A1 (A2)
United charity:
A1 (A2)
A1

Figure 2

Essay Three
Canadian Charitable Giving: Cash versus Playing Charitable Lotteries

1 Introduction

The past couple of decades have borne witness to a rapid increase in the number of lotteries whose proceeds go, in part, to the funding of public services. Some have suggested that the popularity of charitable lotteries has had a negative impact on the amount of money donated to charities. Borg, Mason and Shapiro (1991) in their study of the economics of state lotteries in the United States, observe that individuals who gamble seem to donate less money to charity than those who do not gamble. Similarly, Peacock (2000) observes that, with the growing popularity of the British National Lottery whose net proceeds go to charitable causes, the amount of direct donations to charities in the United Kingdom has fallen. What is the relationship between giving directly to charities and giving indirectly via charitable games? Aside from these two observations regarding the potential relationship between giving to charities directly and giving via lotteries, no paper has examined empirically the joint decision facing individuals regarding how much to donate to charities either directly or indirectly via a charitable lottery (or bingo and casino). In many ways, this gap is not surprising. The data requirements for treating these joint decisions are formidable. Indeed, it is the existence of a new and comprehensive data set in Canada, the Survey of Giving, Volunteering, and Participating (SGVP), that finally permits an empirical examination of the joint decisions of whether and how much to give directly and indirectly to charity.

Although a respectable body of literature now exists on the economics of gambling,[1] very few papers have addressed the particular issues associated with charitable gambling. Morgan (1997) was the first to model theoretically what happens when individuals can contribute to a public good via a lottery mechanism. He provides some justification for the use of lotteries by charitable agencies that do not have the ability to raise revenues through the tax system. The first essay of this thesis shows the conditions under which consumers will voluntarily contribute to charitable lotteries an amount equal to their Lindahl price.

In addition to looking at giving both directly and indirectly, a second gap

[1] See, for instance, the short review of the gambling literature in Schwer and Daneshvary (1999).

filled by this paper concerns the factors that affect individuals' charitable giving in Canada. Only a handful of papers have addressed this question with Canadian data (Hood, Martin and Osberg, 1977; Glenday, Gupta and Pawlak, 1986; Kitchen and Dalton, 1990; Kitchen, 1992; and Callen, 1994). The list for the United States is rather long, and would include the first paper to tackle this subject from an econometric perspective (Taussig, 1967), several empirical studies by Feldstein and coauthors (Feldstein, 1975a and 1975b; and Clotfelter, 1976; and Taylor, 1976), as well as a host of other important contributions, including Clotfelter (1980 and 1985), Brown (1987), Barrett (1991), Lankford and Wyckoff (1991), Brown and Lankford (1992), Greenwood (1993), Randolph (1995), Barrett, McGuirk and Steinberg (1997), and Andreoni and Scholz (1998).

Most of the literature on the economics of charitable giving uses US data, and may be classified broadly into three groups. The principal objective of the first generation of papers was to address the question as to whether charitable donations should be tax exempt or not. To this end, many researchers set about the task of estimating how sensitive donors were to the 'price' (or tax-price) of giving – one minus the marginal tax rate whenever donations are tax exempt – as well as their income elasticity. This question is particularly important: if individuals are not very sensitive to the tax-price of donations, then the amount that they give to charitable organizations as a result of the tax exempt status of donations may not be sufficient to offset the attendant loss in government revenues. In this case, from the point of view of charitable organizations, they may well be better off if donations are not tax exempt and the government sponsors their activities or finds an alternative means of providing the services (e.g., Taussig, 1967; Feldstein, 1975b; Paqué, 1986). While a more detailed discussion of specific results from this body of work is contained in the results section of this paper, a few points regarding the general nature of this literature can be made right away.

One of the striking features of the broad group of papers that first looked at the price and income elasticities of charitable contributions in the United States is that they typically found the tax-price elasticity to be greater than one (in absolute value terms) and the income elasticity to be less than one.[2] These two effects imply that charitable contributions are stimulated when they are exempt from taxes (e.g., Feltstein and Taylor, 1976; Clotfelter, 1980 Clotfelter, 1985), hence justifying this policy for the United States. Interest-

[2]Many of these papers were spurred on by the opposing results first obtained by Taussig (1967) whose methodology and data have been criticized by many subsequent researchers (e.g., Feldstein and Taylor, 1976). A survey of the recent literature can be found in Steinberg (2001).

ingly, as econometric techniques have become more sophisticated and better data have become available, the robustness of this result has been called into question. For instance, Barrett (1991) surveys several papers which find a very small or zero price elasticity for giving.

In comparison to the earlier studies that essentially employed ordinary least squares techniques to tax-filer data, three innovations are worthy of note in what might be called the 'second generation' of research on this topic. First was the recognition of the need for improved econometric modelling, second, the use of better data – e.g., individual or household-level micro data, or panel data; and finally was the recognition that factors other than tax-price and income play a role in an individual's decision of how much money to donate to charities.

From the point of view of econometric methodology, two broad problems have been highlighted in the literature. The first problem concerns the fact that the level of charitable contributions may affect the relevant marginal tax rate in force for any giving individual – that is to say that the tax rate is no longer exogenous. As a consequence, estimates of the price effect for charitable contributions would be unreliable (inconsistent). This problem has been addressed in several ways. Feldstein and Clotfelter (1976) and others have used the marginal tax price associated with the first dollar of giving, which does not vary with level of contributions. Reece and Zieschang (1985) estimate a more sophisticated econometric model in which they explicitly model the fact that the price of giving depends upon how much is donated. Clotfelter (1985) and Feenberg (1987), among others, solve the simultaneity problem between level of giving and tax rate by using an instrumental variables approach; Choe and Jeong (1993) use a simultaneous-equation Tobit model to deal with this problem. In Clotfelter (1985), explicitly dealing with the endogeneity of the tax rate increased his estimate of the price elasticity of contributions from -1.34 to -1.63

The second econometric problem identified and solved by the literature concerns the fact that the level of charitable contributions is censored at zero, which renders inappropriate the use of ordinary least squares for estimating the parameters of the demand for contributions. The proper technique to use would be the Tobit model (or truncated regression model, see Greene, 1997). For instance, Brown (1987) applies the OLS procedure and the Tobit model to the same data set and shows that they yield different estimates of the price and income elasticities of contributions. Using the Tobit procedure, Brown (1987) and Choe and Jeong (1993) continue to obtain results comparable with the first-generation papers, namely that individuals are price sensitive and income insensitive. Others, however, using the Tobit procedure have obtained the opposite result (e.g., Reece and Zieschang, 1985).

The availability of new and better data means, arguably, that more reliable estimates of price and income elasticities can be computed. One innovation over the use of aggregate tax data employs survey data. Several studies rely on individual or household surveys for estimating the demand for charitable giving. Brown (1987) reviews some of the earlier work in this regard, and notes that survey data tend to result in an increase in the estimated price-elasticity of contributions. Among other things, survey data can be more representative than tax-filer data because surveys solicit information from a random sample of households, and not just from individuals who file taxes. Another great advantage of survey data is that they typically include information on a host of personal and household characteristics that are relevant for the decisions of whether and how much to give to charities. A few studies have used panel data in which, typically, a sample of tax-filers are tracked over a period of time (e.g., Clotfelter, 1980; Hood et al., 1977; Barrett, 1991): Randolph (1995) uses a 10-year panel of tax filers and shows that it is very important to distinguish between current and permanent income, and current and permanent tax prices (i.e., intertemporal issues) when estimating tax and income elasticities. He finds that giving is less responsive to price changes and more responsive to income changes than had previous studies.

Several papers have recognized that the income elasticity of charitable contributions may be affected by the income class of the contributor. For instance, Reece and Zieschang (1989) using tax data show very clearly that the magnitude of the income elasticity is a positive function of income class: as the income of the taxpayer increases so too does his or her income elasticity, confirming a result obtained in one of the early studies (Feldstein 1975a). The price elasticity of demand also appears to be negatively correlated with income class (Feldstein and Clotfelter, 1979; Feldstein and Taylor, 1979; Kitchen and Dalton, 1990; Lankford and Wyckoff, 1991). Data have also been disaggregated according to other factors. For instance, regional variation is an important feature of the Canadian landscape hence Kitchen and Dalton (1990) and Kitchen (1992) separate their household survey data according to region and find significant differences in the price and income elasticities across regions. Factors which influence an individuals' giving to religious organizations have also been shown to differ from those influencing secular giving (e.g., Feldstein, 1975b and Kitchen, 1992).

One might also identify a third generation of papers dealing with private charitable giving that would include those papers that do not focus particularly on price and income elasticities, but rather they identify a broader group of other factors that are likely to influence an individual's charitable giving. In this last group one would place papers like Brown and Lankford (1992) and, more recently, Duncan (1999) which examine the relationship between charitable giving and volunteering. Duncan also re-examines the important question of whether government spending crowds out private charity and finds some evidence that it does.

The question regarding whether government expenditure crowds out private charity has been analyzed from a theoretical perspective as well as empirically using data from the United States (e.g., Roberts, 1984; Abrams and Schmitz, 1984; Steinberg and Schiff, 1988; Kingma, 1989; Steinberg, 1991; Khanna and Sandler, 2000). Theoretically, private contributions may be considered as substitutes for government spending (and thus are crowded-out by government spending) or as complementary to government expenditures (crowded-in). The few empirical papers addressing this issue have found mixed results. For instance, Roberts (1984), Kingma (1989), and Duncan

(1999) find that government spending crowds out private contributions while Schiff (1985) finds evidence of both crowding out and crowding in. In Canada, the only paper to look at the impact of government spending and private philanthropy focuses on the relationship between volunteering and government spending. Day and Devlin (1996) find that whether or not government spending crowds out volunteering depends upon the type of government spending in question. Finally, questions like how the giving by others affects individual's philanthropy is receiving some attention in the economics literature, with Andreoni and Scholz (1998) providing empirical evidence in support of interdependent preferences for charitable giving.

This paper falls quite clearly into the third group of papers with its focus on a question hitherto ignored by the literature, namely on the relationship between direct giving and indirect giving via charitable games. It proceeds as follows. The next section focuses on the theoretical underpinnings of the problem and the appropriate econometric models to employ. This is followed by a detailed description of the data set, and then the analysis of the econometric results. The final section offers some conclusions regarding the nature of the relationship between giving directly and indirect – which, in contrast to the observations cited in the opening paragraph, would appear to be a *complementary* one.

2 Theoretical and Econometric Models

The theoretical framework of this paper is rooted in the voluntary provision of public goods literature, as first developed by Bergstrom, Blume and Varian (1986). While the contributions of this paper are empirical, the following provides a brief description of the theoretical framework underlying the econometric analysis. The theoretical model is not intended to be a complete treatment of this problem – that is the subject of another study – instead it is designed to provide a sketch of the type of utility-maximizing framework behind the empirical treatment.

In the classical model of the voluntary provision of pure public good it is usually assumed that the public good (G) is provided by the total amount of voluntary contributions ($\sum_i g^i$); in other words, the production of the public good is a function of all individuals' contributions – $G = f(g^i)$, $\forall i$. For example, if the public good is provided by a constant-returns-to-scale (or linear) production technology, then, $G = \sum_i g^i$. In this study, however, we take account of the fact that charities actually raise their funds in two main ways: from direct gifts and from charitable games, including lotteries, bingos, casinos, as well as organized charitable concerts and galas and so on.

The voluntary provision of public good model in this present study explores the relationship of direct giving (in cash) and the indirect giving via sponsoring a host of charitable activities whose proceeds are used to finance the provision of public goods. The public good level in this study can thus be expressed as follows:

$$G = \sum_j Y_d^j + \delta \sum_j Y_i^j \qquad \text{where } 0 < \delta \leqslant 1 \tag{1}$$

where the public good G is provided by the total amount of cash given directly to charity $\sum_j Y_d^j$, and the total amount of net revenues that charity raises indirectly $\delta \sum_j Y_i^j$ via lotteries, bingos, casinos, selling products, and so on. δ thus represents the proportion of total indirect giving that goes to the provision of the public good and $(1-\delta)\sum_j Y_i^j$ is the cost of indirect fund-raising – for example, the prize pool for the lottery winners, hotel and restaurant expenses for the charitable gala dinners, and so forth. For simplicity, let us assume that there is no cost of fund-raising for direct giving in this model. In addition, (1) can also be rewritten as follows:

$$G = \left(Y_d^j + \sum_j Y_d^{-j} \right) + \delta \left(Y_i^j + \sum_j Y_i^{-j} \right) \qquad \text{where } 0 < \delta \leqslant 1$$

where $\sum_j Y_d^{-j}$ and $\sum_j Y_i^{-j}$ represent the total amount of direct and indirect giving respectively by all consumers except consumer j. Individual j will decide how much to give in cash and/or indirectly by maximizing his or her utility function[3] with respect to two main constraints, as follows:

$$\begin{aligned} &\max_{X^j, Y_d^j, Y_i^j} U^j(X^j, G, Y_i^j) \\ \text{such that } \omega^j &= P_X X^j + P_{Y_d}^j Y_d^j + P_{Y_i} Y_i^j \\ G &= \left(Y_d^j + \sum_j Y_d^{-j*} \right) + \delta \left(Y_i^j + \sum_j Y_i^{-j*} \right) \\ \text{and } Y_d^j &\geqslant 0 \, , \, Y_i^j \geqslant 0 \end{aligned} \tag{2}$$

where ω^j is the individual $j's$ level of wealth which will be allocated between

[3]Technically speaking, the appropriate utility function is an expected utility function that takes into account the probability of winning the charitable gambling. For simplicity, however, we assume here that this probability is so low that donors do not take it into consideration when maximising their utility. In other words, there is no uncertainty in this model.

the private consumption of a set of private goods X^j with the price vector P_X, and the contribution to the provision of public good G, either in cash (Y_d^j) or indirectly (Y_i^j).[4] $P_{Y_d}^j$ is the individual $j's$ tax-price for cash giving that depends on the amount he or she gives and the tax system in place (in general, $P_{Y_d}^j$ is equal to one minus the marginal tax rate, thus $P_{Y_d}^j$ is less than one), and P_{Y_i} is the price of indirect giving. Notice that as consumer j maximizes his or her utility by choosing the optimal level of X^j, Y_d^j, Y_i^j, consumer j would assume that the level of donations made in cash and indirectly by all other consumers; i.e., $\sum_j Y_d^{-j*}$ and $\sum_j Y_i^{-j*}$), is optimal, thus taking them as given. In addition, the level of donations by consumer j of both direct and indirect giving must be non-negative. We normalize the price vector P_{Y_i} to be one, and rewrite the above consumer's maximization problem by substituting its constraints into the objective function:

[4]Notice that although income from the indirect giving is used by charities for the provision of public goods, the indirect giving, by itself, is the private goods for consumers. For example, as the indirect donations that charity raises from organising an auction go to finance charitable activities, donors who win the auction can keep whatever they buy for themselves.

$$\max_{Y_d^j, Y_i^j} U^j \left(\frac{\omega^j - P_{Y_d}^j Y_d^j - Y_i^j}{P_X}, \quad \left(Y_d^j + \sum_j Y_d^{-j*} \right) + \delta \left(Y_i^j + \sum_j Y_i^{-j*} \right), \quad Y_i^j \right) \tag{3}$$

If the last constraint that both giving in cash and indirectly are strictly positive, the first-order necessary conditions for the above problem are

$$\frac{\partial U^j}{\partial Y_d^j} = -U_X^j \left(\frac{P_{Y_d}^j}{P_X} \right) + U_G^j = 0 \tag{4}$$

$$\frac{\partial U^j}{\partial Y_i^j} = -U_X^j \left(\frac{1}{P_X} \right) + \delta U_G^j + U_{Y_i^j}^j = 0 \tag{5}$$

We can use these expressions to find the marginal rate of substitution among the three 'goods' – the private good X^{j*}, the public good G^*, and the amount spent on indirect Y_i^{j*}.

$$\frac{U_G^j}{U_X^j} = \frac{P_{Y_d}^j}{P_X} \quad (6)$$

$$\frac{U_{Y_i^j}^j}{U_X^j} = \frac{1-\delta P_{Y_d}^j}{P_X} \quad (7)$$

$$\frac{U_{Y_i^j}^j}{U_G^j} = \frac{1-\delta P_{Y_d}^j}{P_{Y_d}^j} \quad (8)$$

Notice that P_X is the price vector for the private good X and $P_{Y_d}^j$ is consumer $j's$ tax-price of giving in cash (Y_d); the price of indirect giving, however, is equal to $1 - \delta P_{Y_d}^j$. To understand why this is so, consider the production function for the public good represented by equation (1), it is obvious that a dollar given in cash is equal to a dollar of public good provision but it costs individual j only $P_{Y_d}^j$, or one minus individual $j's$ marginal tax rate. However, if consumer j chooses to give indirectly, only a portion of that dollar, that is δ, goes to the provision of the public good, while $1-\delta$ of that dollar goes to the private good (for instance, the lottery pot, the charitable dinner, and so on). However, the price of the private goods purchased through indirect giving is actually more expensive than $1 - \delta$, for if consumer j would choose to give δ dollars directly in cash, it would cost him or her only $\delta P_{Y_d}^j$. The price of one dollar of giving indirectly is thus equal to $1-\delta P_{Y_d}^j$. Since both δ and $P_{Y_d}^j$

are less than one, then $1-\delta P^j_{Y_d} \geqslant 1-\delta$. In other words, because consumers cannot claim for a tax deduction if they give indirectly, this becomes an additional component in the price of indirect giving for consumers.

As the price ratios in equations (6) to (8) represent the optimal conditions for consumer j to substitute one good for the other, equation (8) thus represents the price ratio between direct giving and indirect giving. Solving all consumers' first-order conditions in (4) and (5) simultaneously, we obtain consumer $j's$ demand functions of cash giving and indirect giving:

$$
\begin{aligned}
Y_d^{j*} &= f\left(P_X, P^j_{Y_d}, \delta, \sum_j Y_d^{-j*}, \sum_l Y_i^{l*}\right) \\
Y_i^{j*} &= f\left(P_X, P^j_{Y_d}, \delta, \sum_j Y_d^{-j*}, \sum_l Y_i^{l*}\right)
\end{aligned}
$$

Notice that the demand functions of cash giving (Y_d^{j*}) and indirect giving (Y_i^{j*}) depend on the price level of private goods X, consumer $j's$ tax-price for direct giving, the proportion δ of indirect giving that goes to the provision of the public good, and the optimal level of direct and indirect donations chosen by all the other consumers; i.e., $\sum_j Y_d^{-j*}$ and $\sum_j Y_i^{-j*}$ respectively. Once we include other non-price factors into our analysis – to reflect, for instance, the individual's preferences –, the reduced form expression of the above demand functions translate into two empirical equations, one for each type of giving:

$$Y_d^* = \beta'_d Z_d + \varepsilon_d \qquad where \;\; Y_d = Max(0, Y_d^*) \tag{9}$$

$$Y_i^* = \beta'_i Z_i + \varepsilon_i \qquad where \;\; Y_i = Max(0, Y_i^*) \tag{10}$$

Z_d and Z_i represent the two identical vectors of explanatory variables which include consumer $j's$ personal characteristics and the characteristics of all other consumers that can affect consumer $j's$ decisions of giving. In addition, Z_d and Z_i also include a host of other factors, such as, social capital variables that measure the connection that individual has with his or her community, provincial government expenditures on public goods, and regional dummy variables that could capture other aspects of policy variation across regions that may influence donating behaviour. Notice that these two demand functions of giving can be observed if and only if the real amount of giving either in cash (Y_d) or indirectly (Y_i) is greater than zero.

Each individual has to decide how much he or she wants to give and by which means. Everyone can choose to give some positive amount or none at all for both categories of giving. We thus come up with four possible outcomes: the individual chooses to give both directly and indirectly $Prob(Y_d > 0, Y_i > 0)$; he or she chooses to give only in cash $Prob(Y_d > 0, Y_i = 0)$; he or she chooses to give only indirectly $Prob(Y_d = 0, Y_i > 0)$; and, finally, the individual chooses not to give at all $Prob(Y_d = 0, Y_i = 0)$.

Since the amount of giving either in cash or indirectly is greater than or equal to zero, we observe a censored dependent variable which cannot take on a negative value. The Tobit model is thus a good candidate for analyzing this problem. In the real world, it is quite likely that individuals make the decision as to whether or not to give to charities or to participate in charitable lotteries, as well as how much to give in both instances, in a joint manner rather than sequentially. Thus, the model of giving directly and indirectly should take this jointness into account. The bivariate Tobit model does precisely this, and hence is the basic framework used in this paper.

It is well known that the disturbance terms of the two censoring regressions ε_d and ε_d are jointly normally distributed with 0 means, variances σ_d and σ_i, and the covariance σ_{di}. If the correlation between the disturbances of the two equations, ρ_{di}, is non-zero, a system of maximum likelihood functions is considered to be the efficient method of estimation. The maximum likelihood functions for the bivariate Tobit used in this study are similar to those presented in appendix A of Shonkwiler and Harris (1997), as well as those described in the appendix of Brown and Lankford (1992). The likelihood functions for the bivariate Tobit model in this study can be written as:

$$
\begin{aligned}
&\prod_{y_d>0,y_i>0}(2\pi\sigma_d\sigma_i(1-\rho_{di}^2)^{1/2})^{-1}\exp\left[\frac{-1}{2(1-\rho_{di}^2)}\left[\begin{array}{c}\frac{(Y_d-\beta'_dX_d)^2}{\sigma_d^2}+\frac{(Y_i-\beta'_iX_i)^2}{\sigma_i^2}\\ -2\rho_{di}\left(\frac{(Y_d-\beta'_dX_d)}{\sigma_d}\frac{(Y_i-\beta'_iX_i)}{\sigma_i}\right)\end{array}\right]\right]\\
&\prod_{y_d>0,y_i=0}\Phi\left[\frac{-\beta'_iX_i-\rho_{di}\sigma_i\left(\frac{Y_d-\beta^i_dX_d}{\sigma_d}\right)}{\sigma_i(1-\rho_{di}^2)^{1/2}}\right]\sigma_d^{-1}\phi\left[\frac{Y_d-\beta'_dX_d}{\sigma_d}\right]\\
&\prod_{y_d=0,y_i>0}\Phi\left[\frac{-\beta'_dX_d-\rho_{di}\sigma_d\left(\frac{Y_i-\beta^i_iX_i}{\sigma_i}\right)}{\sigma_d(1-\rho_{di}^2)^{1/2}}\right]\sigma_i^{-1}\phi\left[\frac{Y_i-\beta'_iX_i}{\sigma_i}\right]\\
&\prod_{y_d=0,y_i=0}\Phi\left[\frac{-\beta'_dX_d}{\sigma_d}-\frac{-\beta'_iX_i}{\sigma_i},\rho_{di}\right]
\end{aligned}
$$

where $\Phi[..,\rho_{di}]$ is the bivariate standard normal cumulative density function, $\Phi[.]$ is the univariate standard normal cumulative density function, and $\phi[..]$ is the standard normal density function such that if $z \sim N(0,1)$ then $\phi(z) = \frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}z^2\right)$.

From the bivariate Tobit model in equations (9) and (10), there are six interesting conditional means of giving that can be derived following the method in Pudney (1989, appendix 2, pp. 308-311). We will start with direct giving (or cash donations):

$$f(Y_d/Y_d \geq 0) = \frac{f(Y_d)}{\Pr ob(Y_d \geq 0)} \quad (11)$$

$$E(Y_d/Y_d \geq 0) = \int_0^{\infty} Y_d f(Y_d/Y_d \geq 0)\, dY_d \quad (12)$$

We can substitute (11) into (12) and use the fact that Y_d is lower censored (at zero) with the normal distribution, that is $Y_d \sim LCN(\mu_d, \sigma_d, 0)$. We then can find the density function for the censored random variable Y_d[5]

[5]The concept of the conditional mean of giving is, actually, the average amount of giving taking into account that the data is censored. Some thus called this average "censoring mean" (see Greene 1997, pp. 962-963).

$$
\begin{aligned}
f\left(Y_d/Y_d \geq 0\right) &= \frac{\frac{1}{\sigma}\phi\left[\frac{Y_d-\mu_d}{\sigma_d}\right]}{1-\Phi\left[\frac{0-\mu_d}{\sigma_d}\right]} \\
&= \frac{\frac{1}{\sigma}\phi\left[\frac{Y_d-\mu_d}{\sigma_d}\right]}{\Phi\left[\frac{\beta_d' X_d}{\sigma_d}\right]} && (13) \\
E\left(Y_d/Y_d \geq 0\right) &= \beta_d' X_d + \frac{\sigma_d \phi\left[\frac{\beta_d' X_d}{\sigma_d}\right]}{\Phi\left[\frac{\beta_d' X_d}{\sigma_d}\right]} && (14) \\
&= \beta_d' X_d \Phi\left[\frac{\beta_d' X_d}{\sigma_d}\right] + \sigma_d \phi\left[\frac{\beta_d' X_d}{\sigma_d}\right] && (15)
\end{aligned}
$$

Applying the same method we can also find the conditional mean for indirect giving, i.e., $E\left(Y_i/Y_i \geq 0\right)$. For the joint density function $f(Y_d, Y_i)$, the concept of the conditional means can be described as follows:

$$
\begin{aligned}
f\left(Y_d, Y_i/Y_i \geq 0\right) &= \int_0^\infty \frac{f(Y_d, Y_i)}{\Pr ob\left(Y_i \geq 0\right)} dY_i \\
E\left(Y_d, /Y_i \geq 0\right) &= \int_{-\infty}^\infty Y_d \int_0^\infty \frac{f(Y_d, Y_i) dY_i}{\Pr ob\left(Y_i \geq 0\right)} dY_d \\
&= \int_0^\infty \frac{E(Y_d, /Y_i) f(Y_i)}{\Pr ob\left(Y_i \geq 0\right)} dY_i && (16)
\end{aligned}
$$

given that $Y_i \sim LCN(\mu_i, \sigma_i, 0)$, in Pudney (1989, appendix 2, equation

(A2.41)) we then have that

$$E(Y_d,/Y_i \geq 0) = \beta_d' X_d + \frac{\sigma_d \rho_{di} \phi \left[\frac{\beta_i' X_i}{\sigma_i} \right]}{\Phi \left[\frac{\beta_i' X_i}{\sigma_i} \right]} \tag{17}$$

where $\rho_{di} = \frac{\sigma_{di}}{\sigma_d \sigma_i}$ is the correlation coefficient, and extending the notion of the expected value of giving with one condition to two, we obtain

$$\begin{aligned} E\left(Y_d,/Y_d \geq 0, Y_i \geq 0\right) &= \int_0^\infty Y_d \int_0^\infty \frac{f(Y_d,Y_i)}{\Pr ob\left(Y_i \geq 0\right) \Pr ob\left(Y_d \geq 0\right)} dY_i dY_d \\ &= \frac{E(Y_d,/Y_i \geq 0)}{\Pr ob\left(Y_d \geq 0\right)} \end{aligned} \tag{18}$$

Once again, we can apply the above method and find the expected means for indirect giving (Y_i) conditional on direct giving (Y_d), i.e. $E\left(Y_i,/Y_d \geq 0\right)$ and $E\left(Y_i,/Y_d \geq 0, Y_i \geq 0\right)$.

In addition to calculating the predicted values of giving directly and indirectly, which are interesting in their own right, we can make use of these values to analyze the (conditional) elasticity of giving with respect to various exogenous variables. We do so by imposing a one per cent increase in the selected explanatory variable, for example household income, and then predicting the rate of change in each of the conditional means calculated above. The rate of change in the expected value of giving is thus equivalent to the (conditional) income elasticity of the giving. For example, the percentage change in $E(Y_d, /Y_i \geq 0)$ given that household income has increased by one percent is an estimate of the income elasticity of giving in cash for households given that household also chooses to give indirectly as well.[6] The variables of this study for which these elasticities are calculated are the tax-price of giving, provincial government expenditures per capita, household income, the number of children in the household ages less than five years, and the number of children living in the household aged 13-17 years.

In addition to the bivariate Tobit analysis, we also run bivariate probit regressions to see if the qualitative results differ significantly across the two models. While the probit model considers those factors that influence only the decision to give, the Tobit model takes account of both this decision and the amount that consumers actually contribute. The bivariate probit model of giving in cash and indirectly as explained in Greene (1997, section 19.6,

[6]The elasticities calculated in this study thus can be called "censoring elasticities "as well.

pp. 906-12) is as follows:

$$D_d^* = \alpha_d' Z_d + \varrho_d \qquad where \;\; D_d = 1 \text{ if } D_d^* > 0, \text{ or 0 otherwise} \tag{19}$$

$$D_i^* = \alpha_i' Z_i + \varrho_i \qquad where \;\; D_i = 1 \text{ if } D_i^* > 0, \text{ or 0 otherwise} \tag{20}$$

the disturbance terms ϱ_d and ϱ_i are jointly normally distributed with mean $E(\varrho_d) = E(\varrho_i) = 0$, $Var(\varrho_d) = Var(\varrho_i) = 1$, and the covariance $Cov(\varrho_d, \varrho_i) = \delta_{di}$. The maximum likelihood function for the estimation of a bivariate probit model also can be found in Greene (1997, chapter 19).

3 Data Set

In November 1997, Statistics Canada, in cooperation with Human Resources Development Canada, the Canadian Centre for Philanthropy, Canadian Heritage, Health Canada and Volunteer Canada, undertook a comprehensive survey of individuals' philanthropic and civic activities. This Survey of Giving, Volunteering, and Participating (SGVP) contains detailed responses from

18,301 individuals regarding their philanthropic and other endeavour over the course of the 12 month period November 1, 1996 to October 31, 1997. It represents a rich source of data on a broad array of household and individual characteristics, as well as on the charitable donations made by individuals, both directly via giving to registered charities and indirectly via charitable lotteries, casinos and bingos.

Of the 18,301 respondents, 15,422 individuals responded to questions of interest to this study – thus, the 'full sample' is comprised of 15,422 individuals. The full sample is also broken down into four categories according to giving behavior: 12,077 individuals give both in cash and indirectly,[7] 1620 individuals give only in cash, 680 individuals give only indirectly, and 1,045 individuals do not give at all. Table (1) presents the breakdown of our SGVP sub-sample into these four types of givers.

[7]Notice that the definition of indirect giving here is slightly different from the definition in SGVP 1997 survey. For in the SGVP 1997 survey, Statistics Canada included putting money in the box near cash register as part of indirect giving, but we consider this type of contribution as part of cash giving. In addition, this study does not include giving in-kind, bequests, donations of food, clothing, giving money to relatives as well as giving to other individuals.

Table 1: Breakdown of the SGVP sub-sample according to types of giving

Type of giving	giving indirectly	not giving indirectly
cash giving	12,077	1,620
(unweighted % sample)	(78%)	(11%)
(weighted % sample)	(70%)	(12%)
no cash giving	680	1,045
(unweighted % sample)	(4%)	(7%)
(weighted % sample)	(6%)	(11%)

Source SGVP 1997 data file.

Because the estimation procedures employed in this paper are highly non-linear, it was crucial that the analysis be undertaken using a certain number of continuous variables - which was impossible given the nature of the public-use SGVP data set. For instance, in the public-use data set, household income is available in ranges only, as is the age of the individual respondent. As a result, the analysis in this paper had to be conducted using the non-public access master file of the SGVP, which, among other things, contains information on the respondents' age and income.[8]

Table (2) presents the list of variables used in the regression analyses, plus

[8] We are very grateful to Statistics Canada for giving us permission to use the master file of the SGVP at their premises. Apinunmahakul and Devlin (2000) was written for Statistics Canada in return for access to this data set.

their definitions. Although the SGVP contains several other variables that could affect individuals' giving behaviour, it became impossible to include them all because of the complicated nature of the bivariate Tobit and probit models. Including too many dummy variables affected the ability of these models to converge.

Table (3) describes the personal characteristic of respondents broken down into the four categories of giving described earlier, plus for the full sample of 15,422 individuals. The average amount of giving in cash for the whole sample is 199 dollars, and is 53 dollars for indirect giving. People who give in both categories tend to give more than people who give only in cash or indirectly: on average, they give 252 dollars in cash compared to 170 dollars for people who give only in cash, at the same time, they also sponsored charitable activities by giving indirectly 72 dollars as opposed to 41 dollars for people who only give indirectly. Interestingly, people who give both directly and indirectly earn, on average, a higher income as well as being more educated in comparison to the groups of non-givers. The average individual and household income for people who give in cash and indirectly are 27,852 dollars and 53,145 dollars respectively, which represents about a 12 per cent higher individual income and a 10 per cent higher household income in comparison to those of the full sample; other types of givers all have average incomes lower than the average income of the full sample. This observation might mean that both giving in cash and indirectly are normal goods since the higher income group tends to give more than does the lower income group. In addition, the level of income is also directly related to level of education for 35 per cent of the whole sample has high school education, but people who give in cash and indirectly have the highest proportion of individuals with the higher educational levels, ranging from some post-secondary education to being a university graduate. It is thus not surprising that most of the people who give both are employed (67 per cent), and people who do not give at all have the lowest rate of employment (45 per cent).

It is interesting to note that the average age of people who give both directly and indirectly is the same as the average age of those who do not give at all, as well as the average age of the sample as a whole (44 years); people who give only in cash are, on average, older than these groups (48 years) while people who choose lotteries and so on as the means of donating to charity tend to be younger (39 years old). A little bit more than half of cash givers are female while males prefer to give indirectly (53 per cent) or to not give at all (57 per cent).The sample is randomly distributed across provinces and/or regions: more than one-third of the sample live in Ontario, about a quarter live in Quebec, and the rest are in the Prairies (15 per cent), British Columbia (13 per cent), and Atlantic Canada (9 per cent) respectively. Notice that as the majority of people reside in Ontario, and 40 per cent of them give both directly and indirectly, this implies that Ontario residents on average give more than people living in other provinces (for both in cash and indirect giving).

For family characteristics, more than 60 per cent of people who choose to give in cash are married while more than half of the non-married individuals prefer to give indirectly or to not give at all. One explanation for this might be that indirect giving also provides individuals with a form of entertainment which is better suited to the single life-style. The majority of people who give indirectly or not give at all (73 per cent) therefore makes the decision of giving by themselves, while most of the married couples who give in cash trend to make their decision jointly. In addition, people who give both ways have more children in their household than do the other groups of givers, and most of these children are aged 6 to 12 years old.

The sample also indicates that 49 per cent of people who give both directly and indirectly claim a tax credit for their cash donations while only 31 per cent of people who give in cash do so. The majority of givers (more than 90 per cent) consider themselves healthy; people who choose to give only in cash have the highest percentage of religious affiliation while people who choose not to give at all are the least likely to have a religious affiliation. Most respondents spoke English during the SGVP interview (75 per cent). The majority of all givers (more than 60 per cent) live in cities with a population of more than 100,000, and three quarters of all non-givers live in the city.

In addition to personal and household characteristics, the SGVP also provides information on a host of factors that may be considered as indicators of 'social capital' or civic connectedness. This study focuses on four such factors: the length of time an individual has lived in his or her current residence, whether or not the individual votes in political elections, whether or not the individual was born in Canada, and lastly the amount of television watched by the respondent. The sample shows that 72 per cent of cash givers have lived in their current residence for more than six years while only 63 per cent of the non-cash givers (i.e., indirect givers or non-givers) have dwelled in their residence for the same length of time. Furthermore, the majority of the sample participates in federal, provincial or municipal elections, but individuals who give both directly and indirectly are more active in elections

(85 per cent) than are other people. Not surprisingly, some 80 per cent of respondents were born in Canada; and about one half of the sample watches television 15 - 29 hours per week.

Since this paper is interested in the determinants of giving – both directly and indirectly – it may also be important to separate the full sample into subgroups according to the characteristics of individuals. Three characteristics seem particularly important. First, the SGVP asked respondents whether they made their own decisions regarding how much to donate, or whether their decisions were jointly determined with their spouse. Second, the SGVP sample was separated according to the sex of the respondent. And, lastly, because giving to religious organizations like churches or synagogues may be motivated by factors that differ from giving to other organizations, the sample was separated on the basis of whether the individual gave to a place of worship. Tables (4) to (6) provide the characteristics of the respondents whenever the full-sample is disaggregated according to these three factors.

In terms of the amount given, table (4) indicates that people who make their decision jointly with their spouse tend to give more in cash: joint-decision givers donate 247 dollars in cash which is 87 dollars higher in comparison to those who make their decision on their own; by contrast, their indirect donations are only one dollar higher than those who make their own decision. In addition, joint-decision givers have a higher rate of employment (64 per cent compare to 60 per cent), and thus a higher average income at both the individual level (by 3,537 dollars) as well as the household level (10,695 dollars higher). In addition, since income usually is related to the level of education, we thus observe that own-decision givers have a higher share of respondents (36 per cent) in the high school level than do joint-decision givers (34 per cent) but joint decision giver have a higher proportion of respondents in the other educational levels beyond high school.

Furthermore, since all joint decision givers are married, they thus have higher average household size (3.25 persons versus 2.70 persons) with the percentage of children in the household more than double compare to own decision givers (46 per cent versus 21 per cent). Most of the children in the joint-decision households are younger than in the own-decision group. In addition, the average age of the joint-decision giver is 47 years of age, 4 years older than own-decision givers. Although both groups have lived in their community for a long time, joint-decision givers stay in their community longer than do own-decision givers. On the contrary, most of the own-decision givers live in the city area (70 per cent), and only 21 per cent of them live in a rural area, while 62 per cent of joint-decision givers live in the city and 27 per cent of them live in rural area. Social cohesion, or how connected an individual feels to his or her community, might play a role in explaining why joint-decision givers give more in cash than own decision givers, we thus will test this hypothesis later on in our regression analysis.

Table (5) describes the characteristics of givers according to their gender, we find that females and males give about the same amount in cash as they give indirectly, in spite of the fact that the male's average income is some 13,713 dollars higher than that of the female. Interestingly, the level of education for both groups is not much different. Table (6) presents the average characteristics of those who give to a place of worship as well as those who donate money to organizations other than places of worship. We see that some 66 per cent of the donations of those in the former group go to places of worship.

In addition to the variables available in the SGVP data set, we are also interested in how donors respond to the 'price' of giving, which, assuming that donations are income-tax exempt, is reflected in the marginal tax rate facing the individual. In Canada, charitable contributions are treated as a tax credit rather than an income deduction which changes conceptually the way in which one thinks about the marginal tax rate. If donations are deductions from income, then the tax-price of the donation is a function of the individual's income level, the tax credit, by contrast, is a function of how much the individual gives.

Before describing how the tax credit system works in Canada, we turn to a brief description of the Canadian income tax system. Income taxes are levied by the federal government and the provincial government. Federal taxes are levied as a function of income, essentially three tax brackets are in place. In 1997, all taxable income up to 29,590 dollars was taxed at 17 per cent, taxable income between 29,590 and 59,180 dollars was taxed at 26 per cent, and then all taxable income above 59,180 was taxed at 29 per cent. In all provinces except Quebec at that time, the provincial tax rate was determined as a function of the federal tax collected. Thus, for instance, Ontario imposed an income tax that was 48 per cent of the federal tax bill. Because each province, except Quebec, imposed a mark-up over the federal tax rate, variations in these provincial rates thus constitute the primary source of variation in income tax rates for a given individual with a given income living in Canada.

The tax-credit system in Canada for donations is prescribed by the federal government and is as follows: the first 200 dollars of donations are awarded a tax credit of 17 per cent, all amounts exceeding 200 dollars earn a credit of 29 per cent. However, because the provincial tax rate is a function of the federal tax payable (except in Quebec), the tax credit awarded any given individual is significantly greater than the amounts just indicated. Thus, in principle, the marginal tax rate can be constructed as follows: for each individual who gives up to 200 dollars, the tax rate is equal to 17 per cent (the federal tax credit on the first 200 dollars of charitable donations) plus 0.17 times the basic income tax rate relevant for the province in which the individual resides. Thus, for instance, someone who gives 200 dollars in Ontario faces a marginal tax rate for that donation (in 1997) of (0.17+0.17*0.48) = .25 or 25 per cent. For anyone who gives more than 200 dollars the tax rate applicable on the last dollar donated (the marginal tax rate) is calculated with a 29 per cent federal tax credit, using the same procedure as outlined above. As a consequence, every individual who gives less than 200 dollars residing in province x faces the same marginal tax rate, as does everyone with donations above 200 dollars residing in the same province also has the same marginal tax rate. It thus becomes obvious that individuals who give more than 200 dollars receive a higher income tax credit than those who give less - however, this implies that the tax-price of the donation is not independent of the amount the individual gives. To avoid this endogeneity problem, this paper simply uses the basic provincial tax rate that applies to each individual, which is the source of variation across individuals of a given income. As a result, the only variability in this marginal tax rate is across the province of residence.[9]

The analysis also looks at how individual giving may be affected by government spending. In this study, we include as a measure of government spending as per capita consolidated provincial-local government expenditures on programs. Although we would have liked to analyze the impact of different areas of provincial government spending, such as health care, education, and social services on giving, this proved to be impossible because these expenditures were highly collinear with our tax variables, rendering the bivariate Tobit model unable to converge.[10] We thus had to confine our anal-

[9] 1997 tax rates retrived from www.ccra-adre.gc.ca/tax/individuals/faq/98_rate-e.html. Note that in Quebec charitable tax credits are treated differently, we thus used the average of income tax rate from all the other provinces, which is equal to 55.2 per cent, as the proxy for the Quebec income tax rate. The issue of which tax rate to use is not a simple one. The method that we choose to adopt in this paper is designed to capture interprovincial differences while eliminating any endogeneity problems. Clotfelter (1985 ch.3) provides a rich discussion on the merits and demerits of different measures of tax rates.

[10] We do not run into this problem of being unable to converge if we regress each giving equation separately.

ysis to using the total per capita amount of provincial government program expenditures.[11]

4 Results

Several specifications were estimated of different econometric models, rendering it complicated to present the results in a concise manner. Nevertheless, it seems sensible to articulate the main part of the discussion around the results obtained from the bivariate Tobit model using the full set of regressors. At the onset, it is important to establish that the bivariate Tobit model is indeed the best approach for the problem at hand, which requires determining if the decisions of whether and how much to give to charities directly and indirectly should be estimated jointly using the bivariate Tobit, or separately using two different Tobit specifications.

To answer this question, we turn to tables 7 through 10 which report the bivariate Tobit and bivariate probit estimations[12] for the full sample (table

[11]The government spending data were obtained from CANSIM matrices 8181-8193. Note that the spending variables exclude expenditures on debt charges and transfers to local governments. Population data came from CANSIM matrix number 6367-6378, and 6408-6409.

[12]In all cases, the dependent variable (direct or indirect contributions) has been divided through by 1,000 in order for the highly non-linear bivariate Tobit model to converge.

7), for the sub-sample of individuals who report in the SGVP that they make decisions regarding charitable contributions on their own (table 8)[13], for individuals who give to places of worship - the 'religious' group (table 9), and for individuals who give to organizations other than places of worship (table 10).[14] At the end of these tables are the estimates of the standard error of each regression, as well as the estimates of the correlation between these standard errors (ρ). Notice that for the whole sample and for the sample looking at giving to all but places of worship, the estimated rhos are positive and highly statistically significant - indicating that in these two cases, giving directly and indirectly are jointly determined and hence should be estimated using a procedure that takes this into account. However, individuals who determine on their own whether and how much to give to charity, appear to make these decisions separately from the decisions concerning indirect giving. These decisions appear to be similarly independent for giving only to places of worship and indirect giving. Interestingly, when one looks at the bivariate

[13]Because most people who make decisions on their own are not married (65 per cent of the sample), we use individual income as the appropriate income measure for this group. Running the regressions with household income did not qualitatively change the results.

[14]Notice that the fact that we are referring to people who give to places of worship as the 'religious' group should be interpreted rather narrowly. First, in no way do we think that by not giving to a place of worship a person is not religious. Second, people may give to religious organizations that are not places of worship.We thus refer to those who do not give to places of worship as 'non-religious' only to ease the exposition.

probit estimations of the various specifications, a different story emerges: for all four specifications, the estimated rhos of the equations are positive and statistically significant, suggesting that all of the decisions of whether or not to give directly or indirectly are taken jointly, however the decisions as to how much to give are taken separately for those who make their own decisions and for those who give to a place of worship. Table 11 reports the likelihood ratio tests of the coefficient vectors from table 7-10. These test results indicate that the estimated coefficients obtained from the bivariate-Tobit and probit models with different specifications (i.e., the full sample, own decision, religious givers and non-religious givers) are statistically different from each other.[15]

Table 12 also reports the estimated coefficients arising from the univariate Tobit model. It is interesting to note that, for the whole sample, the estimated coefficients from the bivariate Tobit model for the direct giving equation are consistently larger than those from the univariate Tobit model. As discussed throughout this section, the different models, and different specifications of each model, result in different measures of elasticities.

Having established that individuals, for the most part, make their de-

[15]For all the likelihood ratios are much higher than the chi-squred statistics with 56 degree of freedom.(see table 11)

cisions regarding giving directly and indirectly in a joint manner, we focus primarily on the results arising from the bivariate Tobit specification. We use other models, and most importantly the results from the bivariate probit analysis, to illuminate further what is happening. Before turning to the results another important issue needs to be addressed - that of heteroscedasticity: the assumption that the variance of the disturbance term is constant across the sample typically does not hold for cross-section data (e.g., Greene 1997, chapter 12). Our data set is no exception to this rule. A series of Lagrange-Multiplier tests run on different groups of variables indicate that heteroscedasticity is present for several groups of variables[16] Unfortunately, although we detected the presence of heteroscedasticity, especially surrounding the income variable, we were unable to do very much about it. The bivariate Tobit procedure would not converge with a heteroscedasticity correction (irrespective of the various forms of heteroscedasticity employed); we tried to estimate an extremely parsimonious model with a correction, and that too

[16]For instance, we ran a series of LM tests for five groups of variables for the univariate probit model - education (four variables: LM = 10.24), government expenditure and regional dummies (five variables: LM = 16.60), presence and number of children (four variables: LM = 2.25), and the length of time in the current residence plus whether or not the individual was born in Canada (four variables: LM = 19.76). The critical value of LM with five degrees of freedom is 16.75, and four degrees of freedom is 14.86, at the 0.995 level of significance. In other words, heterscedasticity was associated with two of these four groups. As soon as income was put into any of these groups, the LM statistic increased in value.

did not converge, even the univariate Tobit models would not converge. By contrast, the univariate probit model did converge with a heteroscedasticity correction involving variables other than household income (which is likely to be the main offender), and a parsimonious version of both the univariate and bivariate probit models converged using an income correction.

In order to see what the impact may be of correcting for heteroscedasticity in the income variable, table 13 presents the parsimonious versions of the bivariate probit models with and without the correction. It is useful to note that, although the statistical significance of the estimated coefficients falls for every variable in the model, in no case does the estimated coefficient become insignificant after the correction (although the estimated t-ratio for the ATLANTIC coefficient does drop from -2.65 to -1.70). Interestingly, the marginal effects arising from the uncorrected and corrected models are remarkably similar. Ultimately, it proved to be impossible to deal with heteroscedasticity in most of the analysis, even with the univariate Tobit, and given that individuals do appear to make their giving decisions jointly, it was judged to be more important to focus in on that aspect of the analysis. It is also the case that the papers analyzing charitable contributions using survey data, with a couple of notable exceptions,[17] do not typically recognize let alone deal with the problem of differing variances across the sample. Thus, we are left in the position of recognizing the potential impact of heteroscedasticity on our estimates, but forging ahead with results that cannot be corrected for this problem.[18]

A final point to note before proceeding with the discussion of the results concerns statistical significance and elasticities. If an estimated coefficient is statistically significant, one tends to think of the variable to which the coefficient belongs as being 'important' in terms of explaining the variation in the dependent variable. However, it is not at all clear what 'important' means: a variable may be highly statistically significant, but its impact on the dependent variable is minute. To this end, some measure of the marginal impact of the variable or the elasticity of the variable would be very useful; this is relatively easy to compute for the bivariate probit model but is much more

[17] Both Glenday, et al. (1986) and Lankford and Wyckoff (1991) deal with heteroscedasiticy in their univariate Tobit models using a much more parsimonious specification than is undertaken in our paper.

[18] We also contacted William Greene, the author of the software program LIMDEP that we used for this study, who also indicated that both the bivariate Tobit and probit are complicated models owing to the correlation coefficient and non-convexity of the log likelihood function. Including heteroscedasticity into the model increases the complexity, thus makes the likelihood function unmanageable by LIMDEP, especially, in our model with 28 explanatory variables.

complicated to obtain for the bivariate Tobit model. As described earlier, in order to get an idea of the impact of changing one of the independent variables on the amount donated, this paper estimates the conditional expected value of giving (either directly or indirectly) under various scenarios, and then compares this value to that which arises when the given independent variable is increased by one per cent.

The discussion of the results is articulated around three broad groups of variables: those reflecting personal or household characteristics, those representing social capital, and, finally, government policy variables. Focusing on the impact of each of these groups of variables allows us to present the myriad of results in a coherent manner. Unfortunately, it also means that we have to compare and contrast simultaneously results that are presented in several tables, with this in mind, we now proceed to the discussion.

4.1 Personal or Household Characteristics

In contrast to much of the previous work on charitable giving, this study makes use of a whole host of personal and household characteristics that are likely to influence an individual's decision to give to charity – characteristics that were simply not available to many of the other researchers.[19] For the most part, these characteristics, which include the individual's age, sex, marital status, education, religiosity, individual and household income, and the presence and number of children, play an important role in the decisions of how whether and how much to contribute.

From tables 7 to 10, we find that males typically donate less to charities in a direct manner than do females. The results from giving indirectly indicate that males are not statistically different from females. However, looking at the bivariate probit results of only the decision to give indirectly, one finds that males, in general, are less likely to decide to play a charitable lottery,[20] but if they do, they behave in a manner which is not statistically different from their female counterparts. Being married is not a statistically significant determinant of either giving directly or indirectly for the sample as a whole. However, for direct giving it is positively related to giving to a place of

[19] Personal characteristics are more commonly available only for micro-data studies. Since most of the other studies use aggregate data, then their exclusion is understandable. For those papers that used survey data, several reasons may explain why some personal or household characteristics have been ignored. For instance, Kitchen and Dalton (1990) who use the 1982 Survey of Family Expenditure data set in Canada, report that they could not use certain variables because of a collinearity problem (p. 291). Other papers may well have been simply following the pattern set by the earlier generation of work on this subject.

[20] except for the 'own-decision' group where males' decisions are not significantly different from females.

worship and negatively related to giving to other than a place of worship. By contrast, being married and giving to a place of worship is associated with a negative impact on giving indirectly.

The estimated coefficient on age from the bivariate Tobit model suggests that the age of the individual matters when explaining direct giving.[21] Indeed, the marginal effects of the bivariate probit model indicate that a small increase in a person's age would increase the probability of contributing directly to charities by 0.04 for the whole sample and the own-decision sample, and by 0.13 for the giving to places of worship sample. Table 14 presents the impact of age on the expected value of charitable donations: a one per cent increase in a person's age will increase the value of direct giving by 1.5 per cent given that the person also gives indirectly, but has no effect on indirect giving. The bivariate Tobit results confirm that age does not, for the most part, matter in the equations explaining indirect giving, with the exception of the equation for giving to places of worship. In this case, age has a negative impact on indirect giving. Thus, the older a person is, the more likely that he or she will give directly to charities, and if he or she gives to places

[21]Note that in cross-sectional studies, one cannot distinguish between age effect and cohort effect. Thus, for instance, we cannot indicate with certainty if giving increases with age per se, or if older people now happen to belong to a more generous cohort.

of worship, then the less likely he or she will be to participate in charitable gambling. Interestingly, if one examines the results from the bivariate probit, one finds that age has a systematically negative impact on giving indirectly.

The presence and number of children in different age groups has a typically positive but somewhat variable impact on direct giving. The results from the bivariate Tobit of the whole sample (table 7) and for the giving to place of worship sample (table 9) suggests that the number and presence of children in all but the oldest age group (KID18PL) has a positive and statistically significant effect on direct giving. Indeed, looking again at our estimates of the elasticity of giving with respect to children five years of age and under (table 14), we see that the expected value of donations, conditional on either indirect giving being positive or both indirect and direct giving being positive, increases by four per cent as a result of a one per cent increase in the number of young children in the household. The impact of young children, however, has a large negative effect on indirect giving - the expected value of indirect giving falls by over five per cent with a one per cent increase in the number of children aged five and younger. Notice, however, that, for the same conditional values of donations, a one per cent increase in children aged 13 to 17 has an enormous impact on the expected direct contributions - between 12 and 13 per cent; and it would result in a two per cent increase in indirect giving Thus, the age of the children matters in terms of their impact on the amount of giving and in terms of giving directly versus indirectly, which means, of course, that the giving pattern of the household is likely to change over time as children age. The impact of children for the 'own decision' group is predictably small (as this group has fewer children on average, see table 4); and for the not-to-places-of-worship sample, the presence of children in the two middle age groups has a positive effect, while the presence of older children has a statistically negative effect.

In contrast, children have no impact on the decision to give directly for the whole sample according to the bivariate probit results, while they have a positive impact (except for the oldest group) on the decision to give for the religious group. The presence of children has a mixed effect on indirect giving: for the whole group, young children aged five and under exert a negative influence, while children aged 6 to 12 years have a positive impact on indirect giving. For religious giving, the impact of children on indirect giving is generally negative, but not always statistically significant, while the opposite holds true for non-religious giving.

For the most part, the decision to give and the amount to give are positively related to an individual's level of education – a result that holds true for all but the religious group. Thus, the more educated a person is, the more likely that he or she will decide to give directly to charity, and the more money he or she will give. Indeed, the results also show that compared to other levels of education in all four specifications, individuals with a university degree are the most generous ones both in giving directly and indirectly. Among other things, this finding implies that education yields yet another positive externality, providing further support for the continued public funding of education. This result does not hold true for indirect giving. Looking at the estimated coefficient for each of the four levels of education reported in tables 7 through 10 (and remembering that gradeschool is the reference group) we find that those with high school are more likely to play charitable lotteries relative to individuals with a diploma or post-secondary education, for all four groups in our analysis. Interestingly, it remains those with a university education who play charitable lotteries more than any other group.

Being affiliated with a place of worship – our measure of religiosity – exerts a positive impact on giving directly across all four specifications. Indirect giving is positively affected by this measure as well for all but the place-of-worship group, indicating that religious people are less likely to give indirectly via charitable lotteries as opposed to other people, *ceteris paribus*.

Lastly, we turn to the impact of income on charitable giving. There is no doubt that income plays an important role in charitable giving – just how important has been the subject of extensive debate in the literature. Most of the first generation of studies found an income elasticity of less than one – and typically around 0.8, but as low as 0.2[22] – indicating that as individuals' income increased, charitable contributions would increase but by proportionately less than the rise in income. The basic result that charitable contributions are a normal good with an income elasticity of less than one essentially holds for the next generation of papers as well, but with perhaps a larger variance across the different studies. From tables 7 to 10 we see that income is highly statistically significant in our model, irrespective of specification, for both the direct and indirect giving equations. To see how important income is, we can look at its marginal impact in the bivariate probit model also reported in these tables. For the whole sample, a one unit increase in income will increase the probability of giving by 0.04, and by 0.03 for religious giving. Curiously, the marginal effect on the probability of

[22]See Clotfelter (1985) for a review of the earlier studies.

giving of a small increase in income is much lower for the group of individuals who make their charitable decisions on their own - for this group, a small increase in income will increase the probability of giving by 0.007. This pattern repeats itself for the indirect giving decision: the impact of a small increase in income on the probability of playing a charitable lottery is 0.04 for the whole sample, 0.06 for the religious group, and 0.009 for the own-decision group. Thus, for the own-decision group, the decision to give is much less responsive to income in comparison to the other groups.

Turning once again to our estimated elasticities from the bivariate Tobit model (table 14), we find that a one per cent increase in household income generates a 0.83 per cent increase on the expected value of direct giving (conditional on indirect giving being present), or a 0.78 per cent increase in the expected value of direct giving conditional on both direct and indirect giving being position. A one per cent increase in household income increases indirect giving by 0.6 per cent. At this juncture, it is worthwhile also noting that calculating the elasticity of income using the estimates from the bivariate Tobit model provides elasticity measures which are larger than those arising from the univariate Tobit model with separate equations for direct and indirect giving. In the univariate Tobit model, a one percent increase in household income will increase the expected value of direct giving (conditional on giving is positive) by 0.27 per cent; the comparable figure for indirect giving is 0.17 per cent. Clearly estimating the two equations jointly is important when it comes to calculating the impact of income on donations.

Several papers in the literature, including a few Canadian studies (Glenday, et al., 1986; Kitchen and Dalton, 1990; Kitchen, 1992), have indicated that the income class of the individual is important, especially when it comes to estimating the price-elasticity of contributions. To explore further this possibility, we split the sample into three income class groups corresponding to the three income tax rates levied by the federal government: under \$29,590 (6,092 observations), between \$29,590 and \$59,180 (5,507 observations), and over \$50,180 (3,823 observations). The bivariate Tobit model would not converge for the highest income group, but it converged for the two other groups. Moreover, only for the lowest income group was the bivariate Tobit model appropriate judging from the statistical significance of the estimated correlation (rho) between the standard errors of the direct and indirect giving equations, thus for the middle-income group, a univariate Tobit model was estimated. We present in table 15 the bivariate Tobit results for the low-income and middle-income group, and the univariate Tobit results for the middle-income group. Table 16 reports the estimated elasticities arising from the bivariate model for low and middle-income individuals - and shows that the income elasticity of direct contributions is about 0.80 for both groups. This elasticity measure compares to the measures coming out of our bivariate Tobit model for the whole sample, suggesting that income elasticity does not vary with income level in our sample.

4.2 Social Capital Variables

Several variables were included in the regression analyses that try to capture factors that are, in a sense, broader than the individual or household itself. These variables are trying to capture how connected an individual feels to the community (via the length of time the individual has resided in the same abode, whether they live in a rural community, a small town, or a city, whether they were born in Canada), his or her civic mindedness as reflected in whether or not they voted in the past federal, provincial, or municipal elections, and finally, how much television the individual watches as a signal of their awareness (or not) of the outside world. We group these variables under the rubric 'social capital' while recognizing that this term has been loosely used in the literature and has come to mean different things to different people.[23] As a guiding rule, the aforementioned variables might be considered as ones which indicate something about the impact of the community, broadly defined, on the giving patterns of individuals and households.

The length of time that the individual has resided in his or her current abode clearly matters in terms of their direct charitable contributions. For the sample as a whole (table 7), we see that, relative to people who have lived less than two years in their current residence, people who have lived two to five years give less (but the statistical significance of this estimate is just under 10 per cent), those who have lived for more than five years in the same place clearly give more. Looking at the three other groups of individuals, we see that the length of time in a residence is positively related to the amount contributed directly to charities for all but the group of secular givers. For this last group, those who have lived two to five years in the same place give less in a statistically significant way than those who have lived fewer than two years in the same place, although the longer-term residents still give more than either of the other two groups. This result is curious: why should 'medium-term' residents give less than short-term residents? Looking

[23] This was the subject of Charles Manski's presentation at the Canadian Employment Research Forum meeting, Vancouver, June 2000, which is echoed in Manski (2000). Putnum (2000) provides an excellent discussion of social capital and its constituent parts.

at the bivariate probit results, we see that for the sample as a whole and the religious group the length of time that an individual has resided in the same place has no impact on his or her probability of giving. For the other two groups, residential tenure has generally a positive impact. Thus, taking the bivariate Tobit and probit results together suggests that for the sample as a whole and the religious group it is the *amount* of giving that is affected by residence tenure rather than the probability of giving, *per se*.

Turning to the indirect giving equation, we see that for every group except the religious one, medium-term residents give more than either their short- or longer-term counterparts. One might argue that these results suggest that an individual has to be in a neighbourhood for a certain period of time before playing local charitable lotteries or bingos, but that the intensity of these activities wanes over time. For the most part, the estimated coefficients on these dummy variables are positive and statistically significant – indicating that, relative to newcomers, others are more likely to donate indirectly. The results from the bivariate probit analysis presents a different story: relative to new arrivals, medium-term residents are less likely to decide to participate in charitable games. Coupled with the bivariate Tobit estimates, we see that medium-term residents are less likely to decide to play a charitable game but if they do decide to play, they will spend more money relative to either short or long-term residents.

Whether or not living in a rural area, town, or city should be considered as a household or social capital variable is a subjective question: on the one hand, an individual chooses where he or she will live, on the other hand, where an individual lives can have an impact on the decisions that he or she makes. In this section, we interpret the results largely in light of this second effect, recognizing the possibility of a self-selection mechanism being at play as well. In all cases, people who live in a rural community (less than 15,000) or a town (15,000 to 100,000 residents) contribute more to charities directly than those who live in a city. For indirect giving, people who live in a rural area participate in charity-run lotteries more than people who reside in a city in all of the groups under consideration. Those who give to places of worship and live in towns also play charitable lotteries more than city folk.

The relationship between those who live in a town versus a rural community is less clear cut. For the whole sample and direct giving, town folk are more generous than rural residents, the same holds true for those who give to all but places of worship. For the other two groups, the opposite pattern emerges: rural folk who give to places of worship give, on average, about one and a half times more to charity than do town folk while rural residents who make their own decisions regarding charitable contributions give about 30 per cent more (0.0695-0.0500). *A priori,* one might expect that rural folk would have more opportunity to participate in charitable bingos and casinos relative to town and city dwellers, and indeed this is what our results suggest. The bivariate probit results reveal that rural and town dwellers are more likely to give to charity both directly and indirectly in comparison to city residents. Relative to rural folk, town folk are more likely to give directly in the whole sample, and the secular sample, while the reverse is true for the religious and own decision groups. Not surprisingly, rural folk are also more likely than either of the other two groups of individuals to decide to play charitable games.

The SGVP asked individuals several questions regarding their residence in Canada. Because of collinearity problems, we were unable to include variables representing the length of time someone has lived in the country. We were forced to use a cruder variable denoting simply whether or not the respondent was born in Canada. The bivariate Tobit estimates indicate that, except for giving to places of worship, people born in Canada donate more, on average, to charities than do others. Rather than interpreting this result as saying something about the impact of birthplace, this variable is likely capturing the fact that new immigrants are not aware of formal charitable organizations and are thus, perhaps, more likely to be drawn to informal arrangements involving people from their country of origin, extended family members, or people in their immediate vicinity. Interestingly, people born elsewhere give more to places of worship relative to their Canadian-born counterparts, which is consistent with the view that familiarity is an important precursor to charitable giving. People born in Canada are also more likely to give indirectly via charitable games relative to others as well. The bivariate probit results reinforce the bivariate Tobit results, namely that Canadian-born individuals have a higher probability of giving both directly and indirectly relative to others, except in the case of direct giving to places of worship where those born elsewhere dominate.[24]

The next variable of interest to this subsection concerns the amount of television watched by an individual - a variable that is arguably better placed in the personal characteristics section, but which we chose to discuss in the social capital section to the extent that the amount of television watched is

[24] Devlin (2000) was able to include variables representing the length of time an individual has been in Canada when looking at the decision to volunteer, and found that, indeed, newer immigrants were less likely to volunteer their time in comparison to longer-term immigrants.

certainly a function of the availability of television programs and is arguably reflective of cultural norms in society. On the one hand, one might argue that the more television the individual watches, the more informed he or she is regarding current events and hence the need for charitable actions. On the other hand, television is not necessarily (and perhaps not usually) informative. In addition, the amount of television watched may signal something about the general temperament of the individual (at the extreme one may imagine an individual who watches television all day and plays bingo at night!). Overall, therefore, we have no strong priors regarding the impact of this variable on giving.

Four variables were constructed representing the number of hours per week the individual watched television: less than five hours (NOTV), 5 to 14 hours (LESSTV), 15 - 29 hours (MEDTV), and over 30 hours per week (HEAVYTV). The results from the bivariate Tobit model point to a clearly negative impact on giving associated with the number of hours per week the individual watched the television. As the number of hours increased, the amount of giving decreased, *ceteris paribus*. By contrast, those who watched at least five hours of television a week were *more likely* to participate in a charitable game relative to those who watched virtually no television.

The relationship, however, between the amount of television and the amount of indirect giving is not clear cut. For the sample as a whole, those who watched between 15 and 29 hours of television per week contributed the most, followed by the HEAVYTV group, and then the LESSTV group. This pattern differs across the three other specifications of the bivariate Tobit model. The general point is clear: watching television is associated with giving less to charities directly and more to charities indirectly. The results from the bivariate probit model are a bit different. By and large, watching television exerts an insignificant impact on the probability of direct giving, and, whenever statistically significant, a positive impact on the probability of indirect giving.

The final variable of interest to this subsection is VOTE which takes on the value one if the individual voted in either of the last federal, provincial, or municipal elections, and zero otherwise. This variable tries to capture some of the civic mindedness of the respondent. One would expect people who voted to be more aware of civic need, and hence more willing to contribute to attenuate this need, relative to their non-voting counterparts. The results from the bivariate Tobit suggest that, indeed, people who vote are more generous in their direct gifts to charity. By contrast, they are less likely to give indirectly, except for those who give to places of worship. The bivariate probit results indicate that people who vote are more likely to give both directly and indirectly relative to non-voters. Combining these results suggests that both the probability of giving and the amount given on a direct basis are positively associated with voting – our proxy for civic mindedness - while, the probability of playing charitable lotteries is higher for voters versus non-voters; but if voters play, they do so less intensely (spend less money) than their non-voting counterparts.

4.3 Government Policy Variables

The last group of variables include two direct policy measures plus one indirect one. The tax rate imposed by the government affects the price of charitable giving – the higher the marginal tax rate, the lower the price of donating, *ceteris paribus*. Hence, one minus the marginal tax rate represents the price or tax-price of donating. The second policy variable that may affect charitable contributions is government spending. In this paper, because of colinearity problems, only the per-capita value of government spending on programs is included as an explanatory variable. The third variable, which is indirectly related to government policy is the set of dummy variables representing the region in which the individual lives – these variables will pick up any inter-regional differences, including those in government policies not captured by the two previously described measures.

4.3.1 The tax price of giving

It should be recalled that we do not have sophisticated data on marginal tax rates for each individual – these data were simply not available. We also attempted to calculate a marginal tax rate for each individual based on their level of giving (in accordance with the tax credit system currently in operation in every province except Quebec) and province of residence, but this rendered the applicable tax rate as a function of the individual's level of giving. To avoid this endogeneity problem, we were constrained to use as our measure of marginal tax rates the provincial tax rate levied on each individual - i.e., because everyone faces the same federal tax rates for any given income level, the only variability in the amount an individual pays comes from the province in which they reside.

Looking at the bivariate Tobit results for the full sample (table 7) we see that the estimated coefficient on the tax-price of giving is statistically insignificant. However, when one examines this variable for the three subgroups analyzed in this paper, a different story emerges. People who make decisions on their own are somewhat influenced by the marginal tax rate with the sign on TAXPRICE taking on the expected negative sign at a level of statistical significance of 9 per cent (table 8). By contrast, people who give to charities other than places of worship are strongly influenced by the tax-price of donations (table 10). It would seem, therefore, that our result that the tax-price of donating does not matter statistically arises from the influence of religious givers. The finding that religious givers are much less sensitive to the price of donations in comparison to secular givers is consistent with the results of earlier studies that were able to separate givers into these two broad categories (e.g., Feldstein, 1975b; Kitchen, 1992; Bradley, Holden and McClelland (1999)).

Interestingly, the influence of the tax-price of giving on the decision to give, as opposed to both the decision and amount to give, displays a different pattern. From table 7, the bivariate probit results indicate that the tax price is a statistically significant (at the 7 per cent level) determinant of the probability of giving: indeed, a small increase in this tax price would reduce the average individual's probability of giving by about 0.10. Individuals who make the decision to give directly to charities on their own, by contrast, are not affected by the tax rate at all. This result coupled with the result from the bivariate Tobit indicates that the tax rate influences the amount that individuals on their own would give, but not whether or not they would give directly to charity. Finally, the bivariate probit results show that the tax-price is a significant determinant of the probability of giving to places of worship – the probability of giving would fall by 0.2 as a result of a small increase in the price of giving (decrease in the tax rate). Taking this result with the bivariate Tobit result indicates that the decision to give to places of worship is sensitive to the tax rate, while the amount given is not.

A further measure of the sensitivity of direct giving to tax prices is provided in table 14 which reports the expected value of direct giving, conditional on several possibilities. As before, we will play close attention to the expected value of direct giving, given that the individual gives indirectly ($E(Y_d/Y_i>0)$ as well as conditional on the individual giving both directly and indirectly ($E(Y_d/Y_d>0,Y_i>0)$. For the sample as a whole, a one per cent increase in the tax-price, elicits a 0.65 per cent fall in ($E(Y_d/Y_i>0)$ and a 0.61 per cent fall in ($E(Y_d/Y_d>0,Y_i>0)$. However, these results are not very meaningful as the estimated coefficient on TAXPRICE for the whole sample is not statistically significant. More telling are the results from the secular givers where the tax-price variable was highly significant. The change in the expected value of direct giving associated with a one per cent increase in tax price, conditional on having given indirectly, is -1.54 per cent, and conditional on giving both directly and indirectly, is -1.49 per cent.

It is difficult to compare these results on tax-price elasticities with those available in the literature because, if they employ the Tobit model, they typically use the univariate procedure. Only a couple of papers have relied on the bivariate Tobit procedure to estimate giving (Brown and Lankford, 1992; Duncan, 1999), but these papers were looking at the giving in cash and volunteering decisions, not the giving directly and indirectly problem that is the subject of this present study. Brown and Lankford (1992) calculate their price elasticity of giving using the estimated coefficient of the bivariate Tobit model – i.e. the uncensoring elasticities not the censoring elasticities which are employed in this study – and find a price elasticity of demand of -1.79 for men and -1.62 for women; Duncan (1999) finds a price elasticity of -2.21. Our results from the bivariate Tobit model indicate that individuals are a bit less sensitive to changes in the tax-price of giving in comparison to these US studies.

Most of the papers in the literature estimate elasticities using a considerably more parsimonious model than the one employed here. In an attempt to determine whether it is the model specification that is driving our results, we estimate a short-form version of our model which includes only the basic variables common to many papers in the literature - tax-price, income, age, government expenditures, and the presence of children. The Ordinary Least Squares (OLS) results and the univariate Tobit results of this simple specification are provided in table 17. While these models are clearly inadequate for the problem of this paper, it is instructive to examine the different elasticity measures which arise from their employ. The first point to note from this table is that the estimated coefficient on TAXPRICE is insignificant in the OLS specification but not in the Tobit specifications. The OLS price elasticity of demand is -0.38. Determining the elasticity of demand using the Tobit specification is more complicated. In some earlier papers (e.g., Kitchen and Dalton 1990, Kitchen 1992), the elasticity of demand arising from Tobit estimations was calculated using the estimated coefficient associated with the TAXPRICE. In other words, these papers use the estimated Tobit coefficient in the same way as one would use the estimated OLS coefficient. Applying such a procedure to our results would yield an elasticity measure of -1.41. However, The more appropriate elasticity measure that takes into account that the amounts of giving are censored is -0.53. This marginal impact is comparable to the estimated coefficient in the OLS model; and for the sample as a whole, the marginal effect is computed to be very small at -0.16.

The results of this paper indicate that not all individuals are price sensitive: religious givers do not seem to be motivated by the tax price while the more secular givers are – a result which compares favourably with most studies using US. data,[25] and accords well with some Canadian studies. For instance, Hood et al. (1977) using Canadian tax data and the OLS procedure, find a price-elasticity of demand of about -0.86. Glenday, et al. (1986) using micro tax-file data, and a Tobit procedure, find a price elasticity of demand for high-income donors to be -0.15, and zero for low-income donors.[26] Kitchen and Dalton (1990) report a uncensored price elasticity of -1.07 using the consumer expenditure survey data and a Tobit procedure. Kitchen (1990), again using Canadian survey data, finds that religious givers are insensitive to price while giving in the full sample is very sensitive to price (2.29, with the same caveat as his earlier study with Dalton). Callen (1994)

[25] Although, it should be noted that there are papers using U.S. data that find donations to be price insensitive (e.g., Clotfelfter 1980, Reece and Zieschang 1985).

[26] The Glenday et al. study uses data for 1980 which was prior to the removal of the automatic $100 deduction for charitable contributions. It is hence not surprising that they found the price elasticity of contributions for low-income individuals to be zero.

applies the OLS procedure to micro-level data on charities which include information on the level of private contributions, and finds a price elasticity of demand of -0.3.

We turn once again to table 15 which reports the results when individuals are separated according to income class. The bivariate Tobit results are given for the low-income group, while the bivariate and univariate Tobit results are reported for the middle income group (recall that the model did not converge for the high income group). The tax-price of giving is statistically insignificant for the middle-income group, suggesting that, for this group, the tax-price is not a determinant of charitable giving, however, it is highly statistically significant for the low-income group. The estimated elasticity (using the changes in the expected value of giving before and after a one per cent increase in the tax price) of the tax price for the low-income group is -1.31 ($E(Y_d/Y_i>0)$) and -1.27 ($E(Y_d/Y_d>0, Y_i>0)$ from table 16. These results suggest that the low-income group is quite sensitive to the tax-price of contributions and are consistent with the general result found elsewhere that the magnitude of the tax-price elasticity of donations is negatively related to income (Feldstein and Taylor 1976; Feldstein and Clotfelter 1976; Kitchen and Dalton 1990; Lankford and Wyckoff 1991). Given that Canada no longer allows a non-itemized tax deduction for charitable contributions, the result that the contributions of low-income are sensitive to price, is not very surprising.

We estimated a short-form specification of the univariate Tobit model for each of the three income classes to see how comparable these results would be to those found in the literature. Table 18 reports the OLS and univariate Tobit results for each of the three income classes. Using the OLS procedure leads to the conclusion that the tax-price is not a significant determinant of charitable giving The univariate Tobit procedure indicates that the estimated coefficient for tax-price for the low-income group is statistically significant, but for the other two groups it is not. The estimated elasticity for the low-income group is -2.19 without censoring the data and -0.79 with censoring data. It seems clear, therefore, that the elasticity estimates are sensitive to model specification and to the type of procedure utilized – a point that has already been made in the literature (e.g., Brown 1987) but which is worthwhile underscoring.

Finally, it is important to look at the impact of tax-price on the decision to give *indirectly* to charity. The sign and statistical significance of the estimated coefficients of TAXPRICE will indicate whether or not individuals consider both types of charitable giving as substitutes for or complements to each other.[27] Furthermore, the statistical significance of the coefficients on the tax-price variable also indicates the extent to which tax policy can influence indirect giving.

Turning, first, to the bivariate Tobit model (tables 7 to 10), we find that TAXPRICE has a statistically insignificant impact on indirect giving in the sample as a whole, as well as in the three other sub-samples under investigation. An examination of the bivariate probit model estimates, however, tells a different story. The impact of TAXPRICE has a negative and statistically significant impact for the sample as a whole and for the religious givers as reflected in the sign and the significance of the estimated marginal effects. Moreover, the marginal effect of TAXPRICE on the probability of engaging in a charitable game has the largest impact of all of the independent variables included in the model. For the sample as a whole, for instance, a

[27]In principle, the price of giving indirectly (lotteries, bingos and so on) should be included in the direct giving equation as well. Unfortunately, we were unable to find any meaningful data in this regard. For instance, not all provinces have lottery corporations that might provide information on the typical price of lotteries; the price of bingo is certainly not standardized, not to mention the price associated with charitable gambling. The omission of a variable may lead to bias estimates of the coefficients of other variables if the omitted variable is correlated with included variables. In this case, it is possible that lottery prices vary by population size (a proxy for the size of the lottery pot) and thus the estimated coefficient on the regional dummy variables may be biased (Gujarati, 1995, pp.456-458.)

small increase in the tax price would reduce the probability of an individual participating in a charitable game by 0.27. The bivariate probit results, therefore, indicate that individuals consider giving to charities directly and giving indirectly as *complementary* to each other: an increase in tax rates (a decrease in tax price) would lead to an increase in the probability of giving to charity directly via a cash donation, and indirectly, via increased participation in a charitable game. Finally, the estimated coefficient of the tax-price variable is also negative and statistically significant at the 7 per cent level in the bivariate Tobit estimates of the low-income group.

The result that giving directly and indirectly are complementary to each other provides an explanation for the emergence and, indeed, proliferation, of charitable games witnessed over the past couple of decades, suggesting that charities can increase their revenues by providing an indirect avenue through which individuals may give. Also, the fact that the tax price affects the probability of participating in a charitable game, and even the amount played for the low-income group, means that public policy may be playing a role in influencing the participation in such games.[28] It was already well-known in

[28]The point of this paper focuses on the positive aspects of charitable gaming, namely, the higher the expenditures the more money charities receive. Clearly, negative effects are associated with excessive gaming as well. The results of this paper suggest that tax policy may be used to influence the decision to engage in charitable gaming.

the literature that tax policy affects direct contributions, the results of this paper suggest that the impact on charities may be greater than originally considered because of the effect on indirect contributions as well.

4.3.2 Government spending

Another way that government policy has the potential to influence private philanthropy is through expenditure decisions: indeed, a quandary in the literature surrounds whether or not private charity is crowded out by government spending. While the SGVP data set is not perfect for examining this problem because of its in a cross-sectional nature – the only variation in expenditure is interprovincial – we can, nevertheless, explore at a rudimentary level the relationship between provincial spending and charitable giving.

Our measure of government expenditure includes consolidated provincial and municipal expenditures, excluding transfer payments and debt servicing, on a per-capita basis. What is striking about our results is that this measure of government expenditure consistently imposes a negative effect on giving, both directly and indirectly, irrespective of sample under study and irrespective of type of model used to estimate the equations. In other words, our results point to a crowding-out effect between private giving and government spending. It should be noted, that we attempted to run the bivariate Tobit models with government expenditures disaggregated into different categories, but they would not converge, likely because of colinearity between these measures, the tax-price variable, and the regional dummies.

To see how important this crowding-out appears to be, we turn once again to table 14 which presents our estimates of the elasticity of various variables, as reflected in their impact on the conditional expected value of giving (both directly and indirectly). For the sample as a whole, a one per cent increase in per-capital government spending is associated with a 1.84 per cent *decrease* in direct contributions judging from the impact on the expected value of direct giving conditional on giving indirectly, and a 1.73 per cent drop when looking at the expected value of direct giving conditional on both giving directly and indirectly. The impact on indirect giving of a one per cent increase in government spending is just under one per cent. It is interesting to note that the crowding-out effect across the two lower income groups for direct giving is about the same and less than the effect of the whole sample, suggesting that the crowding-out of private direct giving is greater for the highest income group than for the two lower income groups. There is also a stark difference in the impact on indirect giving of government expenditures: for the low income group, a one per cent increase in government spending engenders a very small response - about -0.06 per cent; for the middle-income group, however, the response is large - a 3.4 per cent drop in expected indirect giving.

The results from the bivariate probit model tell us something about the marginal impact of a small change in government spending on the probability of giving. For the sample as a whole, a small change in expenditures would bring about a 0.07 decrease in the probability of giving – an effect which is second only to the impact of changes in the tax-price on direct giving. This effect is considerably lower for the own-decision group (-.03) and considerably higher for the religious group (-0.2). A similar pattern emerges when looking at the decision to play charitable games: the response from the own-decision group is very small and the response from the religious group is somewhat higher in comparison to the impact on the sample as a whole.

One of the concerns that we had about this measure of government expenditure is the extent to which it is collinear with other variables in the study. Table 19 presents the correlation matrix between tax price, household income, government expenditures, and the five regions of Canada. Bearing in mind that the notion of when a variable is considered as highly correlated with another is a subjective matter, government expenditures are most highly correlated with the province of Quebec (0.75), positively correlated with the regions of Quebec, British Columbia and Ontario, and negatively correlated with the Prairies and Atlantic Canada. Thus, the pattern of correlations between government expenditure and regional dummies is not straightforward, which bodes well for the integrity of our analysis; although the strong correlation between Quebec and high government expenditures should be borne in mind.

Notwithstanding the limitations of our analysis, it certainly appears as though crowding out is a potential concern when it comes to government expenditures and charitable contributions - a result which compares well to most empirical papers on this topic. There are at least two avenues through which individuals may realize that government expenditures have changed. For instance, charities typically derive a portion of their revenue from government grants - indeed, data from the Revenue Canada T3010 charitable returns for several years indicate that virtually every type of charitable organization receives some form of government grant, although some types of organizations rely much more heavily on these funds than do others (Day and Devlin 1997). As government expenditures fall, grants too may fall, leading to a shortfall in services which is picked up by private contributions. Furthermore, as government expenditures fall, the general level of public services fall which again can lead to an increase in private contributions to offset this decline in public services The fact that government expenditures and private contributions are apparently substitutes for each other bodes well for charities grappling with government cutbacks, however it also implies that charities may not benefit fully from additional government largesse.

4.3.3 Regional Variables

To capture the impact of differences across the five regions in Canada[29] dummy variables were included in all models. People who live in Ontario constitute the reference group, against which all other individuals are compared. Interpreting the coefficients on these regional dummy variables is not straightforward: they may be capturing policy differences, other than in taxation rates and expenditures, across the provinces; they may also be capturing inter-regional differences in the tastes and preferences for private charity (as opposed, say, to the public provision of services). Nevertheless, it is certainly

[29] Data were unavailable for the territories.

interesting to observe the regional diversity in direct and non-direct giving.

From the direct giving equations of the bivariate Tobit model (tables 7 through 10) we see that for the sample as a whole as well as for the own-decision group, individuals in the Atlantic region and Quebec are less generous than those who live in Ontario, while individuals in the prairies are more generous, *ceteris paribus*. For the giving to a place of worship group the pattern is a bit different; people in the prairies are still the most generous and those in Quebec and British Columbia are less generous than their Ontario counterparts. Lastly, except for British Columbians, the non-religious givers are typically less generous elsewhere than those who live in Ontario. Splitting the sample according to income yields some further differences: low-income and medium-income individuals who live in the Prairies or in British Columbia are more generous than their Ontario counterparts, while those of Quebec are consistently less generous.

The indirect giving equations display a slightly different pattern of giving. For the sample as a whole, and for the secular givers sample, people in the Atlantic region and Quebec spend less money while British Columbians spend more money than do the Ontarians. For the own-decision group, people in Quebec are less generous while those in British Columbia are more generous than Ontarians; and religious givers in all provinces but British Columbia are less generous than Ontarians – once again, those living in British Columbia are the most generous.

The bivariate probit results indicate that, with one exception,[30] the people of Ontario are more likely, *ceteris paribus*, to decide to give either directly or indirectly to charity relative to individuals in all other regions. They also indicate, with the exception of the secular giving sample, that people in Quebec are consistently less likely to decide to give either directly or indirectly relative to Ontarians.

5 Concluding Remarks

Until now, no one has examined the relationship between giving to charities directly via tax-exempt donations or indirectly via an array of charitable games. The fact that individuals can contribute to charities (and thus the public good) in these two ways suggests that these two methods of giving may well be related in some way. Indeed, the literature has alluded to a link between giving directly and indirectly but, likely as a result of the lack

[30] Except for the secular givers sample wherein British Columbians are more likely to decide to give directly to charity relative to Ontarians.

of data, has not been able to examine this link in a systematic manner, until now. It is the availability of a new and rich data set that allows us to determine the relationship between giving directly and indirectly to charity. Furthermore, from an econometrics perspective, it is the availability of the bivariate Tobit procedure that has allowed us to exploit this new data set in a manner which takes account of the jointness of these decisions.

By and large, the decisions of whether and how much to give to charities directly via a tax-exempt donation or indirectly via a host of charitable games are undertaken jointly by individuals. Moreover, the fact that the individual decides to play a charitable lottery, for instance, actually encourages the individual to decide to give directly as well. One reason for this complement may be that once an individual is sold on the idea of buying a lottery ticket for charity, it may be easier to sell him or her on the idea of making a charitable contribution as well (this argument works both ways) (e.g., Charity Village, 1997). For the low-income group (under 29,590 dollars), our results also suggest that the decisions as to how much to give directly and indirectly are complementary as well. Thus, rather than leading to less money available for direct charitable donations, charitable gaming may actually increase the amount of money donated directly to charities. Of course, the question that we cannot answer here is whether or not the charities themselves will end up with more net revenue as a result of indirect gifts. Although very little data are available over time on the amount of revenue going to charities as a result of charitable gaming, the available evidence is certainly encouraging from the point of view of charities. For instance, the province of Alberta has seen an almost three-fold increase in the returns to charities from holding casinos over the past three years: from 27.8 million dollars in 1996-97, to 76.7 million dollars in 1999-2000 (Alberta Gaming Corporation, 2000). And, in spite of an increase in the number of charitable lotteries, total donations have generally been on the rise in real terms over the period 1984 to 1996 (Canadian Centre for Philanthropy, 1997).

This paper also contributes to the small number of studies on charitable donations in Canada. Moreover, because of the richness of the SGVP data set, we were able to look at an impressive array of potential determinants of charitable contributions. The paper was thus able to fill two important gaps in our understanding of this phenomenon: it is the first paper of which we are aware to look at the role played by social capital factors in the decision of whether and how much to contribute; and, it is the first paper in Canada to examine the impact of government spending on charitable contributions.

Social capital appears to play an important role in determining both the decision to contribute and how much to contribute to charity. In particular, we show that the tenure of residence matters when it comes to charitable giving: people who have lived in their current homes for more than five years give more directly to charity than do others. Social stability is thus a determinant of private philanthropy. Rural and town dwellers give more than city folk, perpetuating the convention wisdom regarding the generosity of small-town folk versus those living in a big city. Furthermore, our results indicate that people who vote donate more to charity directly and less indirectly relative to non-voters – suggesting that somehow a sense of civic responsibility goes hand-in-hand with direct private charity. By contrast, people who watch a lot of television give less directly and more indirectly relative to others.

The findings of this paper indicate quite clearly that social capital is important for private philanthropy, suggesting that yet another benefit associated with measures which promote social stability and a sense of civic mindedness is the promotion of private largesse.[31] All other things being equal, implicating people in community life through, for instance, community centres or the promotion of civic awareness and voting would lead to a

[31]Devlin (2000) found a similar result regarding social capital and volunteering.

positive external benefit by way of increased private charitable contributions.

An important result of this paper is that government expenditures do appear to crowd out private contributions in Canada. Indeed, estimates of the conditional elasticities of charitable contributions indicate that private individuals are quite sensitive to changes in government spending: a one per cent increase in per capita provincial government spending will bring about an almost two per cent decrease in charitable contributions. The impact of this finding on the revenues of any given charitable organization will depend critically on its reliance on government versus private contributions – nevertheless, it must be of some concern to charities that an increase in government grants has the potential to be offset by a reduction in private contributions. Of course, in times of fiscal restraint, this result may be of some comfort to charities trying to provide public services with reduced government grants.

Other notable findings came out of this study. For instance, in addition to the crowding-out of private donations by government spending, we also confirmed that government tax policy exerts a very clear influence on private philanthropy. Secular givers are quite sensitive to the tax-price of donations – with an elasticity measure in the region of 1.50 per cent, whereas, those who give to places of worship are not motivated to do so by the tax-exempt status of their gift. The implications of this result are clear: government tax policy can be used to influence the mix. Furthermore, while the tax-price does not affect the amount of giving indirectly to charity, it does clearly influence the decision to give indirectly to charity: as taxes increase (the tax-price falls) more individuals decide to participate in charitable games.

Finally, our study confirms the importance of income for giving both directly and indirectly. The income elasticity of direct donations appears to be about 0.80 which is certainly in line with most of the empirical studies in the area. Interestingly, indirect giving is less sensitive to changes income in comparison to direct giving, with an income elasticity of about 0.60. One of the implications of this result is that the amount of charitable gambling undertaken by individuals is insensitive to income changes: during recessions, therefore, the impact on this form of giving, as well as on direct giving, is small, while boom periods have a similarly modulated impact on giving. In other words, individual giving is not subject to large swings as a result of business cycle oscillations.

From the point of view of charities, there is cause for some optimism on the revenue front. The presence of charitable games should not detract individuals from giving in a direct manner, implying that the introduction of charitable lotteries and such may well lead to more money for the charity's coffers. Of course, the costs of running these indirect mechanisms is high, and the chance of individuals contracting 'lottery fatigue' must certainly be taken into account for the long-run success of this form of fund-raising. The fact that the income-elasticity of charitable giving is low, and that government funding crowds-out private contributions, combine to suggest that the charities' revenues are likely to be quite stable over time, in spite of business cycle fluctuations and government restraints and surpluses.

There remains work to be done in this area. For instance, a theoretical model needs to be constructed that examines the various incentives to give directly and indirectly On the empirical front, it would be useful to include a time dimension to the analysis that looks at the extent to which direct giving and indirect giving evolves over time. And, finally, lack of data prevented us from examining the extent to which the revenues of charities are affected by the introduction of charitable games. Again, adding a time dimension to the analysis would allow us to say something about the impact of indirect giving on the composition of charitable revenue over time.

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Tables

Table 2 : Variable Names and Definitions

Variables	Definitions
Dependent Variables	
CASHGIVE	Total amount of donations (in cash)
INDIRECT	Total amount spend on charitable raffle\ lottery tickets, bingos\casinos, charity events
AMTWORSH	Amount of donations to place of worship
PUREDONR	Dummy variable, 1 if CASHGIVE is greater than zero, 0 otherwise
INDDONR	Dummy variable, 1 if INDIRECT is greater than zero, 0 otherwise
Personal and household	
AGE	Respondent`s age
AGE24	Dummy variable, 1 if age 15-24 years, 0 otherwise
AGE34	Dummy variable, 1 if age 25-34 years, 0 otherwise
AGE44	Dummy variable, 1 if age 35-44 years, 0 otherwise
AGE54	Dummy variable, 1 if age 45-54 years, 0 otherwise
AGE64	Dummy variable, 1 if age 55-64 years, 0 otherwise
AGE65	Dummy variable, 1 if age 65 years and over, 0 otherwise
MALE	Dummy variable, 1 if male, 0 otherwise
MARRIED	Dummy variable, 1 if married, 0 otherwise
EMPLOY	Dummy variable, 1 if employed at the time of survey (according to the Labour Force Survey status)
ENGLISH	Dummy variable, 1 if English is the language of interview
GRADESCH	No school, or elementary school only: **reference group**
HIGHSCH	Dummy variable, 1 if high school (some or completed), 0 otherwise
DIPLOMA	Dummy variable, 1 if some post-secondary education, 0 otherwise
POSTSEC	Dummy variable, 1 if post-secondary diploma, 0 otherwise
UNIV	Dummy variable, 1 if university degree, 0 otherwise
AFFILIA	Dummy variable, 1 if answers `yes` for the question `Do you have any religious affiliation?` , 0 otherwise
TAXCLAIM	Dummy variable, 1 if answers 'yes' for the question 'tax credit for charitable contributions' , 0 otherwise
HEALTHY	Dummy variable, 1 if anwers 'excellent' or 'very good' or 'good' or 'fair' for the question 'your health is ...', 0 otherwise
OWNDECIS	Dummy variable, 1 if makes the decision of financial giving on own, 0 otherwise
INC	Respondent's income
HHINC	Household income
HINC20K	Dummy variable, 1 if household income less than $20,000, 0 otherwise
HINC39K	Dummy variable, 1 if household income from $20,000 but less than $40,000, 0 otherwise
HINC59K	Dummy variable, 1 if household income from $40,000 but less than $60,000, 0 otherwise
HINC79K	Dummy variable, 1 if household income from $60,000 but less than $80,000, 0 otherwise
HINC80K	Dummy variable, 1 if household income from $80,000 and above, 0 otherwise

Table 2 : Variable Names and Definitions

Variables	Definitions
Dependent Variables	
KIDINHH	Number of own children in the house
KID05	Number of own children ages 0-5 years old
KID0612	Number of own children ages 6-12 years old
KID1317	Number of own children ages 13-17 years old
KID18PL	Number of own children ages 18 years old or older living in the house
HHSIZE	Household size
Social Capital	
SHORTSTAY	Dummy variable, 1 if stays in the community not more than 2 years: **reference group**
MEDSTAY	Dummy variable, 1 if stays in the community for 3-5 years, 0 otherwise
LONGSTAY	Dummy variable, 1 if stays in the community for more than 6 years, 0 otherwise
RURAL	Dummy variable, 1 if lives in area with a population of less than 15,000, 0 otherwise
TOWN	Dummy variable, 1 if lives in area with a population of 15,000-99,999, 0 otherwise
CITY	Dummy variable, 1 if lives in area with a population more than 100,000: **reference group**
CANADIAN	Dummy variable, 1 if born in Canada, 0 otherwise
VOTE	Dummy variable, 1 if vote in federal or provincial or municipal election, 0 otherwise
NOTV	Dummy variable, 1 if watches TV less than 5 hours a week: **reference group**
LESSTV	Dummy variable, 1 if watches TV 5-14 hours a week, 0 otherwise
MEDTV	Dummy variable, 1 if watches TV 15-29 hours a week, 0 otherwise
HEAVYTV	Dummy variable, 1 if watches TV over 30 hours a week, 0 otherwise
NEWLAND	Dummy variable, 1 if landed immigrant within 3 years at time of survey, 0 otherwise
MEDLAND	Dummy variable, 1 if landed immigrant within 4 to 8 years at time of survey, 0 otherwise
OLDLAND	Dummy variable, 1 if landed immigrant over 8 years at the time survey, 0 otherwise
Government Policy	
TAXPRICE	Provincial basic income tax rate
GOVEXP	Provincial government expenditure per capita
ONT	Dummy variable, 1 if lives in Ontario: **reference group**
PRAIRIES	Dummy variable, 1 if lives in Alberta, Manitoba, Saskatchewan, 0 otherwise
ATLANTIC	Dummy variable, 1 if lives in Newfoundland, P E I, Nova Scotia or New Brunswick , 0 otherwise
QUE	Dummy variable, 1 if lives in Quebec, 0 otherwise
BC	Dummy variable, 1 if lives in British Columbia, 0 otherwise

Table 3: Summary of Personal Characteristics of Sub-samples.

	Whole sample	Give both	Only give in cash	Only give indirectly	Not give at all
Sample size	15422	12077	1620	680	1045
CASHGIVE	198.5800	252.3700	170.0100	0.0000	0.0000
INDIRECT	53.4090	72.3230	0.0000	41.4780	0.0000
AMTWORSH	95.5110	118.1800	99.9490	0.0000	0.0000
PUREDONR	0.8273	1.0000	1.0000	0.0000	0.0000
INDDONR	0.7646	1.0000	0.0000	1.0000	0.0000
TAXCLAIM	0.3803	0.4861	0.3098	0.0000	0.0000
HEALTHY	0.9657	0.9724	0.9590	0.9549	0.9372
AFFILIA	0.7542	0.7759	0.8207	0.6283	0.6130
CANADIAN	0.8003	0.8297	0.7382	0.7469	0.7133
OWNDECIS	0.5547	0.5063	0.5863	0.7280	0.7302
SHRTSTAY	0.1552	0.1440	0.1508	0.2236	0.1934
MEDSTAY	0.1361	0.1305	0.1331	0.1455	0.1693
LONGSTAY	0.7087	0.7255	0.7161	0.6309	0.6373
INC	24977.0000	27852.0000	21708.0000	16355.0000	15209.0000
HHINC	48254.0000	53145.0000	40910.0000	34194.0000	33283.0000
HINC20K	0.2093	0.1506	0.2914	0.3468	0.4130
HINC39K	0.2586	0.2457	0.3110	0.2631	0.2795
HINC59K	0.2313	0.2475	0.1927	0.2205	0.1777
HINC79K	0.2213	0.2597	0.1466	0.1514	0.1007
HINC80K	0.0795	0.0966	0.0583	0.0182	0.0291
ONT	0.3826	0.3946	0.3482	0.3792	0.3472
PRAIRIES	0.1544	0.1584	0.1365	0.1179	0.1687
ATLANTIC	0.0810	0.0887	0.0680	0.0717	0.0518
QUE	0.2538	0.2291	0.3364	0.2892	0.2984
BC	0.1282	0.1292	0.1110	0.1420	0.1340
AGE	44.3500	44.0680	48.4970	39.4980	44.1790
AGE24	0.1206	0.1016	0.1091	0.2348	0.1904
AGE34	0.2038	0.2073	0.1732	0.2378	0.1969
AGE44	0.2309	0.2504	0.1933	0.1706	0.1832
AGE54	0.1787	0.1931	0.1509	0.1608	0.1282
AGE64	0.1142	0.1152	0.1239	0.0991	0.1049
AGE65	0.1519	0.1324	0.2496	0.0970	0.1964
MARRIED	0.6423	0.6940	0.6009	0.4759	0.4536
EMPLOY	0.6172	0.6719	0.5008	0.5293	0.4495

Table 3: Summary of Personal Characteristics of Sub-samples.

	Whole sample	Give both	Only give in cash	Only give indirectly	Not give at all
Sample size	15422	12077	1620	680	1045
ENGLISH	0.7526	0.7778	0.6602	0.7255	0.7110
VOTE	0.8088	0.8451	0.7864	0.6920	0.6691
LESS5TV	0.2042	0.2026	0.2275	0.2269	0.1757
LESSTV	0.4885	0.4964	0.4648	0.4399	0.4915
MEDTV	0.2310	0.2296	0.2262	0.2452	0.2374
HEAVYTV	0.0764	0.0714	0.0816	0.0881	0.0954
MALE	0.4912	0.4813	0.4607	0.5310	0.5655
GRADE	0.1089	0.0820	0.1958	0.1146	0.1787
HIGH	0.3472	0.3312	0.3093	0.4721	0.4215
DIPLOMA	0.2741	0.2933	0.2607	0.2206	0.1967
POSTSEC	0.1295	0.1316	0.1213	0.1308	0.1252
UNIV	0.1403	0.1619	0.1130	0.0619	0.0779
HHSIZE	2.9483	2.9680	2.9177	2.9884	2.8360
KIDINHH	0.3258	0.3586	0.2610	0.3020	0.2044
OWNK05	0.2107	0.2275	0.1754	0.2218	0.1379
OWNK0612	0.2375	0.2649	0.1764	0.2105	0.1472
OWNK1317	0.1480	0.1618	0.1306	0.1097	0.1015
OWNK18PL	0.1655	0.1740	0.1959	0.1267	0.0991
RURAL	0.2353	0.2519	0.2145	0.2148	0.1655
TOWN	0.1027	0.1087	0.0933	0.0887	0.0831
CITY	0.6620	0.6395	0.6922	0.6965	0.7515
NEWLAND	0.0227	0.0117	0.0305	0.0384	0.0750
MEDLAND	0.0168	0.0125	0.0353	0.0153	0.0236
OLDLAND	0.1288	0.1179	0.1581	0.1674	0.1444

Table 4: Personal Characteristics of Givers when decision for cash give was made on own versus jointly with spouse

	Own decision	Joint decision
Sample size	**8661**	**6761**
CASHGIVE	159.8900	246.7800
INDIRECT	52.8330	54.1260
AMTWORSH	65.8620	132.4500
PUREDONR	0.7729	0.8951
INDDONR	0.7223	0.8173
TAXCLAIM	0.2950	0.4865
HEALTHY	0.9642	0.9677
AFFILIA	0.7357	0.7773
CANADIAN	0.8153	0.7816
OWNDECIS	1.0000	0.0000
SHRTSTAY	0.1723	0.1339
MEDSTAY	0.1333	0.1395
LONGSTAY	0.6944	0.7266
INC	23402.0000	26939.0000
HHINC	43492.0000	54187.0000
HINC20K	0.2793	0.1220
HINC39K	0.2489	0.2708
HINC59K	0.2143	0.2524
HINC79K	0.1939	0.2555
HINC80K	0.0637	0.0993
ONT	0.3628	0.4073
PRAIRIES	0.1445	0.1666
ATLANTIC	0.0792	0.0832
QUE	0.2933	0.2046
BC	0.1202	0.1383
AGE	42.5660	46.5710
AGE24	0.1975	0.0247
AGE34	0.1982	0.2108
AGE44	0.1938	0.2771
AGE54	0.1627	0.1985
AGE64	0.0924	0.1413
AGE65	0.1554	0.1475
MARRIED	0.3552	1.0000
EMPLOY	0.5990	0.6399

Table 4: Personal Characteristics of Givers when decision for cash give was made on own versus jointly with spouse

	Own decision	Joint decision
Sample size	**8661**	**6761**
ENGLISH	0.7139	0.8008
VOTE	0.7720	0.8546
LESS5TV	0.2083	0.1990
LESSTV	0.4793	0.4999
MEDTV	0.2304	0.2317
HEAVYTV	0.082	0.0694
MALE	0.4678	0.5203
GRADE	0.1088	0.1090
HIGH	0.3567	0.3353
DIPLOMA	0.2551	0.2977
POSTSEC	0.1490	0.1053
UNIV	0.1303	0.1528
HHSIZE	2.7025	3.2545
KIDINHH	0.2142	0.4649
OWNK05	0.1190	0.3250
OWNK0612	0.1528	0.3429
OWNK1317	0.1042	0.2026
OWNK18PL	0.1241	0.2170
RURAL	0.2055	0.2725
TOWN	0.0993	0.1070
CITY	0.6953	0.6205
NEWLAND	0.0243	0.0208
MEDLAND	0.0149	0.0191
OLDLAND	0.1147	0.1465

Table 5: Personal Characteristics of Male versus Female Givers.

	Male	Female
Sample size	**6653**	**8769**
CASHGIVE	197.8100	199.3200
INDIRECT	53.4510	53.3680
AMTWORSH	93.9880	96.9800
PUREDONR	0.8055	0.8484
INDDONR	0.7554	0.7735
TAXCLAIM	0.3713	0.3890
HEALTHY	0.9679	0.9637
AFFILIA	0.7103	0.7966
CANADIAN	0.7899	0.8103
OWNDECIS	0.5284	0.5802
SHRTSTAY	0.1568	0.1537
MEDSTAY	0.1358	0.1363
LONGSTAY	0.7074	0.7100
INC	31973.0000	18224.0000
HHINC	51450.0000	45169.0000
HINC20K	0.1696	0.2476
HINC39K	0.2628	0.2545
HINC59K	0.2404	0.2224
HINC79K	0.2388	0.2044
HINC80K	0.0883	0.0711
ONT	0.3814	0.3838
PRAIRIES	0.1555	0.1533
ATLANTIC	0.0800	0.0820
QUE	0.2529	0.2547
BC	0.1303	0.1263
AGE	43.6290	45.0450
AGE24	0.1205	0.1206
AGE34	0.2125	0.1955
AGE44	0.2370	0.2251
AGE54	0.1829	0.1746
AGE64	0.1132	0.1151
AGE65	0.1340	0.1691
MARRIED	0.6773	0.6085

Table 5: Personal Characteristics of Male versus Female Givers.

	Male	Female
Sample size	**6653**	**8769**
EMPLOY	0.6943	0.5427
ENGLISH	0.7550	0.7502
VOTE	0.8013	0.8160
LESS5TV	0.1882	0.2195
LESSTV	0.4858	0.4911
MEDTV	0.2473	0.2153
HEAVYTV	0.0787	0.0741
MALE	1.0000	0.0000
GRADE	0.1131	0.1048
HIGH	0.3424	0.3518
DIPLOMA	0.2753	0.2729
POSTSEC	0.1192	0.1396
UNIV	0.1501	0.1309
HHSIZE	3.0066	2.8921
KIDINHH	0.3080	0.3430
OWNK05	0.2057	0.2156
OWNK0612	0.2219	0.2524
OWNK1317	0.1332	0.1623
OWNK18PL	0.1536	0.1769
RURAL	0.2339	0.2367
TOWN	0.0998	0.1055
CITY	0.6663	0.6578
NEWLAND	0.0253	0.0202
MEDLAND	0.0180	0.0156
OLDLAND	0.1339	0.1239

Table 6: Personal Characteristics of Giving to Place of Worship versus . Not to Place of Worship.

	place of worship	No plc of worship
Sample size	**6637**	**7060**
CASHGIVE	408.1600	114.8700
INDIRECT	56.8270	64.9590
AMTWORSH	270.5400	0.0000
PUREDONR	1.0000	1.0000
INDDONR	0.8427	0.8558
TAXCLAIM	0.5685	0.3787
HEALTHY	0.9630	0.9759
AFFILIA	0.9630	0.6483
CANADIAN	0.7811	0.8419
OWNDECIS	0.4517	0.5679
SHRTSTAY	0.1262	0.1590
MEDSTAY	0.1219	0.1376
LONGSTAY	0.7519	0.7035
INC	26277.0000	27419.0000
HHINC	50401.0000	51990.0000
HINC20K	0.1739	0.1700
HINC39K	0.2680	0.2462
HINC59K	0.2286	0.2472
HINC79K	0.2395	0.2452
HINC80K	0.0901	0.0914
ONT	0.4048	0.3749
PRAIRIES	0.1515	0.1578
ATLANTIC	0.1027	0.0729
QUE	0.2672	0.2288
BC	0.0738	0.1657
AGE	47.5840	42.6090
AGE24	0.0687	0.1280
AGE34	0.1830	0.2165
AGE44	0.2310	0.2499
AGE54	0.1817	0.1906
AGE64	0.1383	0.1003
AGE65	0.1973	0.1147
MARRIED	0.7296	0.6431

Table 6: Personal Characteristics of Giving to Place of Worship versus . Not to Place of Worship.

	place of worship	No plc of worship
Sample size	**6637**	**7060**
EMPLOY	0.5937	0.6855
ENGLISH	0.7317	0.7814
VOTE	0.8618	0.8173
LESS5TV	0.2017	0.2097
LESSTV	0.5125	0.4762
MEDTV	0.2109	0.2426
HEAVYTV	0.0749	0.0715
MALE	0.4588	0.4926
GRADE	0.1337	0.0732
HIGH	0.2900	0.3562
DIPLOMA	0.2956	0.2831
POSTSEC	0.1154	0.1409
UNIV	0.1652	0.1466
HHSIZE	3.0531	2.8916
KIDINHH	0.3655	0.3279
OWNK05	0.2413	0.2037
OWNK0612	0.2760	0.2334
OWNK1317	0.1762	0.1429
OWNK18PL	0.2032	0.1580
RURAL	0.2826	0.2192
TOWN	0.0946	0.1151
CITY	0.6228	0.6656
NEWLAND	0.0202	0.0104
MEDLAND	0.0217	0.0117
OLDLAND	0.1384	0.1131

Table 7: Bivariate Tobit and Bivariate Probit Results (Full Sample)

	Direct Giving			
	TOBIT		PROBIT	
Variables	coeff.	t-ratio	marg. eff.	t-ratio
Personal and household				
AGE	0.4432	24.783	0.0437	8.351
MALE	-0.0287	-2.674	-0.0238	-6.231
MARRIED	0.0187	1.423	0.0310	7.283
HIGHSCH	0.1077	3.927	-0.0044	-0.719
DIPLOMA	0.2338	8.312	0.0319	4.785
POSTSEC	0.2460	7.850	0.0348	4.434
UNIV	0.5539	19.641	0.0587	7.054
AFFILIA	0.4325	23.960	0.0658	14.004
HHINC	0.2441	30.857	0.0368	14.470
KID05	0.0770	2.147	0.0176	1.508
KID0612	0.0956	4.104	0.0156	1.341
KID1317	0.3352	11.515	0.0137	0.818
KID18PL	-0.0106	-0.306	0.0173	1.161
Social Capital				
MEDSTAY	-0.0372	-1.616	-0.0038	-0.582
LONGSTAY	0.0368	2.070	0.0058	1.096
RURAL	0.0632	4.424	0.0187	3.811
TOWN	0.0996	6.147	0.0233	3.579
CANADIAN	0.1541	11.048	0.0297	5.966
VOTE	0.1450	7.183	0.0253	5.500
LESSTV	-0.1173	-9.905	-0.0009	-0.186
MEDTV	-0.1712	-9.770	-0.0012	-0.206
HEAVYTV	-0.1864	-5.795	-0.0011	-0.148
Government Policy				
TAXPRICE	-0.1665	-1.115	-0.0981	-1.800
GOVEXP	-0.5402	-31.303	-0.0703	-11.845
PRAIRIES	0.0234	1.752	-0.0002	-0.035
ATLANTIC	-0.1980	-3.589	-0.0323	-1.649
QUE	-0.3584	-12.289	-0.0387	-4.243
BC	0.0159	0.886	0.0004	0.052

Table 7: Bivariate Tobit and Bivariate Probit Results (Full Sample)

	Indirect Giving			
	TOBIT		PROBIT	
Variables	coeff.	t-ratio	marg. eff.	t-ratio
Personal and household				
AGE	0.0064	0.425	-0.0470	-5.690
MALE	0.0023	0.248	-0.0128	-2.198
MARRIED	-0.0015	-0.147	0.0403	6.184
HIGHSCH	0.1950	11.452	0.0763	7.876
DIPLOMA	0.1658	9.384	0.0805	7.827
POSTSEC	0.1432	6.676	0.0753	6.231
UNIV	0.2193	10.588	0.0929	7.459
AFFILIA	0.0687	5.196	0.0117	1.573
HHINC	0.1062	17.271	0.0444	11.555
KID05	-0.0489	-1.887	0.0077	0.421
KID0612	0.0587	2.408	0.0054	0.322
KID1317	0.0389	1.264	-0.0435	-1.748
KID18PL	-0.0036	-0.123	-0.0308	-1.383
Social Capital				
MEDSTAY	0.1148	6.077	-0.0191	-1.810
LONGSTAY	0.0799	4.909	-0.0057	-0.692
RURAL	0.0673	6.039	0.0413	5.363
TOWN	0.0150	1.012	0.0285	2.861
CANADIAN	0.1690	12.435	0.0555	7.154
VOTE	-0.0471	-3.850	0.0483	6.450
LESSTV	0.0610	4.481	0.0036	0.483
MEDTV	0.0867	6.309	0.0172	1.980
HEAVYTV	0.0780	3.942	0.0247	2.033
Government Policy				
TAXPRICE	-0.0336	-0.287	-0.2678	-3.278
GOVEXP	-0.1682	-11.849	-0.0585	-6.523
PRAIRIES	-0.0168	-1.209	-0.0348	-3.759
ATLANTIC	-0.1220	-2.983	-0.0919	-2.999
QUE	-0.2319	-10.752	-0.1043	-7.624
BC	0.0361	2.304	-0.0167	-1.550
Disturbance Variances and Correlation				
Sigma(1)	1.7139	1983.527		
Sigma(2)	3.4356	7607.938		
RHO(1,2)	0.0253	2.707	0.6417	55.427
no. of observations	15422		15422	
Log likelihood function	-16303.78		-12882.46	
no. of iterations	64		63	

Table 8: Bivariate Tobit and Bivariate Probit Results (Own Decision)

	Direct Giving			
	TOBIT		PROBIT	
Variables	coeff.	t-ratio	marg. eff.	t-ratio
Personal and household				
AGE	0.3923	22.885	0.0361	4.425
MALE	-0.0211	-1.781	-0.0325	-5.042
MARRIED**				
HIGHSCH	0.1873	7.192	-0.0052	-0.500
DIPLOMA	0.3507	13.031	0.0642	5.611
POSTSEC	0.3732	12.543	0.0551	4.242
UNIV	0.6982	25.916	0.0949	6.754
AFFILIA	0.4247	22.516	0.0762	9.833
INC	0.0342	13.332	0.0070	6.520
KID05	0.0722	1.319	-0.0047	-0.173
KID0612	0.0072	0.144	0.0316	1.313
KID1317	0.1055	1.613	0.0118	0.295
KID18PL	-0.0984	-1.419	0.0380	1.317
Social Capital				
MEDSTAY	0.0727	2.994	0.0102	0.935
LONGSTAY	0.1346	7.283	0.0256	3.032
RURAL	0.0695	4.640	0.0129	1.553
TOWN	0.0500	2.702	0.0265	2.409
CANADIAN	0.1255	7.909	0.0384	4.478
VOTE	0.1985	10.016	0.0337	4.464
LESSTV	-0.0988	-7.039	-0.0061	-0.744
MEDTV	-0.1459	-8.065	-0.0023	-0.242
HEAVYTV	-0.2385	-8.095	-0.0095	-0.737
Government Policy				
TAXPRICE	-0.2466	-1.710	-0.0395	-0.442
GOVEXP	-0.2865	-21.214	-0.0280	-3.596
PRAIRIES	0.0254	1.721	-0.0014	-0.142
ATLANTIC	-0.2260	-4.119	-0.0163	-0.505
QUE	-0.4275	-15.409	-0.0321	-2.158
BC	-0.0317	-1.597	-0.0015	-0.131

Table 8: Bivariate Tobit and Bivariate Probit Results (Own Decision)

	Indirect Giving			
	TOBIT		PROBIT	
Variables	Coeff.	t-ratio	marg. eff.	t-ratio
Personal and household				
AGE	-0.0300	-1.075	-0.0735	-6.990
MALE	0.0138	0.698	-0.0088	-1.063
MARRIED**				
HIGHSCH	0.2177	7.093	0.0981	7.193
DIPLOMA	0.1973	6.220	0.1064	7.252
POSTSEC	0.1365	3.464	0.0817	4.935
UNIV	0.2769	7.035	0.1375	7.646
AFFILIA	0.1046	3.942	0.0152	1.500
INC	0.0178	5.493	0.0092	6.356
KID05	0.1014	1.392	0.1906	5.025
KID0612	0.0195	0.276	0.0125	0.421
KID1317	0.1081	0.827	0.1696	3.205
KID18PL	-0.0611	-0.876	-0.0304	-0.888
Social Capital				
MEDSTAY	0.1602	4.346	-0.0282	-1.937
LONGSTAY	0.0948	3.185	-0.0032	-0.291
RURAL	0.0689	3.035	0.0339	3.102
TOWN	-0.0237	-0.807	0.0088	0.646
CANADIAN	0.1694	5.595	0.0160	1.443
VOTE	-0.0395	-1.558	0.0615	6.011
LESSTV	0.0765	2.775	-0.0075	-0.705
MEDTV	0.0441	1.521	-0.0060	-0.495
HEAVYTV	0.0234	0.621	-0.0154	-0.941
Government Policy				
TAXPRICE	0.0362	0.145	-0.2667	-2.345
GOVEXP	-0.0516	-2.248	-0.0024	-0.245
PRAIRIES	-0.0307	-1.111	-0.0313	-2.438
ATLANTIC	-0.1022	-1.229	-0.0823	-1.953
QUE	-0.2516	-5.842	-0.1133	-5.995
BC	0.0589	1.735	-0.0212	-1.362
Disturbance Variances and Correlation				
Sigma(1)	2.0475	1916.724		
Sigma(2)	2.6490	2228.590		
RHO(1,2)	0.0189	0.766	0.6526	47.283
no. of observations	8661		8661	
Log likelihood function	-9263.067		-8352.432	
no. of iterations	62		61	

Note: **only 35% of own-decision givers are married. Married and own-decision variables thus are closely correlated.

Table 9: Bivariate Tobit and Bivariate Probit Results (Religious group)

	Direct Giving			
	TOBIT		PROBIT	
Variables	**coeff.**	**t-ratio**	**marg. eff.**	**t-ratio**
Personal and household				
AGE	0.4357	17.573	0.1349	10.488
MALE	-0.0220	-1.442	-0.0227	-2.694
MARRIED	0.1143	6.075	0.0659	6.704
HIGHSCH	-0.0954	-2.847	-0.0850	-5.605
DIPLOMA	0.0758	2.218	-0.0099	-0.634
POSTSEC	0.0547	1.387	-0.0161	-0.867
UNIV	0.2476	6.746	0.0352	1.922
AFFILIA	1.3623	49.500	0.5286	41.389
HHINC	0.1379	11.619	0.0273	4.512
KID05	0.2222	4.741	0.0999	3.984
KID0612	0.1265	3.064	0.0767	3.523
KID1317	0.4786	10.876	0.1172	3.630
KID18PL	-0.0229	-0.454	-0.0059	-0.193
Social Capital				
MEDSTAY	0.0023	0.073	0.0050	0.313
LONGSTAY	0.0251	0.985	0.0082	0.652
RURAL	0.1595	8.160	0.0762	7.219
TOWN	0.1079	4.642	0.0132	0.918
CANADIAN	-0.0431	-2.019	-0.0660	-5.710
VOTE	0.1342	5.069	0.0273	2.240
LESSTV	-0.0634	-3.473	0.0191	1.771
MEDTV	-0.1858	-7.744	-0.0329	-2.603
HEAVYTV	-0.1387	-3.505	0.0076	0.424
Government Policy				
TAXPRICE	-0.2076	-0.993	-0.1976	-1.877
GOVEXP	-0.5716	-22.907	-0.1724	-13.599
PRAIRIES	0.0543	2.645	-0.0019	-0.144
ATLANTIC	-0.1113	-1.479	-0.0515	-1.310
QUE	-0.2998	-8.037	-0.0698	-3.828
BC	-0.1202	-4.476	-0.1097	-6.763

Table 9: Bivariate Tobit and Bivariate Probit Results (Religious group)

	Indirect Giving			
	TOBIT		PROBIT	
Variables	coeff.	t-ratio	marg. eff.	t-ratio
Personal and household				
AGE	-0.0752	-2.850	-0.0401	-5.203
MALE	-0.0064	-0.383	-0.0217	-3.920
MARRIED	-0.0356	-2.169	0.0467	7.299
HIGHSCH	0.1416	5.718	0.0810	8.696
DIPLOMA	0.1168	4.546	0.0950	9.527
POSTSEC	0.0561	1.579	0.0907	7.814
UNIV	0.2598	8.568	0.1153	9.682
AFFILIA	-0.0252	-0.558	-0.0117	-1.460
HHINC	0.1332	12.107	0.0573	15.016
KID05	-0.1151	-3.222	0.0057	0.330
KID0612	-0.0570	-1.344	0.0031	0.204
KID1317	-0.0960	-1.718	-0.0485	-2.151
KID18PL	-0.0943	-2.202	-0.0218	-1.022
Social Capital				
MEDSTAY	0.0082	0.229	-0.0192	-1.926
LONGSTAY	0.1067	3.925	-0.0025	-0.319
RURAL	0.1401	7.254	0.0424	5.757
TOWN	0.0498	2.094	0.0383	4.098
CANADIAN	0.1553	6.495	0.0735	9.880
VOTE	0.1492	7.338	0.0566	8.007
LESSTV	0.0776	3.742	0.0012	0.168
MEDTV	0.0595	2.557	0.0189	2.296
HEAVYTV	0.0449	1.240	0.0226	1.996
Government Policy				
TAXPRICE	-0.3012	-1.468	-0.2925	-3.747
GOVEXP	-0.1884	-7.418	-0.0718	-8.113
PRAIRIES	-0.0782	-3.232	-0.0342	-4.014
ATLANTIC	-0.1883	-2.475	-0.0999	-3.449
QUE	-0.2568	-7.221	-0.1127	-8.533
BC	0.2361	8.848	-0.0051	-0.501
Disturbance Variances and Correlation				
Sigma(1)	1.4160	681.090		
Sigma(2)	3.4909	4058.789		
RHO(1,2)	-0.0286	-0.780	0.2256	13.965
no. of observations	15422		15422	
Log likelihood function	-10962.45		-15976.64	
no. of iterations	66		64	

Table 10: Bivariate Tobit and Bivariate Probit Results (Non-religious group)

	Direct Giving			
	TOBIT		PROBIT	
Variables	**coeff.**	**t-ratio**	**marg. eff.**	**t-ratio**
Personal and household				
AGE	0.4237	40.113	-0.0031	-1.249
MALE	-0.0491	-7.697	-0.0002	-0.120
MARRIED	-0.0325	-4.226	-0.0083	-4.353
HIGHSCH	0.1930	11.386	0.0103	4.126
DIPLOMA	0.3002	17.276	0.0053	2.138
POSTSEC	0.3307	17.309	0.0112	3.201
UNIV	0.6746	39.167	0.0106	2.945
AFFILIA	0.1740	20.304	-0.0317	-10.486
HHINC	0.2903	69.140	0.0079	6.823
KID05	0.0011	0.043	-0.0078	-1.670
KID0612	0.1409	11.010	0.0037	0.820
KID1317	0.0485	2.199	-0.0079	-1.256
KID18PL	-0.1365	-5.966	-0.0272	-5.397
Social Capital				
MEDSTAY	-0.0465	-3.288	0.0081	2.570
LONGSTAY	0.0476	4.900	0.0066	2.721
RURAL	0.0296	3.282	-0.0016	-0.776
TOWN	0.0356	3.679	-0.0004	-0.132
CANADIAN	0.1844	22.298	0.0062	2.544
VOTE	0.1575	14.180	0.0130	6.205
LESSTV	-0.0910	-12.742	-0.0050	-2.274
MEDTV	-0.0979	-9.718	0.0036	1.362
HEAVYTV	-0.1154	-6.469	-0.0014	-0.455
Government Policy				
TAXPRICE	-0.4298	-4.860	-0.0261	-1.189
GOVEXP	-0.6033	-63.784	-0.0020	-0.842
PRAIRIES	-0.0402	-4.967	0.0017	0.650
ATLANTIC	-0.2952	-8.368	-0.0042	-0.501
QUE	-0.2664	-15.965	-0.0014	-0.374
BC	-0.0112	-0.987	0.0077	2.116

Table 10: Bivariate Tobit and Bivariate Probit Results (Non-religious group)

	Indirect Giving			
	TOBIT		PROBIT	
Variables	**coeff.**	**t-ratio**	**marg. eff.**	**t-ratio**
Personal and household				
AGE	0.0184	1.169	-0.0308	-3.202
MALE	-0.0034	-0.337	-0.0319	-4.642
MARRIED	0.0146	1.406	0.0721	9.418
HIGHSCH	0.1743	9.576	0.0868	7.426
DIPLOMA	0.1475	7.774	0.1170	9.430
POSTSEC	0.1160	5.110	0.1092	7.591
UNIV	0.1908	8.637	0.1459	10.032
AFFILIA	0.0903	6.539	0.0679	7.893
HHINC	0.0947	14.390	0.0744	17.000
KID05	-0.0305	-1.107	0.0257	1.145
KID0612	0.0663	2.547	0.0134	0.688
KID1317	0.0750	2.227	-0.0435	-1.516
KID18PL	0.0469	1.375	-0.0155	-0.567
Social Capital				
MEDSTAY	0.0966	4.759	-0.0286	-2.293
LONGSTAY	0.0666	3.770	-0.0055	-0.553
RURAL	0.0524	4.506	0.0636	6.968
TOWN	0.0028	0.180	0.0488	4.217
CANADIAN	0.1512	10.511	0.0836	9.146
VOTE	-0.0745	-5.708	0.0702	7.910
LESSTV	0.0701	4.806	0.0058	0.648
MEDTV	0.0800	5.549	0.0190	1.824
HEAVYTV	0.0606	2.936	0.0297	2.081
Government Policy				
TAXPRICE	0.0314	0.258	-0.3802	-3.889
GOVEXP	-0.1481	-9.908	-0.1139	-10.851
PRAIRIES	-0.0128	-0.884	-0.0432	-3.982
ATLANTIC	-0.1013	-2.383	-0.1290	-3.542
QUE	-0.2340	-10.380	-0.1513	-9.353
BC	0.0325	1.990	-0.0217	-1.691
Disturbance Variances and Correlation				
Sigma(1)	3.0078	7776.891		
Sigma(2)	3.4015	6818.397		
RHO(1,2)	0.0613	7.362	0.3195	11.589
no. of observations	15422		15422	
Log likelihood function	-9145.310		-9722.608	
no. of iterations	65		62	

Table 11: Testing the Parameter vectors in different models

	Bivariate-Tobit	Bivariate-Probit
Log likelihood function		
Full Sample	-16303.78	-12882.46
Own decision	-9263.07	-8352.43
Religious	-10962.45	-15976.64
Non-religious	-9145.31	-9722.61
Likelihood Ratio Test		
Whole vs Own	14081.43	9060.06
Whole vs Religious	10682.66	-6188.36
Whole vs Non-religious	14316.94	6319.70
Religious vs Non-religious	3634.28	12508.06

Note: The Chi-square statistics at 1% probability of rejecting null hypothesis is 88.38. All the likelihood ratios reported thus reject the null hypothesis that the parameter vectors in different models are the same.

Table 12: Coefficient of the Univariate Tobit

			Direct Giving					
	Full Sample		Own Decision		Religious		Non-religious	
Variables	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio
Personal and household								
AGE	0.2586	16.952	0.1916	12.592	0.3077	13.218	0.1409	16.134
MALE	-0.0167	-1.687	-0.0103	-0.906	-0.0155	-1.045	-0.0163	-2.867
MARRIED	0.0109	0.941			0.0807	4.558	-0.0108	-1.620
HIGHSCH	0.0629	3.416	0.0915	4.399	-0.0674	-2.562	0.0642	6.015
DIPLOMA	0.1364	7.158	0.1713	7.920	0.0535	1.970	0.0998	9.033
POSTSEC	0.1435	6.508	0.1823	7.444	0.0386	1.193	0.1099	8.637
UNIV	0.3232	14.890	0.3410	13.918	0.1748	5.639	0.2243	17.929
AFFILIA	0.2524	20.033	0.2074	14.756	0.9620	34.889	0.0579	8.067
HHINC	0.1424	20.627	0.0167	7.885	0.0974	9.221	0.0965	24.210
KID05	0.0449	1.512	0.0352	0.825	0.1569	3.665	0.0004	0.021
KID0612	0.0558	2.128	0.0035	0.094	0.0894	2.380	0.0469	3.108
KID1317	0.1956	5.026	0.0515	0.922	0.3380	6.224	0.0161	0.714
KID18PL	-0.0062	-0.171	-0.0481	-0.978	-0.0162	-0.318	-0.0454	-2.130
Social Capital								
MEDSTAY	-0.0217	-1.178	0.0355	1.736	0.0016	0.056	-0.0155	-1.457
LONGSTAY	0.0215	1.458	0.0657	4.155	0.0177	0.773	0.0158	1.869
RURAL	0.0369	2.947	0.0339	2.325	0.1127	6.108	0.0098	1.370
TOWN	0.0581	3.517	0.0244	1.301	0.0762	3.007	0.0118	1.249
CANADIAN	0.0899	6.576	0.0613	3.902	-0.0304	-1.492	0.0613	7.791
VOTE	0.0846	6.083	0.0969	6.583	0.0948	4.260	0.0524	6.525
LESSTV	-0.0684	-5.331	-0.0482	-3.335	-0.0447	-2.344	-0.0303	-4.107
MEDTV	-0.0999	-6.629	-0.0712	-4.205	-0.1312	-5.763	-0.0325	-3.769
HEAVYTV	-0.1087	-5.077	-0.1165	-4.979	-0.0979	-3.043	-0.0384	-3.120
Government Policy								
TAXPRICE	-0.0971	-0.758	-0.1204	-0.827	-0.1466	-0.800	-0.1429	-1.945
GOVEXP	-0.3152	-20.930	-0.1399	-10.594	-0.4036	-17.590	-0.2006	-23.062
PRAIRIES	0.0137	0.914	0.0124	0.714	0.0384	1.698	-0.0134	-1.558
ATLANTIC	-0.1155	-2.433	-0.1104	-2.031	-0.0786	-1.140	-0.0981	-3.603
QUE	-0.2091	-9.404	-0.2088	-8.398	-0.2117	-6.603	-0.0886	-6.949
BC	0.0093	0.522	-0.0155	-0.744	-0.0849	-2.924	-0.0037	-0.366
Disturbance Variances and Correlation								
Sigma	0.5835	158.731	0.4884	114.2160	0.7062	99.412	0.3325	154.721
no. of observations	15422		8661		15422		15422	
Log likelihood function	-12971.0300		-6019.8690		-9621.1730		-5964.0630	
no. of iterations	4		4		6		4	

Table 12: Coefficient of the Univariate Tobit

			Indirect Giving					
	Full Sample		Own Decision		Religious		Non-religious	
Variables	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio
Personal and household								
AGE	0.0016	0.211	-0.0182	-1.586	0.0016	0.211	0.0016	0.211
MALE	-0.0080	-1.631	-0.0093	-1.093	-0.0080	-1.631	-0.0080	-1.631
MARRIED	0.0140	2.437			0.0140	2.437	0.0140	2.437
HIGHSCH	0.0564	6.075	0.0393	5.271	0.0564	6.074	0.0564	6.074
DIPLOMA	0.0583	6.053	0.0444	5.748	0.0583	6.051	0.0583	6.051
POSTSEC	0.0524	4.732	0.0341	3.920	0.0524	4.731	0.0524	4.731
UNIV	0.0751	6.885	0.0605	6.952	0.0751	6.884	0.0751	6.884
AFFILIA	0.0372	6.069	0.0284	5.899	0.0372	6.071	0.0372	6.071
HHINC	0.0392	11.509	0.0093	5.890	0.0392	11.509	0.0392	11.509
KID05	0.0114	0.781	0.0923	2.945	0.0114	0.781	0.0114	0.781
KID0612	0.0208	1.603	0.0259	0.927	0.0208	1.603	0.0208	1.603
KID1317	0.0045	0.231	0.0551	1.325	0.0045	0.231	0.0045	0.231
KID18PL	0.0051	0.282	0.0103	0.273	0.0051	0.282	0.0051	0.282
Social Capital								
MEDSTAY	0.0209	2.304	0.0339	2.218	0.0209	2.304	0.0209	2.304
LONGSTAY	0.0163	2.251	0.0232	1.966	0.0163	2.251	0.0163	2.251
RURAL	0.0277	4.488	0.0369	3.364	0.0277	4.488	0.0277	4.488
TOWN	0.0126	1.537	0.0036	0.254	0.0126	1.537	0.0126	1.537
CANADIAN	0.0553	8.168	0.0655	5.541	0.0553	8.172	0.0553	8.172
VOTE	0.0064	0.936	0.0206	1.870	0.0064	0.936	0.0064	0.936
LESSTV	0.0115	1.805	0.0156	1.436	0.0115	1.805	0.0115	1.805
MEDTV	0.0212	2.843	0.0064	0.500	0.0212	2.843	0.0212	2.843
HEAVYTV	0.0226	2.140	0.0012	0.066	0.0226	2.140	0.0226	2.140
Government Policy								
TAXPRICE	-0.0807	-1.276	-0.0837	-0.767	-0.0807	-1.276	-0.0807	-1.276
GOVEXP	-0.0708	-9.526	-0.0345	-3.480	-0.0708	-9.502	-0.0708	-9.502
PRAIRIES	-0.0143	-1.941	-0.0281	-2.157	-0.0143	-1.941	-0.0143	-1.941
ATLANTIC	-0.0593	-2.531	-0.0707	-1.737	-0.0593	-2.531	-0.0593	-2.531
QUE	-0.0827	-7.527	-0.1154	-6.178	-0.0827	-7.529	-0.0827	-7.529
BC	0.0033	0.379	0.0014	0.091	0.0033	0.379	0.0033	0.379
Disturbance Variances and Correlation								
Sigma	0.2850	152.010	0.3627	110.6600	0.2850	152.010	0.2850	152.010
no. of observations	15422		8661		15422		15422	
Log likelihood function	-4270.552		-4031.254		-4270.552		-4270.552	
no. of iterations	4		5		4		4	

Table 13: Parsimonious Version of the Bivariate Probit with and without Heteroscedasticity Correction.

	without heteroscedasticity correction				with heteroscedasticity correction			
Direct Giving								
Variables	coeff.	t-ratio	marg. eff.	t-ratio	coeff.	t-ratio	marg. eff.	t-ratio
HHINC	0.4377	29.002	0.0496	20.632	0.0775	2.4070	0.0589	19.668
AGE	0.3913	13.620	0.0679	15.237	0.0998	3.0150	0.0787	15.468
TAXPRICE	-1.7689	-4.830	-0.1840	-3.276	-0.3952	-2.4730	-0.1869	-2.999
GOVEXP	-0.7035	-19.142	-0.0883	-15.249	-0.1383	-2.5690	-0.0751	-9.465
PRAIRIES	-0.0339	-0.897	-0.0015	-0.260	-0.0014	-0.1570	0.0031	0.478
ATLANTIC	-0.3547	-2.645	-0.0360	-1.756	-0.0691	-1.6980	-0.0289	-1.267
QUE	-0.2516	-4.182	-0.0161	-1.751	-0.0582	-2.5190	-0.0174	-1.719
BC	-0.1558	-3.561	-0.0190	-2.855	-0.0374	-2.3330	-0.0212	-2.947
Indirect Giving								
Variables	coeff.	t-ratio	marg. eff.	t-ratio	coeff.	t-ratio	marg. eff.	t-ratio
HHINC	0.3517	25.8750	0.0557	16.406	0.3500	25.4920	0.0559	14.538
AGE	-0.0367	-1.3630	-0.0439	-6.598	-0.0318	-1.1850	-0.0438	-6.569
TAXPRICE	-1.6651	-5.1600	-0.2903	-3.693	-1.6352	-5.0730	-0.2908	-3.686
GOVEXP	-0.4373	-13.2490	-0.0554	-6.812	-0.4352	-13.1220	-0.0550	-5.977
PRAIRIES	-0.0615	-1.7650	-0.0135	-1.544	-0.0592	-1.7010	-0.0134	-1.515
ATLANTIC	-0.3474	-2.8570	-0.0618	-2.087	-0.3389	-2.7910	-0.0617	-2.078
QUE	-0.3873	-7.2250	-0.0814	-6.255	-0.3833	-7.1650	-0.0816	-6.214
BC	-0.1043	-2.5270	-0.0143	-1.418	-0.1051	-2.5540	-0.0143	-1.415
Variance function for cash giving equation								
LNHHINC					-0.1405	-4.4490		
RHO(1,2)	0.6694	63.4630			0.6694	63.4630		
no. of observations	15422				15422			
Log Likelihood Function	-13515.6400				-13505.2100			
no. of iterations	24				65			

Table 14: Estimated Elasticities of Some Selected Variables from Bivariate and Univariate Tobit

(a) Full Sample

Variables	Bivariate Tobit				Univariate Tobit	
	Direct Giving		Indirect Giving		Direct Giving	Indirect Giving
	E(Yd/Yi>0)	E(Yd/Yd>0,Yi>0)	E(Yi/Yd>0)	E(Yi/Yd>0,Yi>0)	E(Yd/Yd>0)	E(Yi/Yi>0)
TAXPRICE	-0.6511	-0.6132	-0.2104	-0.2074	-0.2116	-0.4011
GOVEXP	-1.8372	-1.7311	-0.9733	-0.9600	-0.5968	-0.3063
HHINC	0.8294	0.7802	0.6333	0.6243	0.2703	0.1701
AGE	1.5108	1.4210	-0.0456	-0.0462	0.4911	0.0069
KID05	0.0424	0.0399	-0.0529	-0.0523	0.0137	0.0080
KID1317	0.1309	0.1232	0.0211	0.0207	0.0425	0.0022

(b) Non-religious group

Variables	Bivariate Tobit				Univariate Tobit	
	Direct Giving		Indirect Giving		Direct Giving	Indirect Giving
	E(Yd/Yi>0)	E(Yd/Yd>0,Yi>0)	E(Yi/Yd>0)	E(Yi/Yd>0,Yi>0)	E(Yd/Yd>0)	E(Yi/Yi>0)
TAXPRICE	-1.5369	-1.4881	0.2202	0.2172	-0.5667	-0.4011
GOVEXP	-1.8573	-1.7978	-0.4679	-0.4559	-0.6921	-0.3063
HHINC	0.8911	0.8618	0.3149	0.3071	0.3340	0.1701
AGE	1.3133	1.2703	0.0004	-0.0011	0.4877	0.0069
KID05	0.0010	0.0010	-0.0188	-0.0184	0.0002	0.0080
KID1317	0.0163	0.0158	0.0321	0.0313	0.0064	0.0022

Table 15: Tobit estimates by Income Class

	Direct Giving						
	Bivariate Tobit				Univariate Tobit		
	Low income[1]		Middle income[2]		Middle income		
Variables	**coeff.**	**t-ratio**	**coeff.**	**t-ratio**	**coeff.**	**t-ratio**	**marg.eff**
Personal and household							
AGE	0.4416	28.610	0.5018	20.392	0.2432	11.238	0.1440
MALE	-0.0843	-8.036	-0.0463	-3.185	-0.0225	-1.635	-0.0133
MARRIED	-0.0424	-3.963	0.0014	0.074	0.0007	0.040	0.0004
HIGHSCH	0.1516	9.448	0.1061	2.767	0.0514	1.766	0.0304
DIPLOMA	0.2716	15.255	0.2949	7.794	0.1429	4.797	0.0846
POSTSEC	0.4571	23.490	0.2426	5.720	0.1176	3.508	0.0696
UNIV	0.6078	30.932	0.5573	13.990	0.2701	7.977	0.1599
AFFILIA	0.5095	31.502	0.5207	21.064	0.2524	14.485	0.1494
HHINC	0.2651	23.541	0.2759	6.991	0.1337	3.825	0.0792
KID05	0.2588	7.712	0.1328	3.194	0.0644	1.758	0.0381
KID0612	0.0366	1.089	0.1764	4.654	0.0855	2.440	0.0506
KID1317	-0.1127	-2.218	0.2981	5.662	0.1445	2.543	0.0855
KID18PL	-0.1022	-1.839	-0.0179	-0.311	-0.0087	-0.154	-0.0051
Social Capital							
MEDSTAY	0.0103	0.533	0.0427	1.177	0.0207	0.801	0.0122
LONGSTAY	0.0823	5.172	0.1265	4.312	0.0613	2.979	0.0363
RURAL	0.2391	20.815	0.0551	3.010	0.0267	1.599	0.0158
TOWN	0.2298	15.956	0.0922	3.983	0.0447	1.985	0.0265
CANADIAN	0.0653	5.366	0.2579	11.285	0.1250	6.524	0.0740
VOTE	0.1653	10.880	0.1158	4.462	0.0561	2.979	0.0332
LESSTV	-0.2221	-17.950	-0.0420	-2.380	-0.0204	-1.123	-0.0121
MEDTV	-0.2629	-18.200	-0.1457	-5.670	-0.0706	-3.370	-0.0418
HEAVYTV	-0.3073	-14.930	-0.1658	-4.068	-0.0804	-2.529	-0.0476
Government Policy							
TAXPRICE	-0.3526	-2.888	0.3599	1.632	0.1745	0.977	0.1033
GOVEXP	-0.5586	-33.443	-0.5893	-11.130	-0.2857	-6.071	-0.1691
PRAIRIES	0.0503	3.902	0.0580	3.164	0.0281	1.383	0.0166
ATLANTIC	-0.2530	-5.881	-0.0696	-0.893	-0.0337	-0.517	-0.0200
QUE	-0.3803	-16.186	-0.3411	-7.842	-0.1653	-5.328	-0.0979
BC	0.0271	1.750	0.1107	4.151	0.0536	2.147	0.0317
For the giving equation in the univariate model							
Sigma					0.4848	95.487	
no. of observations					5507		
Log likelihood function					-3819.527		
no. of iterations					4		

Table 15: Tobit estimates by Income Class

	Indirect Giving						
	Bivariate Tobit				Univariate Tobit		
	Low income		Middle income		Middle income		
Variables	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio	arg. eff.
Personal and household							
AGE	-0.0886	-7.004	0.0523	1.744	0.0170	1.319	0.0085
MALE	-0.0895	-9.663	-0.0570	-2.993	-0.0203	-2.491	-0.0101
MARRIED	0.0789	9.210	0.0186	0.890	0.0285	2.875	0.0142
HIGHSCH	0.1837	17.178	0.1233	3.158	0.0300	1.723	0.0150
DIPLOMA	0.1901	16.012	0.1186	3.036	0.0387	2.172	0.0193
POSTSEC	0.2610	16.552	0.0694	1.529	0.0224	1.117	0.0112
UNIV	0.1922	8.607	0.2713	5.888	0.0842	4.155	0.0420
AFFILIA	0.0296	2.560	0.0666	2.567	0.0448	4.400	0.0223
HHINC	0.0095	1.265	0.2827	6.309	0.0813	3.914	0.0405
KID05	-0.0886	-2.235	0.0252	0.667	0.0126	0.575	0.0063
KID0612	0.1635	6.253	0.1088	2.416	0.0293	1.406	0.0146
KID1317	-0.2428	-6.238	0.0843	1.432	0.0304	0.901	0.0152
KID18PL	-0.3729	-12.626	-0.0325	-0.423	0.0065	0.194	0.0032
Social Capital							
MEDSTAY	0.0052	0.284	0.0093	0.246	-0.0039	-0.254	-0.0019
LONGSTAY	0.0840	6.407	0.0651	2.118	0.0183	1.497	0.0091
RURAL	0.0150	1.629	0.1286	5.619	0.0419	4.243	0.0209
TOWN	-0.0638	-4.216	0.0682	2.699	0.0207	1.543	0.0103
CANADIAN	0.2146	17.216	0.1261	4.585	0.0515	4.542	0.0257
VOTE	0.0428	4.041	0.0343	1.471	0.0176	1.576	0.0088
LESSTV	0.0992	7.508	-0.0121	-0.490	0.0100	0.928	0.0050
MEDTV	0.2434	18.799	0.0481	1.769	0.0266	2.142	0.0132
HEAVYTV	0.1722	11.188	0.0262	0.701	0.0293	1.559	0.0146
Government Policy							
TAXPRICE	-0.1624	-1.848	0.0811	0.399	-0.0437	-0.413	-0.0218
GOVEXP	-0.0348	-3.023	-0.3881	-6.480	-0.1266	-4.528	-0.0631
PRAIRIES	-0.0010	-0.078	-0.0368	-1.470	-0.0202	-1.672	-0.0101
ATLANTIC	-0.1573	-5.330	-0.0915	-1.243	-0.0528	-1.369	-0.0263
QUE	-0.2637	-15.864	-0.1909	-4.869	-0.0733	-3.975	-0.0365
BC	-0.0769	-4.946	0.1818	5.702	0.0499	3.394	0.0249
Disturbance Variances and Correlation(3)							
Sigma(1)	3.0059	2435.683	2.0629	1565.787			
Sigma(2)	5.3966	9325.623	3.4205	2885.455	0.2842	92.390	
RHO(1,2)	0.0362	1.839	-0.0017	-0.048			
no. of observations	6092		5507		5507		
Log likelihood function	-2254.279		-5025.214		-1466.778		
no. of iterations	65		63		4		

Table 16: Estimated Elasticities for Some Selected Variables from Bivariate and Univariate Tobit Separated by Income Class

Bivariate Tobit								
	Low income(1)				Middle income(2)			
Variables	Direct Giving		Indirect Giving		Direct Giving		Indirect Giving	
	E(Yd/Yi>0)	E(Yd/Yd>0,Yi>0)	E(Yi/Yd>0)	E(Yi/Yd>0,Yi>0)	E(Yd/Yi>0)	E(Yd/Yd>0,Yi>0)	E(Yi/Yd>0)	E(Yi/Yd>0,Yi>0)
TAXPRICE	-1.3108	-1.2704	-0.8195	-0.8159	1.1949	1.1281	0.8150	0.8074
GOVEXP	-1.7534	-1.6997	-0.0574	-0.0567	-1.7105	-1.6173	-3.3910	-3.3609
HHINC	0.8322	0.8061	-0.0053	-0.0054	0.8009	0.7563	2.4679	2.4447
AGE	1.3906	1.3470	-0.4941	-0.4924	1.4559	1.3743	0.4635	0.4593
KID05	0.0977	0.0947	-0.0550	-0.0548	0.0685	0.0647	0.0393	0.0390
KID1317	-0.0229	-0.0221	-0.0736	-0.0733	0.1081	0.1021	0.0923	0.0915

Univariate Tobit				
	Low income		Middle income	
Variables	Direct Giving E(Yd/Yd>0)	Indirect Giving E(Yi/Yi>0)	Direct Giving E(Yd/Yd>0)	Indirect Giving E(Yi/Yi>0)
TAXPRICE	-0.4698	-0.8084	0.4377	-0.2137
GOVEXP	-0.6250	-0.1817	-0.6245	-0.5401
HHINC	0.2973	0.0791	0.2931	0.3478
AGE	0.4956	-0.1092	0.5334	0.0726
KID05	0.0347	0.0540	0.0250	0.0095
KID1317	-0.0084	-0.0284	0.0395	0.0163

Note (1) Low income is households with income less than $29,590.
(2) Middle income is households with income between $29,590 and $59,180

Table 17: Parsimonious Model of the Whole Sample

Direct Giving

	OLS			Univariate Tobit				
Variables	**coeff.**	**t-ratio**	**elasticity**	**coeff.**	**t-ratio**	**elasticity** (uncensored)	**marg.eff.**	**elasticity** (censored)
HHINC	0.1244	23.037	0.6262	0.1891	29.776	0.952	0.1090	0.3569
AGE	0.2109	19.037	1.0618	0.2804	21.637	1.412	0.1616	0.5292
TAXPRICE	-0.0758	-0.661	-0.3817	-0.2803	-2.143	-1.412	-0.1615	-0.5291
GOVEXP	-0.2166	-17.566	-1.0908	-0.3475	-24.220	-1.750	-0.2002	-0.6559
PRAIRIES	0.0265	2.030	0.1334	0.0204	1.360	0.103	0.0117	0.0384
ATLANTIC	-0.0681	-1.602	-0.3428	-0.1166	-2.401	-0.587	-0.0672	-0.2201
QUE	-0.1162	-5.916	-0.5851	-0.1501	-6.665	-0.756	-0.0865	-0.2833
BC	-0.0367	-2.383	-0.1849	-0.0541	-3.051	-0.272	-0.0312	-0.1021
Disturbance Variances and Correlation								
Sigma				0.6007	158.253			
no. of observations				15422				
Log likelihood function				-13474.11				
no. of iterations				4				

Indirect Giving

	OLS			Univariate Tobit				
Variables	**coeff.**	**t-ratio**	**elasticity**	**coeff.**	**t-ratio**	**elasticity** (uncensored)	**marg.eff.**	**elasticity** (censored)
HHINC	0.0179	7.267	0.3350	0.0478	15.626	0.895	0.0237	0.2099
AGE	0.0067	1.322	0.1250	0.0026	0.408	0.048	0.0013	0.0112
TAXPRICE	-0.0075	-0.144	-0.1412	-0.1282	-2.032	-2.400	-0.0636	-0.5627
GOVEXP	-0.0175	-3.110	-0.3276	-0.0663	-9.633	-1.241	-0.0329	-0.2909
PRAIRIES	0.0029	0.491	0.0547	-0.0030	-0.418	-0.057	-0.0015	-0.0133
ATLANTIC	-0.0173	-0.894	-0.3245	-0.0455	-1.942	-0.851	-0.0226	-0.1996
QUE	-0.0369	-4.123	-0.6915	-0.0685	-6.293	-1.282	-0.0340	-0.3007
BC	0.0004	0.052	0.0069	-0.0062	-0.722	-0.115	-0.0031	-0.0271
Disturbance Variances and Correlation								
Sigma				0.2863	151.900			
no. of observations				15422				
Log likelihood function				-4393.874				
no. of iterations				4				

Table 18: Parsimonious Model of Different Income Groups

(1) Low income (for income lower than $29,590)

Direct Giving

	OLS			Univariate Tobit				
	coeff.	t-ratio	elasticity	coeff.	t-ratio	elasticity (uncensored)	marg.eff.	elasticity (censored)
Variables								
HHINC	0.0548	7.998	0.4958	0.0953	10.797	0.862	0.0517	0.3105
AGE	0.1114	13.511	1.0072	0.1459	13.777	1.319	0.0792	0.4754
TAXPRICE	-0.0612	-0.707	-0.5537	-0.2420	-2.234	-2.188	-0.1313	-0.7884
GOVEXP	-0.0978	-9.257	-0.8842	-0.1778	-13.169	-1.608	-0.0965	-0.5793
PRAIRIES	0.0279	2.392	0.2526	0.0160	1.078	0.145	0.0087	0.0521
ATLANTIC	-0.0362	-1.107	-0.3270	-0.0874	-2.127	-0.790	-0.0474	-0.2846
QUE	-0.0660	-4.316	-0.5963	-0.1048	-5.433	-0.947	-0.0568	-0.3414
BC	-0.0073	-0.538	-0.0657	-0.0246	-1.431	-0.223	-0.0134	-0.0802
Disturbance Variances and Correlation								
Sigma				0.3464	92.394			
no. of observations				6092				
Log likelihood function				-2753.528				
no. of iterations				5				

Indirect Giving

	OLS			Univariate Tobit				
	coeff.	t-ratio	elasticity	coeff.	t-ratio	elasticity (uncensored)	marg.eff.	elasticity (censored)
Variables								
HHINC	0.0060	1.683	0.1689	0.0217	4.375	0.614	0.0099	0.1444
AGE	-0.0029	-0.679	-0.0819	-0.0179	-2.991	-0.505	-0.0081	-0.1187
TAXPRICE	-0.0247	-0.551	-0.6983	-0.1325	-2.174	-3.743	-0.0602	-0.8807
GOVEXP	-0.0020	-0.358	-0.0553	-0.0266	-3.522	-0.751	-0.0121	-0.1768
PRAIRIES	0.0017	0.282	0.0482	-0.0026	-0.315	-0.075	-0.0012	-0.0176
ATLANTIC	-0.0174	-1.028	-0.4914	-0.0438	-1.896	-1.238	-0.0199	-0.2912
QUE	-0.0277	-3.499	-0.7824	-0.0558	-5.127	-1.576	-0.0254	-0.3710
BC	-0.0137	-1.950	-0.3857	-0.0285	-2.916	-0.805	-0.0130	-0.1894
Disturbance Variances and Correlation								
Sigma				0.1915	86.900			
no. of observations				6092				
Log likelihood function				-444.3787				
no. of iterations				5				

Table 18: Parsimonious Model of Different Income Groups

(2) Middle income (for income between $29,590 and $59,180)

Direct Giving

Variables	OLS coeff.	OLS t-ratio	OLS elasticity	Univariate Tobit coeff.	Univariate Tobit t-ratio	Univariate Tobit elasticity (uncensored)	Univariate Tobit marg.eff.	Univariate Tobit elasticity (censored)
HHINC	0.1423	4.613	0.8098	0.2028	5.747	1.154	0.1199	0.4366
AGE	0.2043	12.516	1.1629	0.2686	14.239	1.529	0.1588	0.5783
TAXPRICE	0.0392	0.241	0.2231	-0.0738	-0.402	-0.420	-0.0436	-0.1589
GOVEXP	-0.2316	-5.599	-1.3184	-0.3475	-7.339	-1.978	-0.2054	-0.7480
PRAIRIES	0.0360	2.000	0.2047	0.0368	1.793	0.209	0.0217	0.0791
ATLANTIC	-0.0256	-0.430	-0.1455	-0.0420	-0.625	-0.239	-0.0248	-0.0904
QUE	-0.0951	-3.410	-0.5412	-0.1002	-3.166	-0.570	-0.0592	-0.2157
BC	-0.0177	-0.810	-0.1009	-0.0148	-0.593	-0.084	-0.0087	-0.0319
Disturbance Variances and Correlation								
Sigma				0.5028	95.132			
no. of observations				5507				
Log likelihood function				-4049.750				
no. of iterations				4				

Indirect Giving

Variables	OLS coeff.	OLS t-ratio	OLS elasticity	Univariate Tobit coeff.	Univariate Tobit t-ratio	Univariate Tobit elasticity (uncensored)	Univariate Tobit marg.eff.	Univariate Tobit elasticity (censored)
HHINC	0.0510	2.990	1.0303	0.0968	4.742	1.955	0.0484	0.4157
AGE	0.0231	2.558	0.4666	0.0371	3.404	0.749	0.0185	0.1593
TAXPRICE	-0.0163	-0.182	-0.3301	-0.1260	-1.189	-2.545	-0.0630	-0.5413
GOVEXP	-0.0668	-2.921	-1.3502	-0.1412	-5.160	-2.852	-0.0706	-0.6066
PRAIRIES	0.0076	0.768	0.1543	-0.0085	-0.714	-0.171	-0.0042	-0.0365
ATLANTIC	-0.0106	-0.322	-0.2139	-0.0384	-0.990	-0.775	-0.0192	-0.1648
QUE	-0.0225	-1.462	-0.4554	-0.0509	-2.782	-1.029	-0.0255	-0.2188
BC	0.0341	2.820	0.6895	0.0354	2.473	0.715	0.0177	0.1522
Disturbance Variances and Correlation								
Sigma				0.2867	92.247			
no. of observations				5507				
Log likelihood function				-1535.242				
no. of iterations				4				

Table 18: Parsimonious Model of Different Income Groups

(3) High income (for income higher than $59,180)

Direct Giving

	OLS			Univariate Tobit				
	coeff.	t-ratio	elasticity	coeff.	t-ratio	elasticity	marg.eff.	elasticity
Variables						(uncensored)		(censored)
HHINC	0.3082	8.753	0.9491	0.3297	8.800	1.015	0.2080	0.4126
AGE	0.4159	11.008	1.2807	0.5208	12.740	1.604	0.3287	0.6518
TAXPRICE	-0.3344	-0.845	-1.0298	-0.4118	-0.983	-1.268	-0.2599	-0.5154
GOVEXP	-0.5528	-9.677	-1.7026	-0.6351	-10.439	-1.956	-0.4008	-0.7948
PRAIRIES	0.0226	0.593	0.0696	0.0266	0.658	0.082	0.0168	0.0334
ATLANTIC	-0.1684	-1.143	-0.5185	-0.1885	-1.207	-0.581	-0.1189	-0.2359
QUE	-0.2117	-3.237	-0.6521	-0.2293	-3.306	-0.706	-0.1447	-0.2871
BC	-0.0771	-1.757	-0.2375	-0.1077	-2.296	-0.332	-0.0679	-0.1347
Disturbance Variances and Correlation								
Sigma				0.8196	83.350			
no. of observations				3823				
Log likelihood function				-4520.545				
no. of iterations				4				

Indirect Giving

	OLS			Univariate Tobit				
	coeff.	t-ratio	elasticity	coeff.	t-ratio	elasticity	marg.eff.	elasticity
Variables						(uncensored)		(censored)
HHINC	0.0039	0.274	0.0500	-0.0016	-0.099	-0.020	-0.0009	-0.0053
AGE	0.0094	0.613	0.1202	0.0238	1.385	0.305	0.0131	0.0802
TAXPRICE	0.0293	0.182	0.3743	-0.0331	-0.188	-0.423	-0.0182	-0.1114
GOVEXP	0.0040	0.171	0.0507	-0.0035	-0.137	-0.045	-0.0019	-0.0119
PRAIRIES	0.0038	0.246	0.0487	0.0137	0.801	0.175	0.0075	0.0461
ATLANTIC	-0.0173	-0.290	-0.2214	-0.0220	-0.335	-0.281	-0.0121	-0.0740
QUE	-0.0600	-2.262	-0.7673	-0.0801	-2.735	-1.024	-0.0441	-0.2694
BC	-0.0189	-1.058	-0.2411	-0.0218	-1.104	-0.278	-0.0120	-0.0733
Disturbance Variances and Correlation								
Sigma				0.3436	80.876			
no. of observations				3823				
Log likelihood function				-1536.429				
no. of iterations				4				

Table 19: Correlation Coefficient of Explanatory Variables in the Parsimonious Model

Variables	HHINC	AGE	TAXPRICE	GOVEXP	PRAIRIES	ATLANTIC	QUE	BC	ONT
HHINC	1.0000								
AGE	-0.1244	1.0000							
TAXPRICE	0.1241	-0.0002	1.0000						
GOVEXP	-0.0201	0.0000	0.0845	1.0000					
PRAIRIES	0.0288	-0.0133	0.3254	-0.4617	1.0000				
ATLANTIC	-0.0826	0.0031	-0.8222	-0.5368	-0.2695	1.0000			
QUE	-0.0952	0.0038	-0.1684	0.7452	-0.2581	-0.2408	1.0000		
BC	0.0413	-0.0060	0.0978	0.2186	-0.1636	-0.1527	-0.1462	1.0000	
ONT	0.1018	0.0098	0.5054	0.1218	-0.3541	-0.3305	-0.3164	-0.2006	1.0000