Essays on Private Contributions for Public Goods

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Abstract

In many circumstances, public goods are funded by both government revenue and private contributions. Private contributions to public goods could achieve the same social goals as the government-funded public goods. Certain financial aid from the voluntary sectors reduces the heavy fiscal burdens of the public sector by sharing the responsibilities of providing public goods and services. As an alternative to the public provision of public goods, social planners encourage private contributions by providing fiscal subsidies as part of the income tax policy.

My dissertation addresses the questions of whether the private provision of public goods is welfare improving in various aspects in theory and how effective it is applied to the Canadian tax schedule in an empirical model.

In the second chapter of this dissertation, I focus on a particular case of the consumer's utility to investigate the effect of a government transfer to the private donation of a public good. Unlike the classic conclusion, the influence of income redistribution is not always neutral when I take consideration of the substitute relationship between the private contributed public good and the public provision of a public good. Then in chapter 3, I build on the traditional income tax model in Part I and improve it to a two-stage non-cooperative game in which it encompasses both governments funded public goods and private contributions in the optimal income tax problem in Part II. Finally, in chapter 4, I apply my theoretical model in an empirical setting using Canadian family expenditure data. I exploit this rich data on charitable contribution in Canada to assess the effectiveness of Canadian tax incentive towards charitable giving from the private sector. The empirical analysis

illustrates that individuals in Canada are quite responsive to the change of tax incentive for charitable donation since price elasticity, in general, exceeds 1 in absolute value.

In dedication to my beloved grandparents.

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Chapter 1

Introduction

The general field of my dissertation is in the private provision of public goods and income tax policy. Various aspects of the private contributions including the crowding-out by the public provision, subsidizing voluntary donations in non-linear income tax policy and assessment of the effectiveness of the current Canadian tax credit regime are brought together in the dissertation. Overall, this work consists of two component, theoretical and empirical. Theoretical analysis in chapter 2 and chapter 3 and empirical testing in chapter 4 are all preceded with a presentation of an appropriate methodology and an overview of the literature.

In chapter 2, I focus on the crowding-out by the public provision of a public good. I investigate the effect of a government transfer on private donations of a public good by using certain consumer's utilities. Unlike the classic conclusion, the influence of income redistribution is not neutral when I take consideration of the substitute relationship between the public provided sector and the private contributed sector. This

chapter clearly demonstrates that the impact depends exclusively on the elasticity of substitution index between the publicly provided public good and the privately provided public good. Unless the government provision of public good and the voluntary contribution are perfect substitutes, the crowding-out effect in most cases is incomplete. In a particular case, the public provision of a public good may even bring positive change to the private contribution equilibrium. Another interesting scenario in this chapter is when the amount of publicly funded public goods equals the amount of the privately contributed public goods, the substitution parameter does not appear in the conditions defining the Nash Equilibrium. Therefore, the crowding out does not depend on the elasticity of substitution any more in this specific case.

Chapter 3 analyses the voluntary contributions to public goods in the presence of the optimal non-linear income taxation. This chapter begins with the outline of the previous literature on the topic of both the optimal public goods provision and the design of non-linear income taxation. This is followed by a unifying model encompassing both government-funded public good and private contributions in the optimal income tax problem. One purpose of this chapter is to find out the Pareto optimal public good provision with private donations when optimal non-linear income taxes are present. I adopt the incentive compatibility constraint approach elucidated by Stiglitz (1982) where the government maximizes utilities of one group subject to specific constraints. The basic question answered by this chapter is whether subsidizing donation is welfare improving. And what level of the public good should be provided from both the private sector and the public sector, respectively? This chapter is able

to provide new answers to these questions, looking at first the traditional income tax model in which government could control over charitable giving as part of the optimal tax policy in Part I, and then extending the analysis to a two-stage non-cooperative game where charitable giving is endogenous in Part II. The modification of the Samuelson Rule for the private provision or for the public provision of public good depends on whether aggregate charitable donation or government funding public good is a substitute or a complement to labour supply without the warm glow of giving. After considering the two-stage non-cooperative game in an economy with non-linear income taxes, this chapter concludes that the unique Nash equilibrium for this game has the characteristic that only high ability individuals would make a positive charitable donation to the public good.

Chapter 4 builds upon the theoretical analysis presented in chapter 3 and examines the subsidizing voluntary regime in Canada. Since the taxation year of 1988, Canada has exercised the tax credit system which provides tax incentives for charitable giving to Canadian taxpayers. The current tax credit system is different from the more common tax deduction system practiced in most of the countries in the world. This chapter aims to take advantage of the variation in the tax price of charitable giving both across individuals within provinces and within provinces over time in Canada to identify the extent to which peoples' decisions of donations are influenced by tax incentives. The results from this chapter suggest tax incentives influence the households' decision on how much to contribute to charitable giving significantly.

Finally, chapter 5 offers a brief conclusion and discussion of possible future extensions for this dissertation.

Chapter 2

Crowding-out by Public Provision of an Imperfect Substitute

2.1 Introduction

In many circumstances, public goods are funded by the government and voluntary private contribution together. Common analyses believe that public good would be under-supplied by only the private donation. Therefore, governmental transfers are needed for this deficiency. But conventional result shows that a small amount of public provision might not solve the under-supply problem in an actual situation since central government provision can crowd out completely voluntary private provision. Generally, the increase in publicly provided public good will have two effects on the amount of privately contributed public good. First, contributors may reduce their contributions due to an increase in government spending on a public good. This is

known as the substitution effect. The second effect is through a contributor's budget constraint. The government collected tax will decrease contributor's disposable income; hence will lower the contribution to public good. This is the income effect of the government transfer. Since those "crowding out" effects exist, government supplied public goods may not necessarily increase the overall level of funding for public goods.

There are several remarkable pieces of literature on this topic. Warr (1983) discovers that income redistribution among private contributors will not change resource allocation or welfare. In his model, individuals care only about the aggregate supply of the voluntarily supplied public good and crowding out effect is exactly a dollar for a dollar. Brennan and Pincus (1983) argue that policy change can redistribute the resources allocation only if it changes the relative price, and they apply this finding to analysing the growth of government expenditure. In 1984, Roberts reasserted the neutral results that public transfer to the poor crowd out private charity one by one by examining various types of U.S data from the 1920s to 1980s. He concluded that public transfers reduce private charity to zero in a political equilibrium.

However, the most striking analysis came from the research done by Bergstrom et al. in 1986. They consider a general model in which a unique voluntary Nash equilibrium exists. In their article, the consumer only cares about his own private consumption and the aggregate supply of public good and he assumes that the contributions of others would be independent of his contribution. They discover wealth redistribution among contributing individuals will not change the equilibrium level of the public good if it does not alter the contributing set for consumers. But large

income redistribution will alter the provision of public good since it changes the contributor set. Further, they find out that government transfer will decrease the private contribution but will actually increase the overall amount of the public good being provided.

In addition, there are empirical evidence on the topic of crowding-out; but much of these findings are contradictory. Kingma (1989) examines the effect of government support on individual provision by a two stage instrumental variable study. He discovers that the crowding out effect is less than one. Similarly, Hungerman (2005) demonstrates the crowding out effect of church-provided welfare by government welfare. The estimated "crowd-out" effect is between 20 and 38 cents for a dollar in his article.

The vast majority of the articles I mentioned above consider a general public good model in which the consumer only cares about their consumption for private good and the aggregate amount of a public good. Nevertheless, there are still doubts with the validity of the assumption that individuals are "pure altruistic". One alternative public good model, studied by Andreoni (1989), introduced impure altruism into the utility function. Andreoni believes people will get a "warm glow" from a contribution, that is, when an individual voluntarily contributes to a public good, they may obtain utility from the act of giving as well as from increasing total supply of the public good. In this study, he finds out that government provided public good or charity will incompletely crowd out private gifts, specifically, progressive tax may actually increase charitable giving rather than decrease it, as in conventional result.

Moreover, there are other different approaches that address the dual-provision

issue, but focus more on the provision of private goods. Epple and Romano (1996a) evaluate government's role in providing public provision by discussing a majority voting model in which majority voting equilibrium always exists and median-income voter is pivotal. In this equilibrium, a coalition of rich and poor agents with rich choosing the private alternative of a service will oppose median income agents that consume public provision. Further, Epple and Romano (1996b) investigate that a coalition of rich and poor households prefer reduced public provision, while the middle class prefer an increase. Lülfesmann and Myers (2011) develop the ER's model and find that when an equilibrium with positive taxes exists, the dual-provision regime is usually strictly majority dominates either a system of pure private provision or one of pure government provision. Based on those arguments, both government participation and private market are indispensable in operating some critical public sectors in a nation, such as health care or the education sector.

Despite the existence of different beliefs in prior studies, this chapter primarily follows the work done by Bergstrom et al. (1986) in which people are pure altruistic. Each consumer's preferences are assumed to depend on his private consumption and the sum of everyone's voluntary contributions (Bergstrom et al., 1986). They assume the total gifts of others will be independent of his own gifts. This is a model that much literature has established on a theoretical basis; therefore, I believe the study of this model may produce interesting results and is also worth further discussion. In this analysis, I focus on a special case of the utility form for a consumer to investigate the effect of a government transfer on the private donation of a public good. Unlike the classic conclusion, the influence of income redistribution is not neutral when I

take consideration of the substitute relationship between public provided sector and private contributed sector. It suggests that the influence depends exclusively on the elasticity of substitution index between publicly provided public good and privately provided public good. Unless the government provision of a public good and voluntary contribution are perfect substitutes, the crowding out effect in most cases is incomplete. Furthermore, public provision of a public good may even bring positive change to the private donation equilibrium in a particular case. This contradicts the common neutral hypothesis but may have more predictive power in the empirical observation for the public provision of a public good.

This chapter is organized along the following lines. The next section presents a theoretical framework to explain the basic setting of the model. Section 3.3 discusses the findings from the model. Section 3.4 presents the conclusion.

2.2 Theoretical Framework

2.2.1 Basic Model

Suppose there is one public good, one private good and n consumers. Assume all consumers will have homogeneous preferences. Each consumer i spends an amount of x_i on private consumption. A consumer's income is w_i, if $w_i > w^*$, he belongs to the group of contributors, and he will contribute a positive amount ξ_i to the private provision of the public good. He will allocate his wealth between consumption of

private good and donation to the public good,

$$x_i + \xi_i = w_i,$$

If $w_i \leqq w^*$, a consumer decides to make zero contribution to the private provision of public good. People in this group, their budget constraint will be,

$$x_i = w_i,$$

The richest M people choose to contribute in equilibrium, here I assume each contributor is identical (i.e. they have same preferences and same incomes). This assumption is essential for the neutrality result, that is, equalizing wealth redistribution among current non-contributors or among current contributors will leave the equilibrium supply unchanged[1]. The total supply of private provision of the public good is $Z_1 = \sum_{i=1}^{M} \xi_i$. I define $Z_{1_{-i}} = Z_1 - \xi_i$, which is the sum of all private contributions to public good except consumer i's contribution.

The utility function for each consumer is

$$u(x_i, Z_1),$$

Let $D(1, w_i + Z_{1_{-i}})$ be a consumer i's demand function for the privately provided public good, all consumers will have the same demand function for the public good since they have identical tastes. Let x be the numeraire good and its price is 1.

[1]Theorem 5 in Bergstrom et al. (1986)

Define $y = w_i + Z_{1_{-i}}$, a consumer's demand function for private provision of public good with the inequality constraint before tax is

$$Z_1 = \max\{D_i(1, y), Z_{1_{-i}}\}.$$

The following conditions define a Nash equilibrium[2] for the private provision of public good,

$$\begin{aligned} Z_1 &= D_i(1, w_i + Z_{1_{-i}}), && if\ consumer\ i\ belongs\ to\ contributors; \\ Z_1 &\geqq D_j(1, w_j + Z_{1_{-j}}). && if\ consumer\ j\ contribute\ zero\ gift. \end{aligned}$$

If consumers are identical, we will get $D(1, w_i + (m-1)\xi_i) = m\xi_i$, where m is the number of consumers who are actually contributing to the public good.

A Nash equilibrium in this model is a vector of private donation (ξ_i^*), $i = 1, 2, 3.....n$, such that for each i, (x_i^*, ξ_i^*) solves,

$$\begin{aligned} \max_{x_i, \xi_i} \quad & u_i(x_i, \xi_i + Z_{1_{-i}}) \\ s.t \quad & x_i + \xi_i = w_i, \\ & \xi_i \geqq 0. \end{aligned}$$

For a consumer who makes zero contribution to the private donation of public good, $Z_1 = Z_{1_{-i}}$. However, for a consumer who makes a positive contribution, his donation will make $Z_1 > Z_{1_{-i}}$. Therefore, the maximization problem for a consumer can also

[2]See Bergstrom et al. (1986) for the proof of existence and uniqueness of the Nash Equilibrium.

be written as

$$\begin{aligned} \max_{x_i, Z_1} \quad & u_i(x_i, Z_1) \\ s.t \quad & x_i + Z_1 = w_i + Z_{1_{-i}}, \\ & Z_1 \geqq Z_{1_{-i}}. \end{aligned}$$

Now, suppose the government starts to collect taxes t_i from those consumers. Since all contributors have same income and same tastes, they will pay the same amount of tax. The total amount of taxes collected by the government is $\sum_{i=1}^{n} t_i$. Z_2 represents a new public good that is being funded by the government tax which is not exactly the same as Z_1. This is a different assumption compared with prior literature; since they assume government-provided public good is exactly the same as the privately provided one, this may be unrealistic in the actual situation. The new utility function for a consumer is

$$u(x_i, Z_1, Z_2),$$

However, now consumers have to spend their money on the private good, taxes, and also on the private donation if $w_i > w^*$. New $y = w_i - t_i + Z_{1_{-i}}$.

The new vector that defines a Nash Equilibrium would be (x_i^*, Z_1^*) solves,

$$\begin{aligned} \max_{x_i, Z_1} \quad & u_i(x_i, Z_1, Z_2) \\ s.t \quad & x_i + t_i + Z_1 = w_i + Z_{1_{-i}}, \\ & Z_1 \geqq Z_{1_{-i}}. \end{aligned}$$

When the government is providing Z_2, the demand function for a consumer has changed. New demand function of a contributor for the private provision of public good will depend on three elements: the price of the privately provided public good, income, and the quantity of the government-provided public good. Thus, the new demand function of a contributor for the private provision of public good after tax would be

$$D(1, w_i - t_i + (m-1)\xi_i, Z_2) = m\xi_i.$$

2.2.2 Equilibrium Conditions

Suppose that consumer's preference can be represented by the utility function

$$U(x, Z_1, Z_2) = f(x)[(Z_1)^\rho + (Z_2)^\rho]^{1/\rho}, \qquad \rho \leq 1.$$

for some concave function $f(x)$[3]. $\sigma = \frac{1}{1-\rho}$ is the elasticity of substitution between the privately provided public good and the publicly provided public good, where ρ is a constant and could be negative.

[3]This case includes the Cobb-Douglas case, in which $f(x) = x^\alpha$.

Since all consumers are identical, I will neglect the subscript i from now on. Then the marginal rate of substitution between the private good x, and the privately provided public good Z_1 is

$$MRS \equiv \frac{U_x}{U_{Z_1}} = Z_1 \left[1 + \left(\frac{Z_2}{Z_1}\right)^{\rho}\right] \frac{f'(x)}{f(x)}. \tag{2.2.2.1}$$

If the price of the private good x is 1, and the price of the privately provided public good is also 1, then the demand functions for the goods are determined by the conditions $MRS = 1$ (where the MRS is defined by equation 2.2.2.1), and by the budget constraint $x + Z_1 = y$. So with voluntary provision of the public good, the equilibrium levels of Z_1 and x are determined by the conditions:

$$Z_1 \left[1 + \left(\frac{Z_2}{Z_1}\right)^{\rho}\right] \frac{f'(x)}{f(x)} - 1 = 0, \tag{2.2.2.2}$$

and

$$x + Z_1 = w - t + \frac{m-1}{m} Z_1. \tag{2.2.2.3}$$

2.3 Results

2.3.1 Taxes Equal the Cost to Finance the Public Sector

Suppose first that the tax t paid by each contributor equals her share Z_2/m of the cost of the public good. In this case, equation 2.2.2.3 indicates that if each person lowered her contribution $\xi \equiv Z_1/m$ to provision of the privately provided public good by t, then the budget constraint would still be satisfied. So when $t = Z_2/m$, the

changes will satisfy the budget constraint.

$$\triangle Z_1 = -Z_2; \quad \triangle \xi = -t; \quad \triangle x = 0,$$

If Z_1 and Z_2 are perfect substitutes, then these changes will also ensure that equation 2.2.2.2 still holds. So the special case in which $\rho = 1$ yields the familiar result of full crowding out when the two goods are perfect substitutes.

Proof. Define:

$$F = Z_1\Big[1 + \Big(\frac{Z_2}{Z_1}\Big)^{\rho}\Big]\frac{f'(x)}{f(x)} - 1 = 0, \tag{2.3.1.1}$$

$$F_{Z_2} = \rho\Big(\frac{Z_2}{Z_1}\Big)^{\rho-1}\frac{f'(x)}{f(x)}, \tag{2.3.1.2}$$

$$F_{Z_1} = \Big[1 + (1-\rho)\Big(\frac{Z_2}{Z_1}\Big)^{\rho}\Big]\frac{f'(x)}{f(x)}, \tag{2.3.1.3}$$

$$\begin{aligned}\frac{dZ_1}{dZ_2} &= \frac{-\rho(\frac{Z_2}{Z_1})^{\rho-1}\frac{f'(x)}{f(x)}}{[1 + (1-\rho)(\frac{Z_2}{Z_1})^{\rho}]\frac{f'(x)}{f(x)}} \\ &= \frac{-\rho(\frac{Z_2}{Z_1})^{\rho-1}}{1 + (1-\rho)(\frac{Z_2}{Z_1})^{\rho}} \\ &= \frac{-\rho}{\left(\frac{Z_2}{Z_1}\right)^{1-\rho} + (1-\rho)\left(\frac{Z_2}{Z_1}\right)}.\end{aligned} \tag{2.3.1.4}$$

If Z_1 and Z_2 are perfect substitutes, in which case we have $\rho = 1$, equation 2.3.1.4 becomes,

$$\frac{dZ_1}{dZ_2} = -1.$$

This yields the conventional full crowding out result. ■

Suppose $\rho < 0$[4], that is, Z_1 and Z_2 are pretty weak substitutes. Then it must have less than full crowding out : if Z_2 increases, and Z_1 decreases by the same amount as the increase in Z_2, then the original quantity of x would still satisfy the budget constraint 2.2.2.3. However, if $\rho < 0$, the increase in Z_2 will decrease the left side of 2.2.2.2 and so will cause a decrease in Z_1, such that first-order condition will not be satisfied if x is unchanged. The only way to restore the first-order condition is to increase Z_1 a little, and to decrease x[5]: so the increase in Z_2 does not fully crowd out private provision of Z_1.

However, when $0 < \rho < 1$, increases in Z_2 will increase the left side of equation 2.2.2.2, so that it is not necessarily the case that complete crowding out must decrease the left side of 2.2.2.2. It is possible that more than 100% crowding arises : for example, if $\rho = 0.9$, and we start out with $Z_2 = 0$, then a small increase in Z_2, funded by taxes on contributors, must lead to a fall in private provision Z_1 which is greater in magnitude than the increase in Z_2[6]. It can be seen in the proof that

[4]If $\rho = 0$, then $dZ_1/dZ_2 = 0$. It shows that when Z_1 and Z_2 have not so strong substitutes relationship, the provision of Z_2 may not have any impact on the amount of public good being privately provided.

[5]Both Z_1 and x have to change because there is still a budget constraint; the starting point was full crowding out which will satisfy the budget constraint if the contributors are paying all the cost of the Z_2 increase. Thus moving away from complete crowding out would mean an increase in Z_1, that implies x must decease to keep the budget constraint hold.

[6]Suppose, for example that $\rho = 0.9$. Then the left side of equation 2.2.2.2 will actually increase if we increase Z_2 from 0 to 1, and decrease Z_1 from 9 to 8. That is, increasing Z_2, paying for it

dZ_1/dZ_2 is not monotonic when ρ is in the range between 0 and 1.

Proof.

$$\begin{aligned}\frac{dZ_1/dZ_2}{d\rho} &= \frac{-[(\frac{Z_2}{Z_1})^{1-\rho} + (1-\rho)(\frac{Z_2}{Z_1})] + \rho[-(\frac{Z_2}{Z_1})^{1-\rho}\ln\left(\frac{Z_2}{Z_1}\right) - (\frac{Z_2}{Z_1})]}{[(\frac{Z_2}{Z_1})^{1-\rho} + (1-\rho)(\frac{Z_2}{Z_1})]^2} \\ &= \frac{-(\frac{Z_2}{Z_1})^{1-\rho} - (1-\rho)\left(\frac{Z_2}{Z_1}\right) - \rho\left(\frac{Z_2}{Z_1}\right)^{1-\rho}\ln(\frac{Z_2}{Z_1}) - \rho(\frac{Z_2}{Z_1})}{[(\frac{Z_2}{Z_1})^{1-\rho} + (1-\rho)(\frac{Z_2}{Z_1})]^2} \qquad (2.3.1.5) \\ &= \frac{-(\frac{Z_2}{Z_1})^{1-\rho}[1+\rho\ln(\frac{Z_2}{Z_1})] - (\frac{Z_2}{Z_1})}{[(\frac{Z_2}{Z_1})^{1-\rho} + (1-\rho)(\frac{Z_2}{Z_1})]^2},\end{aligned}$$

when $0 < \rho < 1$. ■

2.3.2 No Taxes Raised from Contributors

The polar opposite case is the case in which the government increases its provision Z_2 of the publicly provided public good without levying any taxes on contributors to the privately provided public good. In that case, the original (x^*, Z_1^*) pair which satisfy 2.2.2.2 and 2.2.2.3 when $Z_2 = 0$ will still satisfy the budget constraint 2.2.2.3 after an increase in Z_2. So the contributors will want to increase x, and decrease Z_1, in response to the increase in Z_2, if and only if the left side of equation 2.2.2.2 increases when Z_2 increases. This suggests the following:

through taxes on contributors, and decreasing Z_1 by the same amount (holding private consumption constant), will increase the consumer's MRS between private good x and privately-provided public good Z_1, so that consumers will decrease contributions by MORE than their taxes, in order to restore equilibrium.

Corollary 1 *If an increase in the publicly provided public good Z_2 is provided for free to contributors, then aggregate contributions will increase in response to this increase in public provision if and only if $\rho < 0$*[7].

2.3.3 Government-Provided Public Good Equals Private Contributed Public Good

Generalizing the previous two subsections' specifications of how the public sector is financed, suppose that each contributor paid some share τ of the cost of the public sector, so that the equilibrium with voluntary contribution would be defined by

$$Z_1\left[1+\left(\frac{Z_2}{Z_1}\right)^{\rho}\right]\frac{f'(x)}{f(x)}-1=0,$$

and

$$x+Z_1=w-\tau Z_2+\frac{m-1}{m}Z_1. \tag{2.3.3.1}$$

In many cases, increasing in Z_2 leads to a decrease in private contributions, so that Z_1 falls as Z_2 increases. So suppose, for some value of ρ, public expenditure is increased so much that $Z_1 = Z_2$. The levels of $\tilde{x}$, $\tilde{Z}_1$ and $\tilde{Z}_2$ for which this happens are defined

[7]The proof is easily seen as when $\rho < 0$, $dZ_1/dZ_2 > 0$; that means an increase in public provision of Z_2 may actually lead to an increase in voluntary contributions.

by

$$2\tilde{Z}_2 \frac{f'(\tilde{x})}{f(\tilde{x})} = 1 \tag{2.3.3.2}$$

$$\tilde{x} + \left(\frac{1}{m} + \tau\right)\tilde{Z}_2 = w \tag{2.3.3.3}$$

$$\tilde{Z}_1 = \tilde{Z}_2 \tag{2.3.3.4}$$

The substitution parameter ρ does not enter into equations 2.3.3.2-2.3.3.4, which suggests the following:

Corollary 2 *For any financing rule for the public sector, there is some level of provision of the publicly provided public good, $\tilde{Z}_2$, such that the extent of crowding out, if the government increases public good provision from 0 to $\tilde{Z}_2$, does not vary with the elasticity of substitution between the privately provided public good and the publicly provided public good.*

2.4 Concluding Remark

This chapter focuses on the study of the demand function approach for public provision of a public good studied by Bergstrom et al in 1986 and extends it into a special constant elasticity of substitution utility case. In addition, this research takes into account the fact that public provision of a public good is not exactly the same as the private provision. In particular, the crowding out effect found in this analysis varies with the elasticity of substitution between the privately provided public good

and the public provided public good in most scenarios. Under certain assumptions, when public financed public good and private provision of public good are perfect substitutes, the crowding out effect is complete; this is consistent with the prior research. However, when government provision and voluntary provision of public good are weak substitutes, the crowding out effect is less than 100%; in the extreme case when taxes are not collected from the donors in an economy, the aggregate supply of the public good may even increase instead of being unchanged or decrease. Moreover, it proposes that government provision of public good may not necessarily crowd out the privately contributed sector by a dollar for a dollar if their elasticity of substitution index is between 0 and 1; it is possible that more than a 100% crowding out effect may arise in this case. Another interesting scenario in this chapter is when governmentally funded public good equals private contributed public good; in this case, the substitution parameter does not appear in the conditions that define Nash Equilibrium. Hence, the crowding out effect does not depend on the elasticity of substitution any more at this specific level.

There are several significant policy implications from this finding. First of all, government transfer can influence consumers' decision on the amount of contribution to the public good; therefore government should attempt to better understand this negative effect when increasing the public funded public good in order to design the optimal policy and further improve the social welfare. Secondly, in some public sectors, especially when public provided public good and private provided public good are fairly weak substitutes, if government raises the tax in a proper way, government grants may actually increase the total supply of public good.

Further research is needed for examining the theory by applying it into an experimental or econometric experiment. It still requires empirical observation to verify the validity of this theory in the real world.

Chapter 3

Voluntary Private Contributions to Public Goods and the Optimal Non-linear Income Tax

3.1 Introduction

The rule for the public goods provision under optimal income tax schedule has always been a highly controversial topic among tax policy analysts in Western Europe and North America since the mid-1950s. The earliest work can be traced back as long ago as Pigou (1947), who notes that there exists the possibility of indirect damage cost on society, when transferring resources from the private sector to the public sector. In particular, if the lump-sum transfer is not available, then the result according to Samuelson, for the public goods provision might no longer

define the optimum. Samuelson Rule is a Pareto optimal condition for the public good provision, in which the aggregate marginal rate of substitution between a public good and a chosen private good should be equal to the marginal rate of transformation. When the Samuelson Rule is satisfied, the social welfare function is maximized. It is undeniable that the Samuelson Rule laid the foundation for future theoretical reformation of the optimal public goods provision. However, the optimum depends solely on the presence of efficient lump-sum taxation, which is almost impossible to achieve in reality, since the government has restrictions on observing characteristics of individuals, when redistributing income.

Later on, Atkinson and Stern (1974) provide a detailed analysis to elucidate that under certain circumstances, Pigou's interpretation about the Conventional Rule[1] overestimating the true benefit, when raising government revenue, went wrong. They followed the work of Diamond and Mirrlees (1971) and Stiglitz and Dasgupta (1971), and constructed a model in which a set of commodity taxes is employed by the government to finance public goods expenditure. They broke down the conventional benefit measure into two effects, when government revenue is raised by the distortionary tax. On the one hand, there is a distortionary effect that Pigou proposed as the excess burden. On the other hand, there is a revenue effect overlooked by Pigou which depends on the choice of which consumption goods are taxed. If those two effects are combined together, then the result turns out be that the Conventional Rule could overestimate the marginal benefit of public goods or even underestimate it.

[1] Atkinson and Stern (1974) referred to the Conventional Rule as using $\sum MRS$ as a measure of marginal benefit.

In the mean time, the design for optimal non-linear income taxation structure has made a spurt advance for the past century. The most striking breakout theory is due to Mirrlees (1971); he brought out the attention of optimal non-linear tax rate on both high and low incomes. With the recognition of a trade-off between equality and efficiency, Mirrlees's research predicts, under certain assumptions for the utility function, the optimal income tax schedule is approximately linear. The significant advance over Mirrlees's theory was the design of an efficient screening mechanism to find the Pareto efficient income tax structure pioneered by Stiglitz (1982). Stiglitz (1987) later describes his theory as *The New New Welfare Economics*, in which he introduced the self-selection constraint to the design of income tax schedule. He proposes that the optimal tax structure has the property of a zero marginal tax rate on high ability individuals, whereas positive marginal rate on low ability individuals. It is important to note that the model presented here is intrinsically related to the analysis of non-linear optimal income taxation.

Although the theory of optimal public provision continues to develop and mature, the fact that subsidizing voluntary contribution to public good could possibly achieve the same social goals as the public provision got less focus. Public goods generally can be financed by public spending or tax-favoured voluntary contributions. Tax incentives are especially important for those charity organizations where direct government expenditure is forbidden. For instance, religious organizations rely heavily on private donation. However, only a few studies showed the evidence of voluntary contributions under optimal income taxation. Atkinson (1976) studies the income tax treatment of charitable contributions and examines whether tax

deduction should be replaced by a proportional tax credit through a logarithmic utility function form. Feldstein (1980) compares a direct government spending scheme with a tax subsidy for private charitable giving as an extension of the theory of commodity taxation. Saez (2004) develops the optimal linear tax treatment of tax expenditure by using empirically estimable parameters and numerical calibration. He shows that the optimal subsiding rate on private provision contribution to the public good is related to several interacted parameters between the public provision and the private provision such as the size of the crowding out effect and the size of the price elasticity of contributions.

Yet no studies thus far have researched on the public good provision from both public and private sectors under the optimal income taxation subject to the incentive compatibility constraint. The present analysis in this chapter is able to develop a unifying model encompassing both government funded public goods and private contributions in the optimal income tax problem. One purpose of this chapter is to find out the Pareto optimal public good provision with the private donation when optimal non-linear income tax is present. I adopt an incentive compatibility constraint approach elucidated by Stiglitz (1982) where the government maximizes utilities of one group subject to several constraints including incentive compatibility constraints. This chapter builds up an optimal non-linear tax model in which individuals in the economy not only obtain utility from contributing the private donation to public good but also derive utility from the overall increase of public good from the private sector. The government also provides expenditure on the public good from distortionary income tax revenue. To raise public funds, the

government chooses a tax schedule, constrained by the requirement that taxes levied on the two types of people must satisfy a selection constraint: high-wage people cannot be better off choosing to earn the same income as low-wage people, paying lower taxes and donating less private donations.

The basic question answered by this analysis therefore is whether subsidizing donation is welfare improving. And what level of the public good should be provided from the private sector and the public sector, respectively? This chapter of the thesis is able to provide new answers to these questions, looking first at the traditional income tax model in which government could control over the charitable giving as part of the optimal income tax policy, and then extending the analysis to a two-stage non-cooperative game where the charitable giving is endogenous. Here an individual's taxes can be a non-linear function of her income, but the tax credit rate for charitable contributions is assumed constant (for all people in the economy). In this game, the government sets the optimal income tax schedule based on observable individual characteristics at the first stage and individuals will then choose their labour supply and charitable contribution based on government's policy at the final stage.

When the government deploys an optimal non-linear income tax schedule, then the conditions for the optimal provision of public good depend on whether the public provision of the public good and the private provision of the public good are perfect substitutes with the warm glow of giving. The modification of the Samuelson Rule for the private provision or for public provision of public good depending on whether aggregate charitable donation or government funding public good is a substitute or

complement to labour supply without warm glow of giving. However, when there exists a warm glow of giving, the modification of the Samuelson Rule for the private provision depending on whether the warm glow is a substitute or a complement to labour supply with separability in the public provision and the private provision. Both types of people will receive a positive income tax credit when increasing private donation to the public good in this economy. After considering the two-stage non-cooperative game in an economy with non-linear taxes, this chapter concludes that the unique Nash equilibrium for this game has the property that only high ability individuals would make a positive charitable donation to public good.

Closest to this research are those of Boadway and Keen (1993) and Diamond (2006). Boadway and Keen follow upon Stiglitz (1982), and use the self-selection approach to analyse the optimal provision of public goods. As a matter of fact, they only limit their study to the optimal policy for public good from the public sector and individuals can not voluntarily contribute to public good in their model. Economies with only the public provision or those with the private provision alone should be considered as the two extreme cases. As the existence of charitable giving indicates, public goods are usually provided by a combination of both ways. Diamond (2006) argues that subsidized donations have two sides of the potential gain to social welfare. First, more redistribution is going to taken place after subsidizing donation, therefore it can raise social welfare. Second, private contribution to public good can ease resource constraint by possibly reducing private consumption. In Diamond's paper, he assumes that working hours for individuals are fixed, people can choose either to participate in the labour force, or not participate at all. That

is, Diamond only considers the extensive margin[2] upon the labor supply response. Unlike Diamond's model, individuals are able to choose their working hours in the model presented here. This analysis includes the voluntary provision of public goods in the "intensive margin" model of optimal income taxation, in which people differ in unobservable ability, and can vary endogenously their hours of work. Feldstein (1980) and Roberts (1987) investigated the efficiency of tax expenditure for charitable gifts to the public good, but they approach in a fairly different model.

The third chapter of my thesis is organized as two parts in general. In Part I, I will introduce private donation as part of the optimal income taxation problem in which government could offer two different packages of consumption bundle to the two-type individuals. Section 3.2 describes the general framework of this analysis with the simplest case of a non-linear optimal income taxation model. In section 3.3, I derive the optimal public good provision rule for both public sector and private sector. Section 3.4 introduces some special forms in individual tastes and in section 3.5, I give a brief discussion about the optimal tax deduction rule. Furthermore, in Part II, I construct a two-stage non-cooperative game with the private donation to the public good. Section 3.6 to 3.9 develop the two-stage game for this economy. Section 3.10 and 3.11 discuss the general results and policy implication derived from this model. Finally, section 3.12 offers concluding remarks. Like preceding literature, I assume raising public good fund from both public sector and private sector is costless. The problem of the excess burden is obviously important but it

[2]This is sometimes called the "extensive margin" model of optimal income taxation. For general discussion of the difference between extensive margin and intensive margin in labour supply response, see Saez (2002).

complicates the framework, and therefore is better assumed away. In this sense, the analysis might be more valuable in enlightening the structure of the contention about public good provision than in giving a direct solution to policy.

Part I

Private Contribution in Incentive Compatibility Constraint

3.2 The Simplest Case

The present analysis builds upon the preceding model developed by Stiglitz (1982). Throughout this chapter, I consider two types of individuals, more able and less able, differing only in their labouring skills. Everyone has the same utility function and consumes a single private good which is produced by the two types of labours. Individual of type i faces a before tax wage (output per hour) of w_i. In the absence of taxation, his budget constraint is simply

$$c_i = w_i L_i - g_i, \tag{3.2.0.1}$$

where c_i is private consumption, L_i is the number of hours worked (L_i could also be interpreted as being effort) and g_i is his contribution to the privately provided public good (not his consumption) which he may choose to contribute voluntarily. Neither w_i or L_i is separately observable, but

$$Y_i = w_i L_i, \tag{3.2.0.2}$$

the total income, is observable. It ought to be noticed that since labour supply hours and wage rate are imperceptible individually, one cannot surmise ability for each individual. Each individual receives utility from consuming the private good c_i, the private donation g_i, the aggregate private provided of public good G and the government financed public good H. However, individuals get disutility from work.

The utility function for type i is

$$U^i = U^i(c_i, g_i, G, H, L_i), \tag{3.2.0.3}$$

where $\partial U^i/\partial c_i > 0$, $\partial U^i/\partial L_i < 0$, $\partial U^i/\partial g_i \geqslant 0$, $\partial U^i/\partial G > 0$, $\partial U^i/\partial H > 0$[3]. Here I kept the traditional assumptions about the individuals' utility function, that is, U is quasi-concave and continuously differentiable. Assume now that the government imposes a tax as a function of income and charitable contributions so as to raise government revenue

$$T_i = T(w_i L_i, g_i) = T(Y_i, g_i), \tag{3.2.0.4}$$

The individual's consumption now is his income minus both private contribution to public good and his tax payments

$$c_i = w_i L_i - g_i - T(Y_i, g_i), \tag{3.2.0.5}$$

An individual of type i maximizes his utility function subject to his budget constraint

$$\begin{aligned} \max_{\{c_i, g_i, L_i\}} \quad & U^i(c_i, g_i, G, H, L_i) \\ s.t \quad & c_i \leq w_i L_i - g_i - T(w_i L_i, g_i), \end{aligned} \tag{3.2.0.6}$$

[3] $\partial U/\partial g_i > 0$ if (and only if) there is a warm glow from giving.

In this maximization problem, Y_i and T_i (and therefore c_i) are the only observable variables. Hence, we can rewrite utility function in terms of the observable variables

$$U = U^i(c_i, g_i, G, H, \frac{Y_i}{w_i}) \equiv V^i(c_i, g_i, G, H, Y_i; w_i), \tag{3.2.0.7}$$

In brief, this model will consider five goods: the private consumption c_i, the private contribution g_i, the aggregate level of private contribution to public good G, the aggregate level of public provision of public good through income tax H and the total income Y_i. For later reference,

$$\frac{\partial V^i}{\partial c_i} = \frac{\partial U^i}{\partial c_i}; \frac{\partial V^i}{\partial g_i} = \frac{\partial U^i}{\partial g_i}; \frac{\partial V^i}{\partial Y_i} = \frac{\partial U}{\partial L_i}\frac{1}{w_i}; \frac{\partial V^i}{\partial w_i} = -\frac{\partial U^i}{\partial L_i}\frac{Y}{w_i^2} = -\frac{\partial V^i}{\partial Y_i}\frac{Y_i}{w_i},$$

The government's problem is to choose an optimal tax schedule, optimal private donations from each type of individuals and the optimal level of public provided goods to maximize social welfare. To achieve this goal, I will build up the model by using incentive compatibility approach inspiring from Stiglitz (1982). Assume that type 2 is the more able and type 1 is the less able. The objective for the government is to maximize the utility of individuals of type 2, subject to (i) individuals of type 1 having at least a given level of utility; (ii) incentive compatibility constraints; (iii) raising a given amount of revenue (government expenditure constraint); and (iv) the privately provided public good constraint. It does this by offering two $\{c, g, H, Y\}$ packages[4], one of which will be chosen by the more able and the other of which will

[4]If the government can give (non-linear) tax credits or deductions for charitable contributions by imposing a non-linear income tax, then the government can effectively choose the contribution rates.

be chosen by the less able.

The government

$$\max_{\{c_1,c_2,g_1,g_2,G,H,Y_1,Y_2\}} \quad V^2(c_2,g_2,G,H,Y_2) \tag{3.2.0.8}$$

$$s.t \qquad V^1(c_1,g_1,G,H,Y_1) \geqq \bar{U}^1 \tag{3.2.0.9}$$

$$V^2(c_2,g_2,G,H,Y_2) \geqq V^2(c_1,g_1,G,H,Y_1) \tag{3.2.0.10}$$

$$V^1(c_1,g_1,G,H,Y_1) \geqq V^1(c_2,g_2,G,H,Y_2) \tag{3.2.0.11}$$

$$N_1(Y_1-c_1-g_1)+N_2(Y_2-c_2-g_2) \geqq pH \tag{3.2.0.12}$$

$$N_1g_1+N_2g_2 \geqq pG \tag{3.2.0.13}$$

$$g_i \geqslant 0 \; for \; all \; i.$$

where N_i is the number of individuals of type i, p is the cost per unit of the public good by normalizing the price of one unit of private good to 1.

Equation 3.2.0.10 and 3.2.0.11 are the incentive compatibility constraints[5], a more able individual cannot be better off by choosing the same private consumption, private donation and to earn the same income as a less able individual, and *vice versa*. The general issue of tax assessment of different people might be described as follows. There are an extensive number of individuals in any economy who are distinct in terms of a variety of characteristics, specifically their earning power, wealth, and

[5]Stiglitz (1982) referred them as the self-selection constraints. To see a detailed discussion about self-selection constraint, see Stiglitz (1982).

preferences. Different individuals with different characteristics ought to pay different amount of taxes. However, the government could not observe those characteristics costlessly and directly. It is consequently has come to be known as the "screening problem".

The incentive compatibility constraint typically applies to a situation in which one agent attempts to differentiate among a set of other agents on the basis of his observed information. In this case, the government wants to differentiate individuals into two groups: high ability and low ability. But the information of ability is under control of the individual, notably a high ability individual would, in general, have an incentive to be misleading by pretending to be a less able individual to evade tax payment and other obligations. By using the incentive compatibility constraint mechanism, the government confronts individuals with two sets of combinations of choices, and individuals with different abilities would make different selections from the two sets. Their choices, therefore, reveal information about their characteristics to the government. In particular, government wants to seek an optimal combination of tax schedule, private donation and aggregate level of public and private provision to public good, which leads the more able individual to reveal that they are more able by earning higher income rather than pretending to be less able and enjoying more leisure, contributing less public good and finally paying less taxes. In other words, the tax structure and optimal public good provision policy must be designed in such a way that the high ability individuals are willing to disclose their ability by earning higher income.

The Lagrangian for the government maximization problem can be written as

$$\begin{aligned}\mathcal{L} =& V^2(c_2, g_2, G, H, Y_2) + \mu V^1(c_1, g_1, G, H, Y_1) \\ &+ \lambda_2 \left[V^2(c_2, g_2, G, H, Y_2) - V^2(c_1, g_1, G, H, Y_1)\right] \\ &+ \lambda_1 \left[V^1(c_1, g_1, G, H, Y_1) - V^1(c_2, g_2, G, H, Y_2)\right] \\ &+ \gamma[N_1(Y_1 - c_1 - g_1) + N_2(Y_2 - c_2 - g_2) - pH] \\ &+ \beta(N_1 g_1 + N_2 g_2 - pG).\end{aligned} \tag{3.2.0.14}$$

I will focus on the normal case where $\lambda_1 = 0$, $\lambda_2 > 0$, that is, only high ability type have the incentive to mimic the low ability type. Define $\hat{V^2} = V^2(c_1, g_1, G, H, Y_1)$, that is the utility level a more able individual gets when mimicking a less able individual. Consider the non-linear optimal income tax problem, the first order conditions for c_i and Y_i are

$$\frac{\partial \mathcal{L}}{\partial c_1} = \mu \frac{\partial V^1}{\partial c_1} - \lambda_2 \frac{\partial \hat{V^2}}{\partial c_1} - \gamma N_1 = 0, \tag{3.2.0.15}$$

$$\frac{\partial \mathcal{L}}{\partial Y_1} = \mu \frac{\partial V^1}{\partial Y_1} - \lambda_2 \frac{\partial \hat{V^2}}{\partial Y_1} + \gamma N_1 = 0, \tag{3.2.0.16}$$

$$\frac{\partial \mathcal{L}}{\partial c_2} = (1 + \lambda_2) \frac{\partial V^2}{\partial c_2} - \gamma N_2 = 0, \tag{3.2.0.17}$$

$$\frac{\partial \mathcal{L}}{\partial Y_2} = (1 + \lambda_2) \frac{\partial V^2}{\partial Y_2} + \gamma N_2 = 0. \tag{3.2.0.18}$$

Dividing 3.2.0.18 by 3.2.0.17 yields

$$-\frac{\partial V^2/\partial Y_2}{\partial V^2/\partial c_2} = 1, \tag{3.2.0.19}$$

Similarly, dividing 3.2.0.16 by 3.2.0.15 yields

$$-\frac{\partial V^1/\partial Y_1}{\partial V^1/\partial c_1} = \frac{1-\lambda_2(\partial \hat{V}^2/\partial Y_1)/N_1\gamma}{1+\lambda_2(\partial \hat{V}^2/\partial c_1)/N_1\gamma} < 1. \tag{3.2.0.20}$$

Those two equations provide the famous results of the optimal income tax schedule in Stiglitz (1982). The marginal tax rate faced by high ability individuals is zero, whereas the marginal tax rate faced by low ability individuals is between 0 and 100%. However, those results are not my primary interest in the current analysis. The current chapter builds on the insights of these results and develops a basic theory of optimal public good from both public and private sectors when optimal non-linear income tax is in place.

3.3 The Public Goods Decision Rule

To determine the decision rule for public goods, differentiate the Lagrangian with respect to the aggregate level of private provision G, the government provided public good H, the private contribution from less able individual g_1 and the private

contribution from a more able individual g_2. The first order conditions are

$$\frac{\partial \mathcal{L}}{\partial H} = (1+\lambda_2)\frac{\partial V^2}{\partial H} + \mu\frac{\partial V^1}{\partial H} - \lambda_2\frac{\partial \hat{V}^2}{\partial H} - \gamma p = 0, \tag{3.3.0.1}$$

$$\frac{\partial \mathcal{L}}{\partial G} = (1+\lambda_2)\frac{\partial V^2}{\partial G} + \mu\frac{\partial V^1}{\partial G} - \lambda_2\frac{\partial \hat{V}^2}{\partial G} - \beta p = 0, \tag{3.3.0.2}$$

$$\frac{\partial \mathcal{L}}{\partial g_1} = \mu\frac{\partial V^1}{\partial g_1} - \lambda_2\frac{\partial \hat{V}^2}{\partial g_1} + (\beta-\gamma)N_1 = 0, \tag{3.3.0.3}$$

$$\frac{\partial \mathcal{L}}{\partial g_2} = (1+\lambda_2)\frac{\partial V^2}{\partial g_2} + (\beta-\gamma)N_2 = 0. \tag{3.3.0.4}$$

From 3.3.0.1, 3.2.0.15 and 3.2.0.17, we can get

$$\frac{1}{\gamma}\frac{\partial \mathcal{L}}{\partial H} = \left(N_1\frac{V_H^1}{V_c^1} + N_2\frac{V_H^2}{V_c^2} - p\right) + \frac{\lambda_2\hat{V}_c^2}{\gamma}\left[\frac{V_H^1}{V_c^1} - \frac{\hat{V}_H^2}{\hat{V}_c^2}\right] = 0. \tag{3.3.0.5}$$

Solving 3.3.0.5 yields

$$N_1\frac{V_H^1}{V_c^1} + N_2\frac{V_H^2}{V_c^2} = p + \frac{\lambda_2\hat{V}_c^2}{\gamma}\left[\frac{\hat{V}_H^2}{\hat{V}_c^2} - \frac{V_H^1}{V_c^1}\right]. \tag{3.3.0.6}$$

The left-hand side of equation 3.3.0.6 is the sum of marginal rate of substitution between the public sector provision and the private consumption over all individuals. Define $\hat{MRS}_{Hc}^2 = \hat{V}_H^2/\hat{V}_c^2$ as the marginal rate of substitution between the government funded public good and the private consumption for a mimicker. Then 3.3.0.6 can be rewritten as

$$\sum MRS_{Hc}^i = p + \frac{\lambda_2\hat{V}_c^2}{\gamma}\left[\hat{MRS}_{Hc}^2 - MRS_{Hc}^1\right]. \tag{3.3.0.7}$$

Therefore, the deviation from the Samuelson Rule for the public sector provision of public good in the presence of optimal income taxation depends on the difference between the marginal rate of substitution of the mimicker and that of low ability individual. This result is consistent with the two-step model used by Boadway and Keen (1993). The central difference between Boadway and Keen's model and the one presented here is that the present analysis allows for the public good from the private sector as well as from the public sector. That is to say, individuals are allowed to make a private contribution to the public good in addition to government-funded public good. Within the structure of the current model, individual's voluntary contribution interacts with other decisions in the utility function and plays an important element in the optimal tax policy.

By the same manner, we can get the sum of marginal rate of substitution between the private provision of public good G and the private consumption good c_i over all individuals by solving equation 3.3.0.2.

$$\sum MRS^{i}_{Gc} = \frac{\beta}{\gamma} p + \frac{\lambda_2 \hat{V}^2_c}{\gamma} \left[M\hat{RS}^2_{Gc} - MRS^1_{Gc} \right]. \tag{3.3.0.8}$$

The deviation from Samuelson Rule for private sector provision of public good depends upon the Lagrangian multiplier β, γ and also the difference between the marginal rate of substitution of a high ability mimicker and that of a low ability individual.

3.3.1 Without Warm Glow of Giving

Now first assume the marginal utility of contribution, $\partial U^i/\partial g_i$ is zero, that is, there exists no warm glow. The expression of warm glow measures the increase in a person's utility from more contribution, holding constant his consumption c_i and the total level of private provision of public good G. In other words, people will gain utility not only from the increase of aggregate supply of public good but also from their act of giving. The idea of the warm glow was first captured by Andreoni (1989), who believes that charitable contributions are impure altruistic and contributors could get utility from giving. For example, people at a workplace want good reputation among their colleagues in order to get promoted, they might be liberal in giving when their company raises charity.

In this subsection, I assume away warm glow, that is, $\partial U^i/\partial g_i = 0$. Equation 3.3.0.3 and 3.3.0.4 imply that $\beta = \gamma$. The modified Samuelson Rule for private provision with optimal non-linear income taxation in place becomes

$$\sum MRS^i_{Gc} = p + \frac{\lambda_2 \hat{V}^2_c}{\gamma}\left[M\hat{RS}^2_{Gc} - MRS^1_{Gc}\right]. \tag{3.3.1.1}$$

That's also what equation 3.3.0.1 and 3.3.0.2 imply if the publicly provided public good H and the privately provided public good G are perfect substitutes. If those two goods were perfect substitutes, then one of modified Samuelson conditions is redundant. The government could do without private provision or without public provision.

However, when public provision and private provision are imperfect substitutes,

$\beta = \gamma$ suggests that they each have a modified Samuelson Rule, the first-order conditions are exactly the same as if the government provided both the public provision H and the charitable donation G directly, funding them by general tax revenue.

3.3.2 Warm Glow of Giving

Consider the following case where individual does gain utility from the act of giving, that is, $\partial U^i/\partial g_i > 0$. Recall one of the first order conditions 3.3.0.4

$$(1+\lambda_2)\frac{\partial V^2}{\partial g_2} + (\beta - \gamma)N_2 = 0,$$

We can immediately deduce $\gamma > \beta$, since the Lagrangian multiplier is positive and the marginal utility from donation is also positive because of the existence of a warm glow of giving. Comparing the sum of marginal rates of substitution for privately provided public good with government funded public good when they are perfect substitutes, we have:

$$\sum MRS^i_{Gc} = \frac{\beta}{\gamma}p + \frac{\lambda_2 \hat{V}^2_c}{\gamma}\left[M\hat{RS}^2_{Gc} - MRS^1_{Gc}\right] < \sum MRS^i_{Hc}. \tag{3.3.2.1}$$

The sum of marginal rates of substitution for privately provided public goods is lower than that of publicly provided public good. Using the property of diminishing marginal rates of substitution, the privately provided public good, as opposed to the public provision, would rise. In the case where individuals gain warm glow of giving, we would have a higher weighted sum of MRS for public provision than for private provision. This proposes an increase in private provision, relative to public

provision since each person's marginal rate of substitution is a decreasing function of the quantity of the public good. When government provided public good and private provision are perfect substitutes, with the presence of optimal income tax schedule, optimal private provision will have a higher level of provision than optimal public provision with a warm glow of giving.

If there is any warm glow at all, if public provision of public good and private provision of public good are perfect substitutes, the optimum would have zero government financed public good. This can be intuitively interpreted as funding public provision from taxes does not give anyone a warm glow, whereas funding private donation from contributions does yield a warm glow. Thus there is no need to finance public good by taxes if people feel better from contributing (when the private donation of public good and public provided public good are perfect substitutes). In particular, private charitable giving is a more efficient method of providing public good than direct government expenditure with warm glow of giving. This result can be characterized as the following proposition:

Proposition 1 *In the presence of optimal income tax schedule, if public provision of public good and private provision of public good are perfect substitutes, then private provision dominates public provision with warm glow of giving (i.e.,* $\sum MRS^i_{Gc} < \sum MRS^i_{Hc}$*).*

This proposition here reaches a consensus with Saez (2004) that, in spite of the fact that we approach toward a similar issue by a different manner, when individuals get pleasure from charitable giving, it is more productive to induce people to contribute as opposed to having government direct spending on public good. But,

Saez (2004) and Diamond (2006) both pointed out that the idea of warm-glow of giving might be problematic for the design of non-linear tax model since individuals obviously know the social planner intentionally controls their contribution. Diamond argues that warm glow is a measurement in view of the process of deciding the final resource allocation; if one cannot keep track of every single process of resource uses, it might be more efficient to only pay attention to the final resource allocation. Whether warm glow of giving should be included in social welfare function is still controversial. It is advanced in describing individual behaviour but at the same time raises difficulties in modelling social welfare. However, this chapter here does not explore such modelling issue.

3.4 Some Special Utility Forms

The above section discussed the general form of preference for individuals. It is also of value to take into account some special cases in which individuals' preferences are confined. In this section, I will consider some utility forms that have received a great deal of attention in the past literature.

3.4.1 Separability

If individual's utility is separable in leisure, the utility function for individual of type i can be written as

$$U^i(F[c_i, g_i, G, H], L_i), \tag{3.4.1.1}$$

In this case, the private consumption c_i, the private donation g_i, the aggregate level of private provision G and the aggregate level of public provision H are weakly separable from the labour supply L_i. And the sub-utility function $F[c_i, g_i, G, H]$ are homogeneous across individuals. Weak separability[6] is a necessary and sufficient condition for $\partial U^i/\partial G = \partial \hat{U}^i/\partial G$ and $\partial U^i/\partial H = \partial \hat{U}^i/\partial H$.

When there is no warm glow of giving, we know that $\beta = \gamma$. With the restriction that public provision and private provision are weakly separable from labour supply, our modified Samuelson conditions become

$$\sum MRS^i_{Hc} = p = \sum MRS^i_{Gc}. \tag{3.4.1.2}$$

Those are exactly the original Samuelson conditions for public good provision, that is, the sum of marginal rate of substitution over all individual equals marginal rate of transformation between the public good and a chosen private good. This suggests that, in the presence of optimal income taxation, if the utility function has the property that the consumption good is weakly separable from labour supply, then the Samuelson Rule applies to both public provision and private provision of the public good. Again, as I discussed in section 3.3.1, if public provision and private provision are not perfect substitutes, they each have a Samuelson Rule; but if they are perfect substitutes, then one of the Samuelson Conditions is unnecessary, a social planner could do without private provision, or without public provision.

With the warm glow of giving, $\gamma > \beta$. The modified Samuelson conditions 3.3.0.7

[6]Refer to Goldman and Uzawa (1964) and see the proof.

and 3.3.0.8 become

$$\sum MRS^i_{Hc} = p, \tag{3.4.1.3}$$

$$\sum MRS^i_{Gc} = \frac{\beta}{\gamma} p. \tag{3.4.1.4}$$

The Samuelson Rule applies to the public provision with the warm glow of giving; however, for the private provision, $\sum MRS^i_{Gc} < p$ implies over-provision would be optimal relative to the Samuelson Rule. The equilibrium would have public provision equals zero when public provision and private provision are perfect substitutes since people will not gain utility from forced contribution to the public good through paying taxes.

3.4.2 Additive Preference

Another special case that other literature discussed intensively is additive consumer preference. That is, utility is additively separable in the public good. Assume that all the individuals have the same preference and take the form:

$$U(c_i, g_i, G, H, L_i) = A(c_i, g_i, L_i) + B(G) + D(H). \tag{3.4.2.1}$$

This special form yields $U_{HL} = 0$ and $U_{GL} = 0$. Take the partial derivative of marginal rate of substitution between aggregate level of public good and private consumption with respect to labour supply, we obtain:

$$\frac{\partial MRS_{Gc_i}}{\partial L_i} = \frac{U_{GL_i} U_{c_i} - U_G U_{c_i L_i}}{(U_{c_i})^2} = -\frac{U_G A_{c_i L_i}}{(U_{c_i})^2}, \tag{3.4.2.2}$$

$$\frac{\partial MRS_{Hc_i}}{\partial L_i} = \frac{U_{HL_i}U_{c_i} - U_H U_{c_i L_i}}{(U_{c_i})^2} = -\frac{U_H A_{c_i L_i}}{(U_{c_i})^2}. \tag{3.4.2.3}$$

Thus, with the optimal income tax, the condition for the optimal public goods provision implicates $\sum MRS^i_{Gc_i} (or \ \sum MRS^i_{Hc_i}) >, =, < p$ as $A_{c_i L_i} >, =, < 0$. In other words, the optimal level of the private provision of public goods (or government provision) should be over-provided relative to the Samuelson Rule if consumption good and leisure are complements. To be concrete, for example, suppose private consumption c_i and labour supply L_i are substitutes, that is, private provision's relative value decreases with increases in labour supply, then the marginal rate of substitution will be more for a high-ability mimicker than that of a low-ability individual. From the modified Samuelson Rule, it immediately follows that the optimal private provision should be under-provided, even with no warm glow of giving.

3.4.3 Complement or Substitute with Labour Supply

The additive preference discussed above is one of the special cases of this subsection. In general, assume the two types of individuals have identical preferences, then with optimal income taxation in place, optimal public goods private provision condition would involve $\sum MRS^i_{Gc_i} >, =, < p$ as the private provision G is a substitute, a neutral, or a complement with the labour supply L with no warm glow of giving (same applies to public provision). That means, for instance, under-provision is optimal when the private provided public good is a complement with leisure in the sense that marginal rate of substitution for private provision falls with labour supply.

Therefore the marginal rate of substitution will be less for the low ability individual, under-provision will be optimal according to equation 3.3.1.1. In principle,

Proposition 2 *The modification of the Samuelson Rule for private provision (or public provision) of public good depending on whether aggregate charitable donation (or government funding public good) is a substitute or complement to labour supply without warm glow of giving; when there exists warm glow, the modification of the Samuelson Rule for private provision depending on whether warm glow is a substitute or complement to labour supply with separability in aggregate level of public provision and aggregate level of private provision.*

If the public provision (or the private provision) and leisure are substitutes, the government in this particular case could weaken the incentive compatibility constraint by raising the level of public provision (or private provision) above the Samuelson condition. Since the demand for public good would rise as labour supply increases, then marginal willingness to pay would be less for the mimicker. The government could possibly make mimicking less attractive by increasing the level of public sector (or private sector) provision of the public good, therefore more redistribution could take place.

3.5 Optimal Tax Credit Rule

3.5.1 General Case

In general, the government could potentially encourage a certain pattern of consumption or economic behaviours through exercising tax incentives. For example, in the

U.S, individuals are permitted to deduct costs of charitable giving from their assessable income. In this section, I will discuss the inherent optimal tax incentives rule from the nature of the design of this income tax structure. The model here is still the same model discussed in section 3.2 to 3.4. However, this section looks at the shape of the non-linear tax credit schedule implied by the prior model. If the tax schedule by each individual is $T_i(Y_i, g_i)$, which depends on both the person's income and his charitable donation. Then he picks c_i, Y_i and g_i to maximize $V^i(c_i, g_i, G, H, Y_i)$ subject to $c_i = Y_i - g_i - T(Y_i, g_i)$, taking aggregate supply public good from public sector as given, and recognizing his impact on the public provided good: $pG = p(G_{-i} + g_i)$, where G_{-i} denotes the sum of everyone else's contributions and p is the price for the privately provided public good.

Forming the maximization problem formally, the individual maximizes his utility subject to his budget constraint

$$\begin{aligned} \max_{\{c_i, g_i, Y_i\}} \quad & V^i(c_i, g_i, G_{-i} + g_i, H, Y_i) \\ s.t \quad & c_i \leq Y_i - pg_i - T_i(Y_i, g_i), \end{aligned} \tag{3.5.1.1}$$

The first order condition for g_i is

$$\frac{\partial V^i}{\partial c_i}\frac{\partial c_i}{\partial g_i} + \frac{\partial V^i}{\partial g_i} + \frac{\partial V^i}{\partial G}\frac{\partial G}{\partial g_i} + \frac{\partial V^i}{\partial Y_i}\frac{\partial Y_i}{\partial g_i} = 0, \tag{3.5.1.2}$$

Rearranging equation 3.5.1.2 and assuming $p = 1$ for simplicity, we have

$$\frac{\partial T_i}{\partial g_i} = \frac{\partial V^i/\partial g_i + \partial V^i/\partial G}{\partial V^i/\partial c_i} - 1. \tag{3.5.1.3}$$

Using equation 3.2.0.15, 3.2.0.17, 3.3.0.2, 3.3.0.3 and 3.3.0.4 to get

$$\frac{\partial T_1}{\partial g_1} = \frac{\lambda_2 \left[\frac{\partial \hat{V^2}}{\partial g_1} + \frac{\partial \hat{V^2}}{\partial G} - \frac{\partial V^2}{\partial G} - \frac{\partial \hat{V^2}}{\partial c_1} \right] - \frac{\partial V^2}{\partial G} + \beta(1 - N_1)}{\lambda_2 \frac{\partial \hat{V^2}}{\partial c_1} + \gamma N_1}, \tag{3.5.1.4}$$

$$\frac{\partial T_2}{\partial g_2} = \frac{\lambda_2 \frac{\partial \hat{V^2}}{\partial G} - \mu \frac{\partial V^1}{\partial G} + \beta(1 - N_2)}{\gamma N_2}. \tag{3.5.1.5}$$

To determine the sign of $\partial T_2/\partial g_2$, assume utility is separable in aggregate private provision and as well in the warm glow g_i; then from equation 3.3.0.3, $\gamma > \beta$ implies $\mu > \lambda_2$. Therefore, equation 3.5.1.5 tells us $\partial T_2/\partial g_2$ is negative. That is, if utility is separable in aggregate public provision and individual's charitable contribution, the optimal income tax will decrease as private donation goes up for type 2 (high-income type). As well, if we assume individual gets higher marginal utility from private consumption than from private donation[7], $\partial V^i/\partial c_i > \partial V^i/\partial g_i$, then separability implies that the right-hand side of equation 3.5.1.4 is also negative.

Those signs for the first order conditions suggest central planner's policy is in favour of charitable donation in the optimal taxation schedule. The government, in fact, encourages individuals in this economy to contribute to the public good by reducing payment of their tax bill. Both high-ability and less-ability individuals will receive a positive income tax credit when increasing the private donation to the

[7]It seems a reasonable assumption that the warm glow of giving a dollar is worth less than a dollar; otherwise, people would gain from contribution, even if they did not care about the overall level of private contributions.

public good. The more private contribution one makes, the more marginal income tax credit he receives potentially according to the first order conditions.

3.5.2 Large Population

In last section, I assume the price for public good equals 1 for simplicity. And now take the price for public good as a function of the population for both type 1 and type 2 individual. Consider

$$N_1 = n_1 N, \tag{3.5.2.1}$$

$$N_2 = n_2 N. \tag{3.5.2.2}$$

where n_1 and n_2 are proportions for each type of individuals, $0 \leq n_1 \leq 1$ and $0 \leq n_2 \leq 1$. N is the overall population in this economy.

Assume the price for each unit of public good relates to the population distribution,

$$p = (N_1 + N_2)^{\alpha}, \tag{3.5.2.3}$$

where $0 \leq \alpha \leq 1$. If $\alpha = 0$, then the public good from private donation is a pure public good and therefore the price for private provided public good does not vary with the change of population, so this goes back to the case in subsection 3.5.1 where $p = 1$ as fixed. However, if $\alpha = 1$, then the privately provided public good is a pure private good, p would rise with the growth of the overall population. Finally, if $0 < \alpha < 1$, p would increase as the population grows large.

Solving equation 3.5.1.2 with 3.5.2.3 to get

$$\frac{\partial T_i}{\partial g_i} = \frac{\partial V^i/\partial g_i + \partial V^i/\partial G}{\partial V^i/\partial c_i} - (N_1 + N_2)^{\alpha}. \tag{3.5.2.4}$$

Our 3.5.1.4 and 3.5.1.5 become

$$\frac{\partial T_1}{\partial g_1} = \frac{\lambda_2 \left[\frac{\partial \hat{V^2}}{\partial g_1} + \frac{\partial \hat{V^2}}{\partial G} - \frac{\partial V^2}{\partial G} - (N_1 + N_2)^{\alpha}\frac{\partial \hat{V^2}}{\partial c_1}\right] - \frac{\partial V^2}{\partial G} + \beta + N_1\left[\gamma - \beta - \gamma(N_1 + N_2)^{\alpha}\right]}{\lambda_2 \frac{\partial \hat{V^2}}{\partial c_1} + \gamma N_1}, \tag{3.5.2.5}$$

$$\frac{\partial T_2}{\partial g_2} = \frac{\lambda_2 \frac{\partial \hat{V^2}}{\partial G} - \mu\frac{\partial V^1}{\partial G} + \beta + N_2\left[\gamma - \beta - \gamma(N_1 + N_2)^{\alpha}\right]}{\gamma N_2}. \tag{3.5.2.6}$$

Consider the case when $\alpha = 1$, that is the extreme case when aggregate private provision of public good is a pure private good, the marginal tax credit rate for the high-ability individuals might go towards 100% as the number of people for this group approaches to infinity. Pure private good has the property of both rivalrousness and excludability in consumption, meaning consumption of a unit of the good by one person prevents consumption of that same unit by another person. Also the provider of this consumption good can control the use of this good. If the private contribution of public good theoretically has the same feature as pure private good, then the government's income tax credit for a high-income individual might approach a dollar for a dollar if high-ability individuals grow to weight higher percentage of the total population.

Part II

Two-stage Non-Cooperative Game

In Part I, a charitable donation from the private sector are determined by the government as part of the income tax policy. And from now on, private contribution is endogenous and whether contributing to the public good is one of the decisions made by individuals responding to optimal income policy in the economy. It is worth noting that private contributions in this part is private information held by the individual, and government cannot either directly control over private contribution or observe this information separately. Now, suppose the government must offer the same fixed subsidy rate to everyone for contributions to the privately provided public good. If the true price of the privately provided public good is 1, and the subsidy rate is s, then consequently everyone faces a price $1-s$ for contributions to the public good. The price of the publicly provided public good is also assumed to be 1.

Again the government can impose an arbitrary non-linear income tax so that its goal is to maximize the welfare of one group, subject to the other group attaining some given utility level, and the "no-mimicking" conditions. However, when the government cannot control directly individuals' contributions to the privately provided provided public good, the vectors of people's chioces for contributions are the Nash equilibrium for this voluntary contribution game, for example, as in Bergstrom et al. (1986). In other words, there are two stages for this "voluntary contribution game". At the first stage, government imposes a non-linear income tax on the two-group individuals based on their total income and after-tax income; at the final stage, both types of individuals maximize their utility based on government's tax policy and their own budget constraint in which labour income is allocated between the private consumption and the public good contribution.

3.6 Contributing Stage

Suppose that each type of individuals can decide upon a quantity to contribute to the public good, (g_1^*, g_2^*). The pair of g_1^* and g_2^* is the Nash equilibrium to the following $N_1 + N_2$ - player game, where N_i is the number of people for type i. A type 1 individual chooses g_1 so as to maximize his utility function

$$V^1(c_1, g_1, G_{-1}^* + g_1, H, Y_1), \tag{3.6.0.1}$$

subject to

$$c_1 = x_1 - (1 - s)g_1, \tag{3.6.0.2}$$

where

$$G_{-1}^* \equiv (N_1 - 1)g_1^* + N_2 g_2, \quad g_1 \geqq 0. \tag{3.6.0.3}$$

A type 2 individual chooses g_2 so as to maximize his utility function

$$V^2(c_2, g_2, G_{-2}^* + g_2, H, Y_2), \tag{3.6.0.4}$$

subject to

$$c_2 = x_2 - (1 - s)g_2, \tag{3.6.0.5}$$

where

$$G_{-2}^* \equiv N_1 g_1 + (N_2 - 1)g_2^*, \quad g_2 \geqq 0. \tag{3.6.0.6}$$

Here x_1 and x_2 are the net-of-tax income for type 1 and type 2 individual respectively. When the government cannot personalize subsidies for contributions to the privately

provided public good, the non-linear income tax must be based on people's before-tax income Y_i and their total after-tax income x_i; however, not on how that after-tax income is split between c_i and g_i.

The first order condition for the contribution choice problem for type-i individual is

$$(1-s)\frac{\partial V^i}{\partial c_i} = \frac{\partial V^i}{\partial g_i} + \frac{\partial V^i}{\partial G} \quad i = 1, 2. \tag{3.6.0.7}$$

Here I assume that the warm glow, which is the first term on the right side of the equation above, depends on the total contribution of the person, not his contribution minus the subsidy he gets. As in Bergstrom et al. (1986), there is a Nash equilibrium to the above game, that is, solving the gifts g_1^* and g_2^* as functions of $(x_1, x_2, Y_1, Y_2, s, H)$.

Assume that the government can not detect individuals' total contributions nor can base transfers on this total. That means if type 2 person chooses to mimic a type 1 person, he does not need to contribute the same amount g_1^* to the privately provided public goods. He just has to pick a gross/net income combination (Y_1, x_1) in order to pay for the income tax.

So if a person of type 2 were to choose to mimic, the amount he would want to contribute to the privately provided public good would be $\tilde{g}_1$, the maximization problem for a mimicker is

$$V^2(\tilde{c_1}, \tilde{g}_1, G + \tilde{g}_1 - g_2, H, Y_1), \tag{3.6.0.8}$$

subject to

$$\tilde{c_1} = x_1 - (1-s)\tilde{g_1}, \tag{3.6.0.9}$$

where

$$\tilde{G} \equiv G + \tilde{g_1} - g_2^*, \quad \tilde{g_1} \geqq 0. \tag{3.6.0.10}$$

Define $\tilde{c}_1 = x_1 - (1-s)\tilde{g}_1$, $\tilde{G} = G + \tilde{g}_1 - g_2^*$. They are the private consumption and the aggregate private contribution of mimicker respectively.

3.7 Setting the Non-linear Income Taxation

Now the government's problem is the usual non-linear income tax problem, which can be written as the maximization of

$$V^2(x_2 - (1-s)g_2^*, g_2^*, G, H, Y_2), \tag{3.7.0.1}$$

subject to

$$V^1(x_1 - (1-s)g_1^*, g_1^*, G, H, Y_1) \geq \bar{U}_1, \tag{3.7.0.2}$$

$$V^2(x_2 - (1-s)g_2^*, g_2^*, G, H, Y_2) \geq V^2(x_1 - (1-s)\tilde{g_1}, \tilde{g_1}, G + \tilde{g_1} - g_2^*, H, Y_1), \tag{3.7.0.3}$$

$$V^1(x_1 - (1-s)g_1^*, g_1^*, G, H, Y_1) \geq V^2(x_2 - (1-s)\tilde{g_2}, \tilde{g_2}, G + \tilde{g_2} - g_2^*, H, Y_2), \tag{3.7.0.4}$$

$$N_1(Y_1 - x_1 - sg_1^*) + N_2(Y_2 - x_2 - sg_2^*) \geq H. \tag{3.7.0.5}$$

One different setting in this game compared with the conventional optimal income tax problem is that when a person maximize his utility function, he realizes that

if he chooses to mimic, then he will also change his private contribution which will change the total contributions by $\tilde{g}_j - g_i^*$. At the same time, this person is ignoring the fact that the g_i^*'s and g_j^*'s are the Nash equilibrium to the two-stage game, which would actually change if he mimicked.

The government's choice variables in this tax-setting constrained optimization are $(x_1, x_2, Y_1, Y_2, s, H)$ with the G_i^*'s and $\tilde{g}_i$'s depending on those variables, but not being direct control variables for the government.

A full examination would, obviously, start with the general Lagrangian form and inspect its properties. The trouble with such a broad approach is that it does not prompt any basic solutions at any rate. In this section, I first present the first order conditions with general functional forms. Since analytic formulae for the optimal income tax schedule seem impossible, I then make several innocuous restrictions for individual's preference in the following section in order to find some clear implications.

$$\begin{aligned}\mathcal{L} =& V^2(x_2 - (1-s)g_2^*, g_2^*, G, H, Y_2) + \mu V^1(x_1 - (1-s)g_1^*, g_1^*, G, H, Y_1) \\ &+ \lambda_2 \left[V^2(x_2 - (1-s)g_2^*, g_2^*, G, H, Y_2) - V^2(x_1 - (1-s)\tilde{g}_1, \tilde{g}_1, G + \tilde{g}_1 - g_2^*, H, Y_1)\right] \\ &+ \gamma \left[N_1 \left(Y_1 - x_1 - s g_1^*\right) + N_2 \left(Y_2 - x_2 - s g_2^*\right) - H\right]. \end{aligned} \tag{3.7.0.6}$$

Consider the optimal income tax problem, the first order conditions for x_i, Y_i are

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial x_1} =& (1+\lambda_2)\left[-(1-s)V_{c_2}^2 \frac{\partial g_2^*}{\partial x_1} + V_{g_2^*}^2 \frac{\partial g_2^*}{\partial x_1} + V_G^2 \frac{\partial G}{\partial x_1}\right] + \mu\left[V_{c_1}^1\left(1 - (1-s)\frac{\partial g_1^*}{\partial x_1}\right) + V_{g_1^*}^1 \frac{\partial g_1^*}{\partial x_1} + V_G^1 \frac{\partial G}{\partial x_1}\right] \\ &- \lambda_2\left[V_{\tilde{c}_1}^2\left(1 - (1-s)\frac{\partial \tilde{g}_1}{\partial x_1}\right) + V_{\tilde{g}_1}^2 \frac{\partial \tilde{g}_1}{\partial x_1} + V_{\tilde{G}}^2\left(\frac{\partial G}{\partial x_1} + \frac{\partial \tilde{g}_1}{\partial x_1} - \frac{\partial g_2^*}{\partial x_1}\right)\right] - \gamma\left[N_1\left(1 + s\frac{\partial g_1^*}{\partial x_1}\right) + N_2 s \frac{\partial g_2^*}{\partial x_1}\right], \end{aligned} \tag{3.7.0.7}$$

$$\frac{\partial \mathcal{L}}{\partial Y_1} = (1+\lambda_2)\left[-(1-s)V^2_{c_2}\frac{\partial g^*_2}{\partial Y_1} + V^2_{g^*_2}\frac{\partial g^*_2}{\partial Y_1} + V^2_G\frac{\partial G}{\partial Y_1}\right] + \mu\left[-(1-s)V^1_{c_1}\frac{\partial g^*_1}{\partial Y_1} + V^1_{g^*_1}\frac{\partial g^*_1}{\partial Y_1} + V^1_G\frac{\partial G}{\partial Y_1} + V^1_{Y_1}\right]$$
$$- \lambda_2\left[-(1-s)V^2_{\tilde{c}_1}\frac{\partial \tilde{g}_1}{\partial Y_1} + V^2_{\tilde{g}_1}\frac{\partial \tilde{g}_1}{\partial Y_1} + V^2_{\tilde{G}}\left(\frac{\partial G}{\partial Y_1} + \frac{\partial \tilde{g}_1}{\partial Y_1} - \frac{\partial g^*_2}{\partial Y_1}\right) + V^2_{Y_1}\right] + \gamma\left[N_1\left(1 - s\frac{\partial g^*_1}{\partial Y_1}\right) - N_2 s\frac{\partial g^*_2}{\partial Y_1}\right], \tag{3.7.0.8}$$

$$\frac{\partial \mathcal{L}}{\partial x_2} = (1+\lambda_2)\left[V^2_{c_2}\left(1-(1-s)\frac{\partial g^*_2}{\partial x_2}\right) + V^2_{g^*_2}\frac{\partial g^*_2}{\partial x_2} + V^2_G\frac{\partial G}{\partial x_2}\right] + \mu\left[-(1-s)V^1_{c_1}\frac{\partial g^*_1}{\partial x_2} + V^1_{g^*_1}\frac{\partial g^*_1}{\partial x_2} + V^1_G\frac{\partial G}{\partial x_2}\right]$$
$$- \lambda_2\left[-(1-s)V^2_{\tilde{c}_1}\frac{\partial \tilde{g}_1}{\partial x_2} + V^2_{\tilde{g}_1}\frac{\partial \tilde{g}_1}{\partial x_2} + V^2_{\tilde{G}}\left(\frac{\partial G}{\partial x_2} + \frac{\partial \tilde{g}_1}{\partial x_2} - \frac{\partial g^*_2}{\partial x_2}\right)\right] - \gamma\left[N_1 s\frac{\partial g^*_1}{\partial x_2} + N_2\left(1 + s\frac{\partial g^*_2}{\partial x_2}\right)\right], \tag{3.7.0.9}$$

$$\frac{\partial \mathcal{L}}{\partial Y_2} = (1+\lambda_2)\left[-(1-s)V^2_{c_2}\frac{\partial g^*_2}{\partial Y_2} + V^2_{g^*_2}\frac{\partial g^*_2}{\partial Y_2} + V^2_G\frac{\partial G}{\partial Y_2} + V^2_{Y_2}\right] + \mu\left[-(1-s)V^1_{c_1}\frac{\partial g^*_1}{\partial Y_2} + V^1_{g^*_1}\frac{\partial g^*_1}{\partial Y_2} + V^1_G\frac{\partial G}{\partial Y_2}\right]$$
$$- \lambda_2\left[-(1-s)V^2_{\tilde{c}_1}\frac{\partial \tilde{g}_1}{\partial Y_2} + V^2_{\tilde{g}_1}\frac{\partial \tilde{g}_1}{\partial Y_2} + V^2_{\tilde{G}}\left(\frac{\partial G}{\partial Y_2} + \frac{\partial \tilde{g}_1}{\partial Y_2} - \frac{\partial g^*_2}{\partial Y_2}\right)\right] + \gamma\left[-N_1 s\frac{\partial g^*_1}{\partial Y_2} + N_2\left(1 - s\frac{\partial g^*_2}{\partial Y_2}\right)\right]. \tag{3.7.0.10}$$

3.8 Identical Preferences

Some results are possible to establish, however if the utility function is separable in labour supply. Assume people have identical tastes, and there is no warm glow of giving. Consider the privately provided public good as a normal good. In order to simplify this analysis, I assign individual's utility as the following form:

$$V_i = u(c_i, G) + h(H) + f_i(Y_i), \tag{3.8.0.1}$$

where $f_i = f(\frac{Y_i}{w_i})$. This utility function has the property that utility is additively separable in the government funded public good and labour supply.

Forming Lagrangian

$$\begin{aligned}\mathcal{L} =& u(x_2-(1-s)g_2^*,G)+h(H)+f_2(Y_2)+\mu\left[u(x_1-(1-s)g_1^*,G)+h(H)+f_1(Y_1)\right]\\&+\lambda_2\left[u(x_2-(1-s)g_2^*,G)+f_2(Y_2)-u(x_1-(1-s)\tilde{g_1},G+\tilde{g_1}-g_2^*)-f_2(Y_1)\right]\\&+\gamma\left[N_1(Y_1-x_1-sg_1^*)+N_2(Y_2-x_2-sg_2^*)-H\right],\end{aligned} \tag{3.8.0.2}$$

The first order conditions are

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial x_1} =&-(1+\lambda_2)(1-s)u_{c_2}\frac{\partial g_2^*}{\partial x_1}+(1+\mu+\lambda_2)u_G\frac{\partial G}{\partial x_1}+\mu u_{c_1}\left(1-(1-s)\frac{\partial g_1^*}{\partial x_1}\right)-\lambda_2 u_{\tilde{c_1}}\left(1-(1-s)\frac{\partial\tilde{g_1}}{\partial x_1}\right)\\&-\lambda_2 u_{\tilde{G}}\left(\frac{\partial G}{\partial x_1}+\frac{\partial\tilde{g_1}}{\partial x_1}-\frac{\partial g_2^*}{\partial x_1}\right)-\gamma\left[N_1\left(1+s\frac{\partial g_1^*}{\partial x_1}\right)+N_2 s\frac{\partial g_2^*}{\partial x_1}\right]=0,\end{aligned} \tag{3.8.0.3}$$

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial Y_1} =&-(1+\lambda_2)(1-s)u_{c_2}\frac{\partial g_2^*}{\partial Y_1}+(1+\mu+\lambda_2)u_G\frac{\partial G}{\partial Y_1}-\mu u_{c_1}(1-s)\frac{\partial g_1^*}{\partial Y_1}+\mu\frac{\partial f_1(Y_1)}{\partial Y_1}+\lambda_2(1-s)u_{\tilde{c_1}}\frac{\partial\tilde{g_1}}{\partial Y_1}\\&-\lambda_2 u_{\tilde{G}}\left(\frac{\partial G}{\partial Y_1}+\frac{\partial\tilde{g_1}}{\partial Y_1}-\frac{\partial g_2^*}{\partial Y_1}\right)-\lambda_2\frac{\partial f_2(Y_1)}{\partial Y_1}+\gamma\left[N_1\left(1-s\frac{\partial g_1^*}{\partial Y_1}\right)-N_2 s\frac{\partial g_2^*}{\partial Y_1}\right]=0,\end{aligned} \tag{3.8.0.4}$$

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial x_2} =&(1+\lambda_2)u_{c_2}\left(1-(1-s)\frac{\partial g_2^*}{\partial x_2}\right)+(1+\mu+\lambda_2)u_G\frac{\partial G}{\partial x_2}-\mu u_{c_1}(1-s)\frac{\partial g_1^*}{\partial x_2}+\lambda_2 u_{\tilde{c_1}}(1-s)\frac{\partial\tilde{g_1}}{\partial x_2}\\&-\lambda_2 u_{\tilde{G}}\left(\frac{\partial G}{\partial x_2}+\frac{\partial\tilde{g_1}}{\partial x_2}-\frac{\partial g_2^*}{\partial x_2}\right)-\gamma\left[N_1 s\frac{\partial g_1^*}{\partial x_2}+N_2\left(1+s\frac{\partial g_2^*}{\partial x_2}\right)\right]=0,\end{aligned} \tag{3.8.0.5}$$

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial Y_2} =&-(1+\lambda_2)(1-s)u_{c_2}\frac{\partial g_2^*}{\partial Y_2}+(1+\mu+\lambda_2)u_G\frac{\partial G}{\partial Y_2}-\mu u_{c_1}(1-s)\frac{\partial g_1^*}{\partial Y_2}+(1+\lambda_2)\frac{\partial f_2(Y_2)}{\partial Y_2}+\lambda_2(1-s)u_{\tilde{c_1}}\frac{\partial\tilde{g_1}}{\partial Y_2}\\&-\lambda_2 u_{\tilde{G}}\left(\frac{\partial G}{\partial Y_2}+\frac{\partial\tilde{g_1}}{\partial Y_2}-\frac{\partial g_2^*}{\partial Y_2}\right)+\gamma\left[-N_1 s\frac{\partial g_1^*}{\partial Y_2}+N_2\left(1-s\frac{\partial g_2^*}{\partial Y_2}\right)\right]=0,\end{aligned} \tag{3.8.0.6}$$

Each individual's contribution is "a best response" to the other's given the government's income tax policy. A Nash equilibrium would be a stable state that once the contribution decisions are made by the two-type individuals, neither has cause to changing his own contribution upon learning the other's.

3.9 Equilibrium at the Contributing Stage

There are two possible equilibria with this two stage non-cooperative game. There exists a minimum critical level of net-of-tax income x_1^*. If low ability type of individual's income is below this level, then the Nash equilibrium has only high ability type of individual contributing: $g_1 = 0$, $g_2 = G/N_2$; and in this case, the high ability individual has higher private consumption than that of low ability individual, $c_2 > c_1$. However, if type 1 (low earner)' income is above the critical level, then everyone in the economy chooses to contribute in equilibrium, that is, $g_1 > 0$, $g_2 > 0$. Since the consumers' utility has the character of separability, so that the marginal rate of substitution between the privately provided public good G and the private consumption c_i is independent of the labour supply. The Bergstrom, Blume, and Varian neutrality result occurs if both types choose to contribute in equilibrium. The first-order condition for the choice of contribution is $\sum MRS_{c_i,G} = 1 - s$, that is, the marginal rate of substitution between the private consumption and the privately provided public good equals the net price of the contribution. Since everyone consumes the same private provision of public good G, they must have the same private consumption c_i. Therefore, when both types of individuals' income are above the critical level, everyone consumes the same private consumption, $c_1 = c_2$ and the aggregate level of private provision of public good G.

First, consider the case where type 1 individual's income is above the critical level, that is, $c_1 = c_2$. Since everyone is getting the same private provision G, according to

the resource constraint

$$N_1 x_1 + N_2 x_2 = pG + N_1 c_1 + N_2 c_2 \tag{3.9.0.1}$$

then they all must have the same after-tax income x_i when the marginal rate of substitution for private provision is a monotonically increasing function of the after-tax income.[8]

In this case, we have $c_1 = c_2$, $x_1 = x_2$; with uniform subsidy rate, $g_1 = g_2$. The Bergstrom, Blume, and Varian neutrality result carries over in this special case. An income redistribution will change a consumer's donation by precisely the amount of change in his income. In the new Nash equilibrium, each type of consumer has the same private consumption and privately public good provision with that of before-redistribution. We have

$$u_{c_1} = u_{c_2};\ \frac{\partial g_1}{\partial x_1} = \frac{\partial g_2}{\partial x_2} = 1;\ \frac{\partial g_1}{\partial x_2} = \frac{\partial g_2}{\partial x_1} = -1.$$

Type 2 person would have more incentive to mimic type 1 person since the incentive compatibility constraint in section 3.2 implies that:

$$V^2 = u(c_2, G) + h(H) + f_2(Y_2),$$
$$\hat{V^2} = u(c_1, G) + h(H) + f_2(Y_1).$$

[8]The private provision of public good is a normal good.

where $\hat{V^2}$ is the utility type 2 person gets when mimicking type 1 person. Each type consumes the same private consumption good and the same amount of aggregate private contribution to public good. Type 2 person can supply less labour working hours by mimicking type 1 person and can still obtain the same private consumption and public good consumption. There would be no incentive for the mimicker to supply more working hours and type 2 would be made worse off by earning a higher income. However, since individuals have identical preferences, in order to pretend to be a low ability individual, the mimicker has to earn the same income as a low ability individual and get the same net-of-tax income x_1, therefore $\tilde{g_1} = g_1 = g_2$, $\tilde{G} = G$. The result given here are in a rather different form, if the no-mimicking constraint is not satisfied, then there is no solution to the first stage optimal tax problem when both types of individuals choose to contribute at the equilibrium. When net-of-tax income for both types of individuals is above the critical value, we could not find the optimal non-linear income tax for government' welfare maximization problem.

Proposition 3 *The Nash equilibrium for this two-stage non-cooperative game is that only high-income earner would make positive voluntary contribution to the public good,* $g_1 = 0$ *and* $g_2 = G/N_2$.

The equilibrium for this game presented in this chapter agrees on the optimum for subsidized private provision with two types of worker setting in Diamond (2006). Diamond also comes to conclude that in an economy where there are only two types of workers, the optimum will have only the higher type contributing whether incentive compatibility constraint binds or not. In fact, the equilibrium that only high skill workers would contribute to the public good holds regardless both types of individuals

receive a uniform subsidy or different subsidizing rates with different earning levels. As long as the incentive compatibility continues to bind, the equilibrium for this economy always has the optimum allocation in which low income earners contribute nothing at all whereas high income earners are willing to make a positive amount of donation to the private provision of public good. I show in section 3.11 that welfare is always improving with a positive subsidy.

3.10 Optimal Tax Rates at the First Stage

However, the only equilibrium that would have a solution for the first stage is when low-ability workers' income is below the critical value. If income differences are large enough, then the low-ability workers will choose not to contribute and only high-ability workers contribute to private donation: $g_1 = 0$, $g_2 = G/N_2$. High-ability workers are paid enough more to finance both consumption and donation, so they could consume higher private consumption and at the same time make a positive donation to the privately provided public good, $c_2 > c_1$. With only high ability individual contributing,

$$c_1 = \tilde{c_1} = x_1 = \tilde{x_1},\ (1-s)u_{c_2} = u_G,\ \tilde{g_1} = g_1 = 0,\ \frac{\partial g_1^*}{\partial x_i} = \frac{\partial g_1^*}{\partial Y_i} = 0.$$

Consider equalizing wealth from contributors to non-contributors. According to Theorem 5 in Bergstrom et al. (1986), the supply of the public good at the equilibrium will decrease after a wealth redistribution from contributors to non-contributors. Therefore, aggregate private donation from high ability workers, G will decrease and

so does g_2^*. The first order conditions for x_i and Y_i in section 3.8 are reduced to:

$$\frac{\partial \mathcal{L}}{\partial x_1} = (\mu - \lambda_2)u_{c_1} + (1-s)(\mu N_2 + N_2 - 1)u_{c_2}\frac{\partial g_2^*}{\partial x_1} - \gamma\left(N_1 + N_2 s\frac{\partial g_2^*}{\partial x_1}\right) = 0, \tag{3.10.0.1}$$

$$\frac{\partial \mathcal{L}}{\partial Y_1} = \mu\frac{\partial f_1(Y_1)}{\partial Y_1} - \lambda_2\frac{\partial f_2(Y_1)}{\partial Y_1} + (1-s)(\mu N_2 + N_2 - 1)u_{c_2}\frac{\partial g_2^*}{\partial Y_1} + \gamma\left(N_1 - N_2 s\frac{\partial g_2^*}{\partial Y_1}\right) = 0, \tag{3.10.0.2}$$

$$\frac{\partial \mathcal{L}}{\partial x_2} = (1+\lambda_2)u_{c_2} + (1-s)(\mu N_2 + N_2 - 1)u_{c_2}\frac{\partial g_2^*}{\partial x_2} - \gamma N_2\left(1 + s\frac{\partial g_2^*}{\partial x_2}\right) = 0, \tag{3.10.0.3}$$

$$\frac{\partial \mathcal{L}}{\partial Y_2} = (1+\lambda_2)\frac{\partial f_2(Y_2)}{\partial Y_2} + (1-s)(\mu N_2 + N_2 - 1)u_{c_2}\frac{\partial g_2^*}{\partial Y_2} + \gamma N_2\left(1 - s\frac{\partial g_2^*}{\partial Y_2}\right) = 0. \tag{3.10.0.4}$$

Dividing 3.10.0.4 by 3.10.0.3 and dividing 3.10.0.2 by 3.10.0.1,

$$-\frac{\partial V^2/\partial Y_2}{\partial V^2/\partial c_2} = -\frac{\partial f_2(Y_2)/\partial Y_2}{u_{c_2}} = \frac{\gamma N_2 - \frac{\partial g_2^*}{\partial Y_2}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right]}{\gamma N_2 + \frac{\partial g_2^*}{\partial x_2}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right]}, \tag{3.10.0.5}$$

$$-\frac{\partial V^1/\partial Y_1}{\partial V^1/\partial c_1} = \frac{\partial f_1(Y_1)/\partial Y_1}{u_{c_1}} = \frac{(1-\frac{\lambda_2}{\mu})\left(\gamma N_1 - \frac{\partial g_2^*}{\partial Y_1}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right] - \lambda_2\frac{\partial f_2(Y_1)}{\partial Y_1}\right)}{\left(\gamma N_1 + \frac{\partial g_2^*}{\partial x_1}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right]\right)}. \tag{3.10.0.6}$$

Since I assume at the beginning, workers will get disutility from work, that is, $\frac{\partial V^i}{\partial Y_i} = \frac{\partial U^i}{\partial L_i}\frac{1}{w} < 0$. An increase in the total income lowers utility, because to earn it the

individual must sacrifice more leisure. Therefore,

$$-(1+\lambda_2)\frac{\partial f_2(Y_2)}{\partial Y_2} = \gamma N_2 - \frac{\partial g_2^*}{\partial Y_2}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right] > 0, \tag{3.10.0.7}$$

$$(1+\lambda_2)u_{c_2} = \gamma N_2 + \frac{\partial g_2^*}{\partial x_2}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right] > 0, \tag{3.10.0.8}$$

$$-\frac{\partial f_1(Y_1)}{\partial Y_1} = \frac{\gamma N_1 - \frac{\partial g_2^*}{\partial Y_1}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right] - \lambda_2 \frac{\partial f_2(Y_1)}{\partial Y_1}}{\mu} > 0, \tag{3.10.0.9}$$

$$u_{c_1} = \frac{\gamma N_1 + \frac{\partial g_2^*}{\partial x_1}\left[\gamma N_2 s - (\mu N_2 + N_2 - 1)u_G\right]}{\mu - \lambda_2} > 0. \tag{3.10.0.10}$$

Those imply that $-\dfrac{\partial V^2/\partial Y_2}{\partial V^2/\partial c_2} > 0$, $-\dfrac{\partial V^1/\partial Y_1}{\partial V^1/\partial c_1} > 0$. The optimal marginal income tax rates for high ability workers and low ability workers would be both less than 100%.

3.11 Policy Perturbation

In this section, I give a brief discussion about government intervention for public good provision. Consider the subsidy rate s and the government funded public good H are two choice variables at the first stage. The first order conditions of Lagrangian for s and H are

$$\frac{\partial \mathcal{L}}{\partial s} = \left[(1+\lambda_2)u_{c_2} - \gamma N_2\right] g_2^* + \frac{\partial g_2^*}{\partial s}\left[(\mu N_2 + N_2 - 1)u_G - \gamma N_2 s\right] = 0 \tag{3.11.0.1}$$

$$\frac{\partial \mathcal{L}}{\partial H} = (1+\mu)\frac{\partial h(H)}{\partial H} - \gamma + \frac{\partial g_2^*}{\partial H}\left[(\mu N_2 + N_2 - 1)u_G - \gamma N_2 s\right] = 0 \tag{3.11.0.2}$$

It seems not possible to generate a neat explanation from those two first order conditions and consequently it is hard to evaluate the impact of subsidy rate and public provision without imposing a number of strong assumptions on people's decisions of labour supply and private contributions.

The conventional theory claims that the Nash equilibrium of private contribution to public good tends to imply under-provision of the public good compared to Pareto efficient allocations. So to achieve the efficient level of supply for the public good in an economy, a small subsidy is necessary. Generally, it should always be the case that the subsidy rate $s > 0$ at the optimum when only the high income earners contribute. Consider the following 5-steps welfare exercise: (i) Start with $s = 0$, (ii) now increase the subsidy rate a little, and at the same time decrease the net-of-tax income x_2 for the high income earners, so as to keep the government budget balanced (taking into account the new contribution choices made by the high income earners in the second stage), (iii) the fact that originally the sum of high income earners' MRS were greater than the marginal cost of privately provided good G means that the high income earners are better off after this policy change, that is, the result that there is inefficient under provision at the Nash equilibrium with private contributions, (iv) the low income earners are also better off since they're getting more public good from private provision, (v) now, if necessary, increases x_2 and decreases x_1 so that the no-mimicking constraint still holds. The government can always do this: if it decreases x_1 until the low income earners are exactly as well off as they were before the policy perturbation, then the government is making the low income earners strictly better off than they were, (vi) Starting from $s = 0$,

steps $(i) - (v)$ show that one can always increase social welfare and still satisfy all the constraints to the planner's problem by increasing s above zero. Therefore, the planner's optimum must have $s > 0$. This result shows that private provision would not generate a Pareto efficient outcome and it would be Pareto-improving for the high ability type of individuals to increase their contribution towards the private provision. Such results provide a natural role for the government to participate in financing the provision of public goods by the income taxation that was analysed in this chapter.

3.12 Concluding Remarks

This chapter has developed a framework for analysing the non-linear tax treatment of private provision of public good in an economy where there are only two groups of individuals. It also examined the Nash equilibrium in a two-stage optimal income taxation model with voluntary contribution to public good.

Several strong results are obtained from this chapter when individuals are identical. In the standard optimal income taxation model inspired by Stiglitz (1982), the private provision of public good is generally more efficient when private provision and public provision are perfect substitutes with warm glow of giving. Furthermore, I show that the modification of the Samuelson Rule for private provision or public provision of public good depending on whether aggregate charitable donation or government funding public good is a substitute or complement to labour supply without warm glow of giving. Recognizing the endogeneity of charitable giving in

the two-stage game, my analysis demonstrates the Nash equilibrium would have only high-ability individuals making positive donation.

This current approach has obvious limitations, but I believe that it is adequate to show the significance of non-linear tax treatment for charitable giving decision and the optimal tax credit rates. The present model could be extended in three directions. First, it would be interesting to infer multiple public goods provision under the optimal income taxation schedule. Second, a more intensive examination of an economy of heterogeneous individuals may promote further ramification and help to explain why tax-funded subsidy sometimes is more efficient than government direct spending and other times is not. Third, obviously, the basic intuition could be extended to an economy consisting of more than two types of consumers. Exploring these issues more profoundly is important to cast additionally light on the disputable policy issue of public spendings funded by distortionary income tax.

Chapter 4

The Impact of Tax Incentive on Charitable Contribution: Empirical Evidence from Canada

4.1 Introduction

Charitable contribution performs a significant role in providing financial aid to institutions such as churches, hospitals, religious organization, museums and educational institutions. Monetary help from the voluntary sector reduces the heavy fiscal burdens of the public sector by sharing the responsibility of providing public goods and services. Certain tax incentives can lower the cost of charitable giving and provide an indirect subsidy to eligible taxpayers, therefore promote individuals or corporations to give to charity. Generally, there are two regimes of income tax incentives that

reduce the price of charitable giving: the tax deductions regime and the tax credits regime. Taxpayers can reduce the full amount of gifts from their taxable income through the income tax deduction. As a result, the price of the charitable giving is lowered by the proportion of the marginal income tax rate. For instance, in the United States, individuals can deduct charitable giving from their taxable income if they choose to itemize when claiming income tax. Canada employs a tax credit regime in which people that make qualifying gifts can claim a federal and provincial non-refundable credit against their basic income tax otherwise payable.

As an alternative to indirectly providing fiscal subsidies to charitable donation in the form of deductions or credits, government can support charitable organizations in the form of direct matching grants. Since a deduction or credit for charitable donation are funded by foregone tax revenues, evaluation of whether tax incentives is a cost-effective method of financing charitable gifts and organizations has become a research interest for fiscal analysis over the past thirty years. The effectiveness of tax incentives relies on the effect of changing the tax price on charitable donations. Economists deem tax incentives will increase the demand of charitable contributions by decreasing their after-tax cost to the contributor. The higher the credit or deduction rate (the lower the after-tax price), the donors would be expected to contribute higher amounts of gifts to charity and therefore providing greater encouragement to make donations to the charity.

On an economic basis, the characteristic of charitable giving described above suggests it has a negative price elasticity. Price elasticity of the contribution explains the extent to which a contributor increases the quantity of charitable donation with

respect to a reduction in its after-tax cost. For example, a price elasticity between zero and negative one, shows that the tax spending due to tax reduction or credit exceeds the increase in charitable contribution, suggesting the tax incentive to charitable giving is an inefficient way to assist charitable organization.

While there is a large literature examining the price elasticity of charitable donations in the US, limited research has considered the price elasticity of charitable donations in Canada. In the U.S, the tax preference for charitable giving makes the price inversely related to the marginal income tax rate, which implies that individuals with higher income get lower tax price for donations. Hence, most of the U.S literature focuses on disentangling the effect of tax price on charitable giving from the income effect. More definite estimates of the price elasticity of charitable donations and of government crowd-out in Canada would be needed in order to get a better indication of the price effectiveness of the Charitable Donation Tax Credit, both on its own and relative to direct government funding (Department of Finance Canada, 2015). Estimation from prior literature using U.S data may not apply as a direct guide to Canadian tax policy since the tax incentive structure between those two countries are different; culture, innate altruism and other societal differences also lead to different personal reactions to tax incentives as well.

Given that donations have not been studied extensively in Canada, this chapter of my thesis fills a gap in the past research on Canadian philanthropy and makes use of the superiority of the survey data. One advantage of the survey data, compared with the tax filer data, is that it contains affluent information on personal characteristics in households and therefore could overcomes the omitted variable bias problem result-

ing from the unobserved characteristics that could be potentially correlated with the amount of donations or income. This chapter of the thesis analyses the effects of the change of after-tax price among other characteristics such as socio-demographic and geographic characteristics, on charitable giving. Specifically, I analyse the behaviour of Canadians' response towards the change of tax credits for charitable donation across provinces and over time, in the interest of assessing the impact that a change in after-tax price might have on donations. Using the survey of household spending data, I pool the cross-sectional data for thirteen years, track household expenditure by different families across the country, and explore whether the two-tiered tax credit system is cost-effective among different income level taxpayers as well as in different charitable sectors.

The purpose of this research is to take advantage of the variation in the tax price of charitable giving both between individuals across provinces and within provinces over time in Canada to identify the extent to which peoples' decisions of donations are influenced by tax credits. To account for the endogeneity of the tax price for charitable giving, I instrument the tax price of charitable giving for both donations up to $200 and for donations over $200 using the statutory income tax credit rates. The results of this chapter suggest that individuals in Canada are quite responsive to the change of tax incentive for charitable donation since price elasticity found here in general exceeds 1 in absolute value. However, price elasticity of charitable donations for middle-income group is much more elastic compared to that of low-income and high-income group. The price elasticity estimates for charitable donations in this analysis fall well within the range of traditional estimates in the past literature.

The significance of the current analysis is to provide an alternative view to public sector and legislators in Canada about changes in responses of Canadians towards changes in tax incentives for charitable giving. As well as contributing to an evaluation of the current Canadian tax credit system for charitable donations, this analysis also reviews an angle of how to tackle the endogeneity problem of the Canadian tax price for giving by using the thirteen years survey of household spending for Canadian families. The recognition of charitable donations influenced by economic, demographic and geographic factors during taxation year 1997 to 2009 in this finding may provide recommendation to improve social planner' strategies to increase the quantity of donations to charitable organization and of eligible donees in Canada.

There has been plenty of empirical literature on tax incentives on charitable donation with widely varying price elasticities. The earliest work can be traced back to Taussig (1967). Taussig (1967) used a cross-sectional data from the 1962 Treasury Tax File and finds the level of private giving will decline about 0.2 to 0.4 percent in responce to a one percent increase in the price of giving caused by changing the deductibility of gifts. Later, Feldstein and Clotfelter (1976) find the elasticity of charitable giving with respect to the price or net cost of giving is slightly greater than one. In the same year with Feldstein and Clotfelter (1976), Feldstein and Taylor (1976) use cross-sectional data from the 1962 and 1970 Treasury Tax File. They deem the price elasticity falls in the range between -1.0 to -1.5. Randolph (1995) challenges the consensus that prior literature made upon price elasticity and decomposes the effect of tax price into permanent and transitory by using instrument variables. By estimating a ten-year panel of tax return data that covers two tax reforms, he sug-

gests that the permanent price elasticity is −0.51, while transitory price elasticity is −1.55. Randolph argues that the conventional estimate of price elasticity of charitable giving results from a mixture of permanent and transitory variation; however, for tax policy predictions, it is often the permanent behavioural effects that matter most (Randolph, 1995). Auten et al. (2002) deal with the same research question as Randolph. In contrast to the result of Randolph, they estimate the persistent price elasticity ranges from −0.79 to −1.26 based on a time series analyses of panel data. Peloza and Steel (2005) examine the price elasticities of donations through a meta-analytic techniques. Their analysis includes approximately 40 years of estimates of the price elasticity of charitable giving, mostly from U.S. and Canada and concludes the variations in tax deductibility indeed appear to have a marked effect on private donations. Bakija and Heim (2011) use a most recent panel of individual income tax returns covering the years 1979 to 2006 for the United States, and try to distinguish transitory form persistent variation in prices of charitable giving and incomes by incorporating lagged and future changes in price and income in the specification. Their instrument estimates suggests a persistent price elasticity is in excess of one in absolute value. Duquette (2016) identifies a larger effect in magnitude than most literature using individual tax return data have estimated. His research implies that the tax elasticity for charitable donation is about -4 by estimating the effect of the tax deduction on charities' donation revenue form charities' tax filings.

Canadian studies also assess the effectiveness of tax policy on charitable giving. However, among the past Canadian studies, there is still no clear consensus on the magnitude of price elasticity for charitable giving. There are a couple of studies

before Canada switched to tax credit system. Hood et al. (1977) is the first empirical study of charitable donations in Canada. By using the ordinary least squares model, they find income and price all have impact on individuals' donations. Kitchen and Dalton (1990) and Kitchen (1992) investigate the determinants of charitable donation by Canadian families under the tax deduction system. These two research studies suggest that the price of giving is an important determinant of all charitable contributions except for religious organizations. Under the tax credit system, Hossain and Lamb (2012) focus on evaluating the effectiveness of the tax incentive variation across donation sectors by using the Canadian Survey of Giving, Volunteering and Participating. Estimated price elasticities for all sectors in their study are found elastic, except for the religious sector. Particularly, the estimated price elasticity of total donations is -1.68. The most recent Canadian research on charitable giving is Hickey et al. (2017). They use the Longitudinal Administrative database from Canada to estimate the tax price elasticity of donations. The disadvantage of the data in this paper is that it provides very limited information on respondents' characteristics. The tax price elasticity of charitable donations found in this article is -0.6, proposing that Canadians do not respond strongly to changes on the tax price of donations. However, their identification only focuses on the within-province changes in the tax credit rates to identify the effect of tax price on donations.

The remainder of this chapter is organized as follows. The next section reviews the history of Canadian income tax incentive for charitable donation and the significant changes in policy regarding encouraging charitable giving over the last fifteen years. Section 4.3 describes the survey of household spending data and further elabo-

rate how I construct the after-tax price for charitable giving. Section 4.4 outlines the empirical model and identification strategy. In section 4.5, I contrast an alternate method to indicate marginal tax incentive. And section 4.6 reports the benchmark estimates and robustness checks. Section 4.7 provides concluding remark.

4.2 Charitable Donation Tax Credits in Canada

4.2.1 Conversion from Tax Deduction to Tax Credit

Canada converted to the two-tier credit regime from tax deduction regime in 1988, which was the major change in Canadian income tax history in recognition of charitable gifts and contribution. Prior to 1988, charitable contributions by individuals were recognized in the form of a tax deduction, in which the tax benefit from charitable giving essentially depends on an individual's income level. In other words, the after-tax price of donation is lower for a high-income level individual than for a low-income level individual. Critics argued that the deduction was a regressive method of encouraging charitable donation which provided a greater level of encouragement to charities favoured by high-income donors than low-income donors (Duff, 2001). Moreover, the regressivity of tax deduction of giving results in greater encouragement to charitable organizations favoured by rich donors than those favoured by poor donors. Studies demonstrate that high-wage taxpayers have a tendency to commit a greater extent of gifts to colleges, hospitals, and arts galleries, while low-wage taxpayers are in favour of supporting religious organizations.

Since 1988, the Canadian government recognizes charitable donations and gifts

Table 4.1
Charitable Donation Tax Credit Rate[1], by Province in Canada, 1997 and 2009
(%)

	1997		2009	
	First $ 200 of Donations	Donation in Excess of $ 200	First $ 200 of Donations	Donations in Excess of $ 200
Federal	17.00	29.00	15.00	29.00
Newfoundland and Labrador	11.73	20.01	7.70	15.50
Price Edward Island	10.12	17.26	9.80	16.70
Nova Scotia	9.95	16.97	8.79	17.50
New Brunswick	10.71	18.27	9.65	17.95
Québec[2]	23.00	23.00	20.00	24.00
Ontario	8.16	13.92	6.05	11.16
Manitoba	8.50	14.50	10.80	17.40
Saskatchewan	9.40	16.00	11.00	15.00
Alberta	7.74	13.20	10.00	21.00
British Columbia	8.67	14.79	5.06	14.70

1. The credit rate is statutory rate, which is not subject to surtaxes. Surtaxes increase the value of the credit as they are calculated as a percentage of provincial/territorial income taxes net of the provincial/territorial Charitable Donation Tax Credit.
2. The tax credit rate for Québec residents must be adjusted for a 16.5% Québec abatement.

Source: Canada Revenue Agency; Department of Finance Canada calculations.

in the structure of a tax credit, the value of which does not rely on the donor's income level. Eligible taxpayers can get a reduction against their taxable income for annual charitable contribution up to $200 [1] and an additional incentive on charitable contribution exceeding $200 at both the federal level and the provincial level. The tax credit for charitable giving is generally computed at the lowest personal income tax rate for the first $200 of donations and the highest personal income tax rate for

[1]From 2000 to 2005, the cut-off point for higher marginal tax credit in Québec is $2000 as opposed to $200 in any other province. In addition, the credit rate available to Québec residents must be adjusted for the 16.5% Québec abatement.

donations exceeding $200. Some provinces have different rates from the marginal income tax rates at the provincial level, for example, Québec has their own tax credit rate scheme. As a result, the after-tax price of one dollar of charitable giving is roughly 75 cents for donations up to $200 and 50 cents for donations above $200. For the year 2003, for instance, Canadian taxpayers can take a federal tax credit of 16% for the first $200 donated to charities and 29% for the amount beyond the first $200. Taxpayers residing in Ontario can take a provincial tax credit of 6.05% for the first $200 donation and 11.16% for donations above $200. Therefore, the combined federal and provincial credit rates for donors resided in Ontario for the tax year 2003 are 22.05% for donation up to $200 and 40.16% for donation more than $200, bringing the after-tax price for donation of $1 to approximately $0.78 for donation up to $200 and $0.6 for donation over $200.

Tax credits for charitable giving are provided by all the provinces and territories in Canada with similar rules, but credit rates are different across provinces and territories. Table 4.1 shows the charitable donation tax credit rates by province for 1997 and 2009, the first year and the last year covered by the estimation sample in this research. At the provincial level, Québec provides the most generous credit rate in 1997, which is 23% for both donation up to $200 and over $200. On the other hand, Alberta provides the lowest incentive to charitable giving, that is, 7.74% for the first $200 donation and 13.20% for the donation in excess of $200 in 1997. In 2009, British Columbia gives the lowest tax credit rate for the first $200 donation, which is 5.06% and Ontario has the lowest tax credit rate for the donation over $200, which is 11.16%.

Comparing the tax credit rate between 1997 and 2009, the table indicates the tax credit rates vary significantly over the thirteen years. For example, Newfoundland and Labrador experienced a dramatic decrease of tax incentives for charitable donation. The province reduced its credit rate for donation up to $200 from 11.73% to 7.7% and donation above $200 from 20.01% to 15.5%. Most of these changes in Canadian provinces and territories are due to the variation of marginal income tax rate for the lowest and highest tax brackets, while others are due to different tax policy reforms amended by each provinces.

4.2.2 Tax-on-tax Assessment and Tax-on-income Assessment

Personal income taxation is shared between the federal and provincial governments. Before the taxation year of 2000, most provinces collected personal income tax as a proportion of the basic federal tax (i.e. "tax-on-tax"). Under this tax-on-tax system, provincial governments impose individual's income tax by multiplying the provincial tax rate to the basic federal tax. Therefore, there is only a basic federal tax credit rate for donations and gifts. However, in order to get the tax credit rate at the provincial level, one can simply use the federal credit multiplied by the statutory provincial tax rate. After 2000, most provinces switched to a tax-on-income system, in which provinces levy their own provincial specific tax rates on taxable income. The tax on taxable income option allows provinces to establish a unique tax structure based on provincially determined tax brackets and rates (including, if desired, a zero rate on a narrow first bracket) set independently of the federal brackets and rates

(Department of Finance Canada, 2000). This option would also allow provinces to create a specific two-tier rate of non-refundable tax credits for charitable donation, that is, the lowest non-zero provincial tax rate and the highest provincial tax rate respectively.

In particular, this analysis takes advantage of the difference between tax-on-tax assessment and tax-on-income assessment and examines the price elasticity with respect to the changes in provincial tax credits when most provinces switched to tax-on-income regime after 2000. In addition, some provinces have specific changes during the sample period. For example, effective from 2002, Québec changed the non-refundable tax credit rate for donations over $2000 to 24%. Ontario dropped the personal income tax rate from 48% of basic federal tax for 1997 to an effective rate of 42.75% for 1998. Alberta increased tax credit rates for donations and gifts over $200 from 12.75% to 21% in 2007.

4.2.3 Ceilings, Carry-over and Transfer

It is worth to mention that there is no tax incentive for people whose incomes are too low to pay tax. Also, the maximum value of gift can be claimed in one taxation year is subject to 75 percent of the taxpayers net income for that year. Since the tax credit is non-refundable, it provides no tax favoured assistance for donors whose incomes are too low to pay any tax. It is often argued in the literature that the two-tier tax credit system tends to provide a larger tax benefit to high-income donors than low-income donors like the tax deduction system. This is because high-income donors may be able to get lower after-tax price for donations because high-income donors

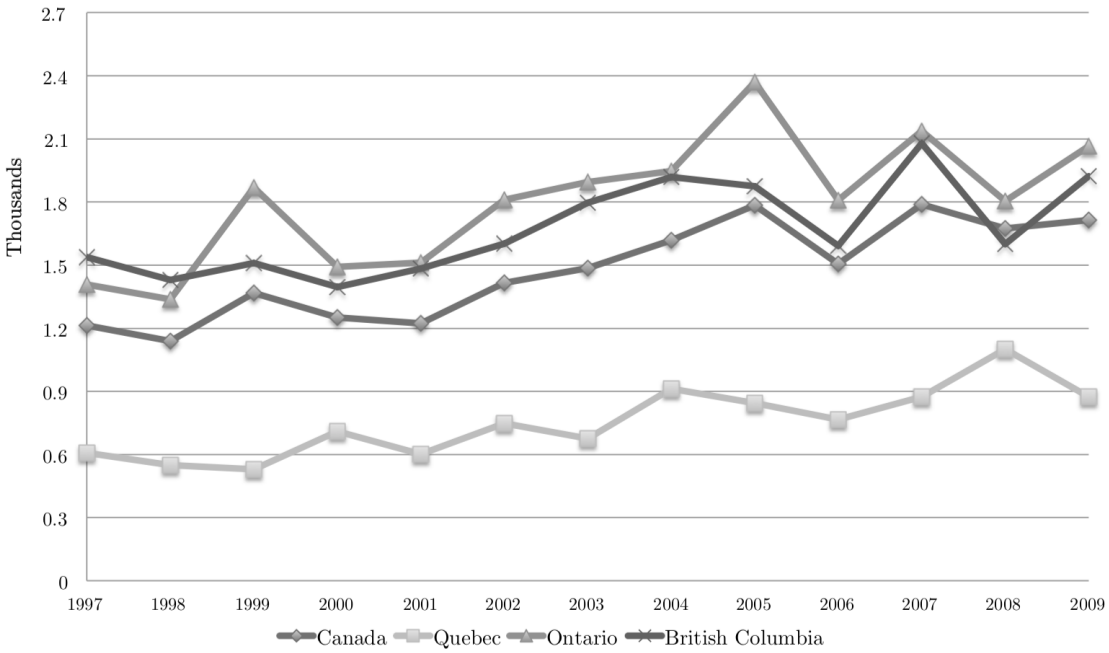
are more likely to make larger donation than low-income donors and the higher tier offers a higher tax saving rate.

Revenue Canada allows individuals to claim charitable donations in the year of making donation or any of the following five taxation years. Taxpayers then can maximize the tax benefit by aggregating charitable donation within six years. In general, the optimal strategy may involve "bunching" claims in a single year, since taxpayers can thereby maximize the amount eligible for a credit at the higher rate, subject again to the offsetting cost associated with a delay in obtaining the value of the credit (Duff, 2001).

Moreover, either spouse can claim the charitable donations made by either spouse or their dependent, despite of who actually made the donation to the qualified donees. For the tax purposes, it is optimal to claim the aggregate charitable donation by one spouse in order to get a higher tax credit rate. That is, the pooling of donation could allow spouses to exceed $200 cut-off, and the household could potentially get a lower after-tax price for donation than if each spouse were claiming the donation separately.

Due to the limitation of the estimation data sample, I only considered the 75% net income rule for each household. Since there is no information in the survey that tells when donations are made and who made it, I assume each household report their donation in each year and the donation amount each household claimed in the survey are the pooling of donation between spouses. However, there are also special tax exemptions for certain gifts. Capital gains on the donated assets are eligible for a tax exemption up to 100% of the net income. Assets eligible for a capital gains tax

Figure 4.1
Household Spending on Money Gifts and Charitable Donation, Average Expenditure (Dollars) by Selected Provinces, 1997-2009



Source: Statistics Canada, Table 203-0018 Survey of Household Spending (SHS), *Household Spending on Money Gifts, Alimony and Charitable Contributions, by Provinces and Territory, Annual*, CANSIM (database).

exemption include publicly listed securities and certain exchangeable share, certified cultural property and ecologically sensitive land (Department of Finance Canada, 2016). Those tax exemptions are beyond the scope of this analysis and therefore will not be discussed further.

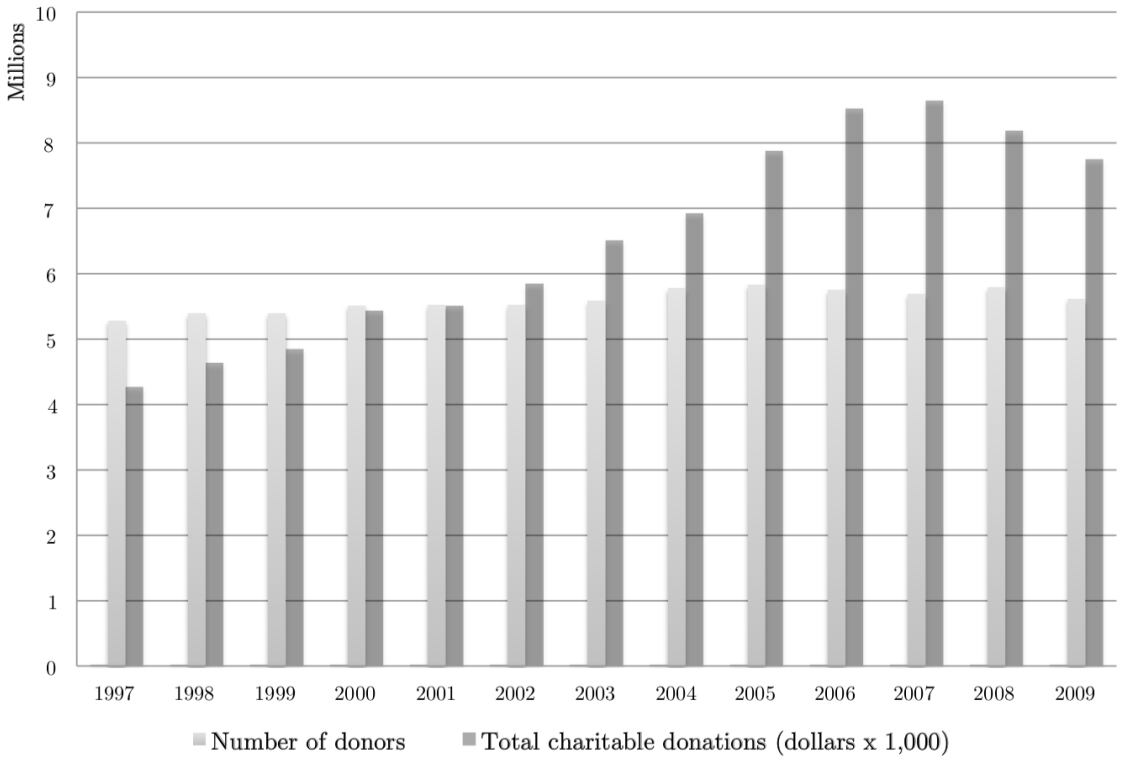
4.2.4 Trends in Charitable Giving in Canada

This subsection discusses the general trends in charitable donations in Canada during the sample year from 1997 to 2009. The analysis for trends was accumulated from statistics reported in the household spending survey as well as federal individual income tax return.

As shown in figure 4.1, the average expenditure on charitable giving from each household increased in general between 1997 and 2009. Québec, Ontario and British Columbia are the three selected provinces showed in this figure along with the national average. Among these provinces, Ontario has the highest average for household donation and has peak of $2370 in 2005; On the contrary, Québec's households contribute the lowest amount of average to charity. In the early 2000s, charitable donations dropped because of the economic slowdown and increased gradually till 2007. Except for Québec, there was a decline since 2007, when the last economic recession took place in Canada, in the average expenditure on charitable donation. Nevertheless, in the last year of the sample period, 2009, Ontario, British Columbia along with Canadian national average recovered from the recession and increased the average spending on donations, while Québec, on the other hand, has a reduced average of $874 in 2009.

Figure 4.2 demonstrates the trends of the number of people claiming the federal charitable donation tax credit and the amount of charitable donation claimed as tax credit from 1997 to 2009. This figure collects statistics from the numbers accounted on federal individual income tax returns. The number of claimants remained steady at about 5.6 million on average. Charitable donations reported in 2009 round up to

Figure 4.2
Number of Claimants and Charitable Donations Claimed as a Tax Credit, 1997-2009



Footnote:
1. Charitable donor is defined as a tax filer reporting a charitable donation amount on line 340 of the personal income tax form.
2. Charitable donation is the allowable portion of total donations, as reported on the income tax return.
3. Taxfilers are people who filed a tax return of the reference year and were alive at the end of the year. Information in this table is based on a version of the T1 file produced 9 months after the reference year. Later versions of the T1 file will contain some additional records.
Source: Statistics Canada, Table 111-0002, Charitable donors, by age and sex, annual (number unless otherwise noted), CANSIM (database).

7.7 billion. The peak for charitable donations claimed was observed in 2007, which is about 8.6 billion. Since 1997, charitable donations increased at about 5% each year until the peak in 2007. Since the number of donors claiming charitable donations only grew at a rate of 0.5% annually over the entire sample period, it would have little impact on the expansion of charitable donations from 1997 to 2009. Thus, the

growth is essentially connected with varieties in average expenditure of donations from each household.

4.3 Data

This section of the chapter describes the main variables of interest and illustrates in details about the after-tax price of a $1 donation.

4.3.1 Data Description

The data for the current research is from the Survey of Household Spending (SHS), spanning from 1997 to 2009. The Survey of Household Spending is a cross-sectional Canadian data set collected from private households in Canada's 10 provinces and three territories. About 98% of the population in the 10 provinces was covered from the survey. In the three territories, the survey covers roughly 92% population. For the estimation model, I append the thirteen years of data as a pooled cross-sectional Canadian data sample. Surveys are advantageous, because they contain data on age, wealth, education, affiliation and other family characteristics, which could be helpful in explaining many aspects of giving by respondents. Conducted since 1998, the Survey of Household Spending collects income and expenditure data at the household level for the preceding year annually. Information consists of households' expenditures on a wide range of goods and services including charitable contributions, money gifts, pension contributions, health care, child care, taxes, and employment insurance and so on. All those expenditures are collected for the family as a unit and the sam-

Table 4.2
Summary Statistics for Continuous Variables

Variables($)	**Mean**	**Min**	**Max**	**Std. Dev**	**N**
Total charitable donations ($)	483.56	0	60600	1440.98	161731
Donation to religious charity ($)	280.20	0	32000	984.42	95345
Donation to non-religious charity ($)	143.21	0	60000	601.41	95345
Real household income ($1000)	61.10	-11	819	47.31	161731
Number of weeks worked full-time by reference person	25.94	0	52	24.22	161731
Direct health care costs ($)	989.50	0	56700	1411.08	161731
Child care ($)	368.37	0	55000	1442.06	161731
Canada/Québec pension plan ($)	1307.87	0	11463	1296.09	161731
Employment insurance premiums ($)	680.19	0	4442	628.54	161731
Registered retirement savings plan ($)	1321.93	-211000	120000	5406.43	161731
Provincial GDP growth rate (%)	-2.83	-6.14	-0.93	1.35	160645
Unemployment rate (%)	-2.56	-3.35	-1.71	0.38	157229

Source: Canada Revenue Agency; Department of Finance Canada calculations.

ple contains approximate a million of observations per year. The survey also collects detailed information about demographic characteristics for the household reference person and the spouse of the reference person including income before taxes, income from earnings, government transferred income, sex, age group, marital status and age of youngest children in the household *etc.* Data of charitable contributions for religious and non-religious institutions is available from 1997 to 2002. Additional demographic data such as educational attainment, disability of the respondents is only available from 2004 to 2009.

reports the mean, minimum, maximum and standard deviations for the main continuous variables from the unweighed sample. The mean value for total charita-

ble donations per household is about $484 in Canadian dollars; of this total, mean for donations to religious charities is $280 and for non-religious charities is $143. Those three variables are my main interested dependent variables. The standard deviation for the total of charitable donations is quite large, which is 1440. This is mainly because there exists a few high-income donors who make very generous contributions. In the regression model, my main dependent variables take logarithm form. Given that there are households that do not make any donations and in order to make sure that the logarithm is defined, I add one dollar to the amount of donation for each observation. In this chapter of the thesis, I study the joint donations between a reference person and his/her spouse. Since the after-tax price for charitable donation is lower over $200, it is always beneficial for only one person in the household to claim charitable contributions made by either spouse or their dependent in order to be eligible to apply a higher tax credit rate. Because the survey is at the household level, separate charitable donations information between a reference persons and his/her spouse is not available. I assume married couples or common-law partners claim charitable donations jointly given that it is generally the optimal strategy to earn higher credit.

The current research incorporates most variables based on the well-developed empirical literature on charitable giving into the regression model as well as additional variables which may have impacts on charitable giving but may not be commonly accessible to other researchers using other data. Average household income is $\$61,1904$. Income is converted to constant 2007 dollars by using the consumer price index (CPI) and is converted to the natural logarithm form. The average number

Table 4.3
Description and Measurement of Dummy and Categorical Variables

Variables	Description of variables
male	Dummy equal to one if reference person is male
RPAGEGRP	Age group of reference person
mard	Dummy equal to one if reference person is married
TENURE	Dummy equal to one if reference person own the dwelling
URBAN	Dummy equal to one if resident of urban area
year	Year dummies from 1997 to 2009
BC	Dummy equal to one if resident of British Columbia (default is Ontario)
QC	Dummy equal to one if resident of Québec (default is Ontario)
Prairies	Dummy equal to one if resident of Alberta, Manitoba, Saskatchewan (default is Ontario)
Atlantic	Dummy equal to one if resident of Newfoundland, Prince Edward Island, Nova Scotia or New Brunswick (default is Ontario)
Territories	Dummy equal to one if resident of Territories (default is Ontario)
HHSZTOT	Household size dummies
ageyoung	Age group of youngest child dummies
NUMYOUTH	Number of youths 18 to 24 in the household
RPDisability	Dummy equal to one if reference person has a disability
Highschool	Dummy equal to one if reference person has a high school diploma

Source: Survey of Household Spending 1997-2009.

of weeks worked full-time by a reference person is around 26. In general, spending on child care, Canada/Québec pension plan and employment insurance premiums can be claimed at the same credit rate as charitable donation below $200 at both federal and provincial level, I include them as independent variables in the regression analysis. Direct health costs and spending on registered retirement saving plan (contribution less withdraw) are also included since they could potentially reduce

the amount of disposable income that may otherwise made to charitable donation. Finally, unemployment rate for each province and territories from 1997 to 2009 was incorporated since it might pick up some cross-provincial unobserved differences and take logarithm form. Unemployment rate is from CANSIM tables published by Statistic Canada.

Table 4.3 presents the description and measurement for dummy variables and categorical variables. Age groups for reference person start at age below 25 and the interval for each group is 4 years except the last interval, which is 85 years old and over. Household size uses dummies that take value from 1 to 6, with 6 being 6 or more members in the household. Table 4.4 further reveals the frequency and percentage distribution of selected sample members' characteristics.

4.3.2 After-Tax Price of Charitable Donations

The key independent variable, which is the tax price of charitable giving, will be discussed in details in this subsection. I define the "tax price" of charitable giving as the after-tax price of one dollar given to the registered charity. In the Canadian tax system, both the federal and provincial governments provide tax credits for charitable donations. Tax filers who claim donations to eligible donees receive a lower federal and provincial tax credit for the first $200 donated and a higher federal and provincial tax credit for amounts exceeding $200. The federal tax credit rate is the same for all the provinces and territories in each taxation year; whereas, the provincial tax credit rates are heterogeneous across provinces and thus so too are the after-tax price of donations. For instance, if one who lives in Ontario make a

donation of $200 in the taxation year of 2009, then each dollar donated to charity generates tax credit of 15 cents from the federal government and an additional 6.05 cents of credits from the provincial government. As a result, one dollar donation costs the donor an out-of-pocket amount of 78.95 cents. This actual cost to the donor is referred as the tax price or the after-tax price of the one dollar donation. In this case, the effective marginal tax credit for one dollar donated is $0.21. Besides, if one who lives in Ontario make a donation more than $200, say, $300. He can still claim 21.05% for the first $200 donated as tax credit; whereas, the remaining $100 can be applied to a higher tax credit rates at both federal and provincial level which provide him 40.16% of tax credit in 2009. Hence, his tax price of one dollar donated to charity is $1 - (200 * 21.05\% + 100 * 40.16\%)/300 = 0.726$ dollar or 72.6 cents when he donated $300 to charity. The greater the tax credit, the cheaper the tax price, and vice versa. All individuals who do not qualify for the credit or who do not donate have a tax price of 1 dollar, in this case there is no tax benefit associating with the charitable giving. Especially, the non-refundable tax credit system in Canada provides no support for charitable donation made by taxpayers whose income is too low to pay any income tax. Finally, the after-tax price of charitable donation is measured in natural logarithms in order to interpret the coefficient as an elasticity.

Table 4.4
Frequency and percentage distributions of sample members characteristics

Variables	**Category**	**Frequency**	**Percentage**
Total charitable donations	> 0	114311	70.44%
	=0	47961	29.56%
Donation to religious charity	> 0	37519	39.13%
	=0	58367	60.87%
Donation to non-religious charity	> 0	58809	61.33%
Gender	Male	79,176	48.79%
Age group of reference person	Less than 25 years	7,267	4.48%
	25-29 years	11,871	7.32%
	30-34 years	15,458	9.53%
	35-39 years	18,753	11.56%
	40-44 years	19,981	12.31%
	45-49 years	19,052	11.74%
	50-54 years	16,121	9.93%
	55-59 years	12,730	7.84%
	60-64 years	10,256	6.32%
	65-69 years	8,864	5.46%
	70-74 years	7,913	4.88%
	75-79 years	6,603	4.07%
	80-84 years	4,558	2.81%
	85 years and over	2,845	1.75%

Source: Canada Revenue Agency; Department of Finance Canada calculations.

Table 4.4
Frequency and percentage distributions of sample members characteristics (continued)

Variables	Category	Frequency	Percentage
Marital status	Married	101,261	62.40%
Tenure	Own a dwelling	110,788	68.27%
Urban	Living in urban area	127,208	79.25%
Year	1997	17855	11%
	1998	15185	9.36%
	1999	17051	10.51%
	2000	14563	8.97%
	2001	16698	10.29%
	2002	14534	8.96%
	2003	6977	4.30%
	2004	13999	8.63%
	2005	5945	3.66%
	2006	14430	8.89%
	2007	5060	3.12%
	2008	9493	5.85%
	2009	10482	6.46%
Region	Ontario	21,628	13.33%
	British Columbia	18,587	11.45%
	Québec	21,465	13.23%
	Prairies	45,979	28.33%

Source: Canada Revenue Agency; Department of Finance Canada calculations.

Table 4.4
Frequency and percentage distributions of sample members characteristics (continued)

Variables	Category	Frequency	Percentage
	Atlantic	49,570	30.55%
	Territories	5,043	3.11%
Household size	1	36127	22.26%
	2	51571	31.78%
	3	29620	18.25%
	4	28842	17.77%
	5	11364	7%
	6 or more members	4748	2.93%
Age of youngest child	No child	83725	51.60%
	0-4 years	21402	13.19%
	5-9 years	15772	9.72%
	10-14 years	15136	9.33%
	15-19 years	13315	8.21%
	20-24 years	6645	4.09%
	25-29 years	6277	3.87%
Number of youth 18-24	0	132416	81.60%
	1	21931	13.51%
	2 or more youth	7925	4.88%

Source: Canada Revenue Agency; Department of Finance Canada calculations.

Québec is the most generous province in this regard, implementing a tax credit of 20% for charitable donations below $200 and 24% for charitable donations over $200 in the taxation year of 2009. But, residents in Québec qualify to receive a 16.5% abatement of the tax they owe. For example, the federal tax credits for donations and gifts in 2009 are 15% and 29%. If someone resided in Québec and made a donation of $1 to qualified charity in 2009, then he could receive $15\% * (1 - 16.5\%) = 12.53\%$ or 12.53 cents at the federal level. Combined with the provincial level of 20% of credit rate, he could claim 32.53 cents for donating $1 in Québec.

Let

$$C(L) = Credit^{L}_{fed} + Credit^{L}_{provin} \tag{4.3.2.1}$$

$$C(H) = Credit^{H}_{fed} + Credit^{H}_{provin} \tag{4.3.2.2}$$

where $Credit^{L}_{fed}$ and $Credit^{L}_{provin}$ are the federal credit rate and provincial credit rate for donation up to $200 respectively; $Credit^{H}_{fed}$ is the higher federal credit rate that is applied to donations over $200, and accordingly, $Credit^{H}_{provin}$ is the higher provincial credit rate that is applied to donations over $200.

In general, the tax price t_p for the donation of $1 is:

$$t_p = \begin{cases} 1 & D = 0 \\ 1 - C(L) & 0 < D \leq 200 \\ [200\big(1 - C(L)\big) + (D - 200)\big(1 - C(H)\big)]/D & D > 200 \end{cases} \tag{4.3.2.3}$$

where D is the amount of charitable donation. For people who make donations less than \$200, the tax price is simply set to be one minus the combined lower federal and lower provincial credit rates; for people who make donations exceeding the \$200 threshold, the tax price is determined by the amount of the charitable giving, and the amount of charitable giving also relies upon the tax price. As a matter of fact, the more one donates, the lower is his tax price. For this reason, ordinary least square estimation would be problematic and the two-way relationship between the amount of donation and the tax price leads to endogeneity bias in the OLS regression. To solve the endogeneity bias, I instead employ two instrumental variables which will be explained in details in the next section.

In addition, the tax price is also different for those individuals whose donation is more than 75% of their net income because the tax credit can only be claimed for charitable donations up to 75% of the net income of a person in a given tax year. Therefore, the tax price of one dollar donation for individuals who donate more than the ceiling is:

$$t_p = \begin{cases} 1 & D = 0 \\ 1 - 75\% \cdot Net \cdot C(L)/D & 0 < D \leq 200 \\ [200\big(1 - C(L)\big) + (75\% \cdot Net - 200)\big(1 - C(H)\big)]/D & D > 200 \end{cases} \tag{4.3.2.4}$$

where Net denotes the net income for a household.

Table 4.5 shows the summary statistics for the after-tax price of charitable donations in the sample, defined as one minus the taxpayer's computed effective

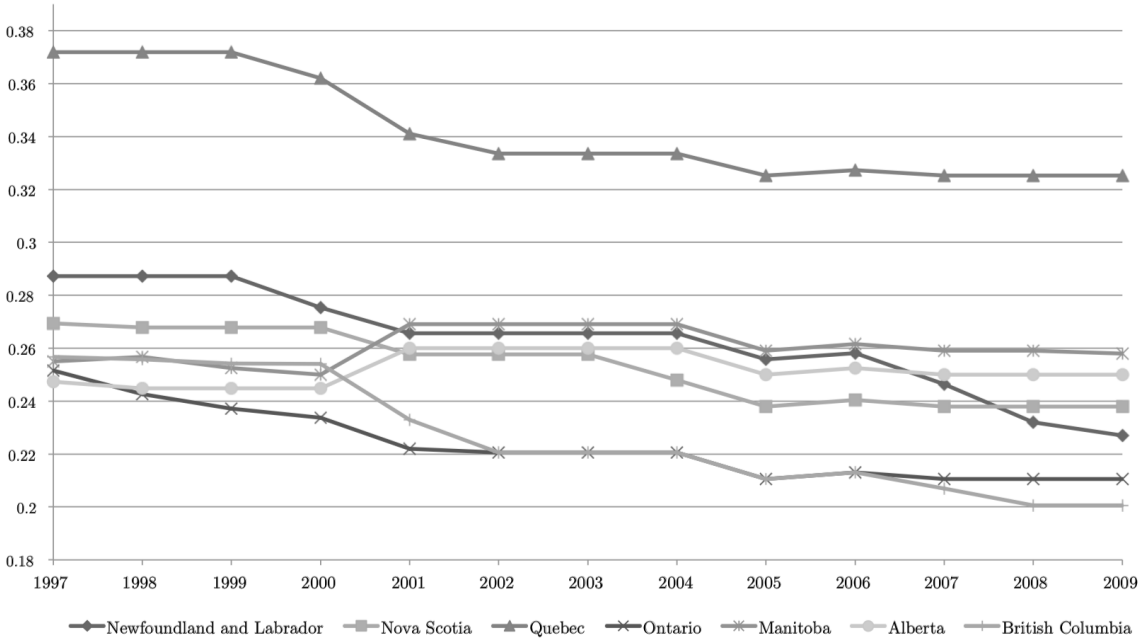
Table 4.5
Summary Statistics for after-tax price, federal credit rate and provincial/territorial credit rate for charitable donation, 1997-2009, Canada

Variables	Mean	Min	Max	Std. Dev.	N
After-tax price	0.7759	0.5016	1	0.1573	161731
Federal credit rate for donation up to $200	0.1578	0.1253	0.17	0.0118	161731
Federal credit rate for donation exceeding $200	0.2837	0.2422	0.29	0.0162	161731
Provincial/Territorial credit rate for donation up to $200	0.1048	0.0506	0.23	0.0454	161388
Provincial/Territorial credit rate for donation exceeding $200	0.1644	0.1116	0.25	0.0371	161388
Combined federal-provincial/territorial credit rate for donation up to $200	0.2627	0.2006	0.3720	0.0384	161388
Combined federal-provincial/territorial credit rate for donation exceeding $200	0.4480	0.4016	0.5	0.0264	161388

Source: Government of Canada, tax packages for 2001-2009 and PricewaterhouseCoopers LLP, Tax Facts and Figures for Individuals and Corporations 1997-2000.

credit rate given the observed expenditure on charitable donations, the federal and provincial credit rate in Canada. For year $1997 - 2000$, I collect the federal and provincial credit rates from the *Tax Facts and Figures for Individuals and Corporations* published by PricewaterhouseCoopers LLP. The credit rates for the rest of the years are from the website of the Government Canada. The lowest combined federal-provincial/territories tax credit rate for donation up to $200 is 20.06% which happens in British Columbia in 2009, whereas the highest combined federal-provincial/territories tax credit rate for donation up to $200 is 37.2% which happens in Québec from 1997 to 1999. The average tax price applied to one dollar

Figure 4.3
Charitable Donation Tax Credit Rates for Donation up to $200[1], by selected Provinces, 1997-2009

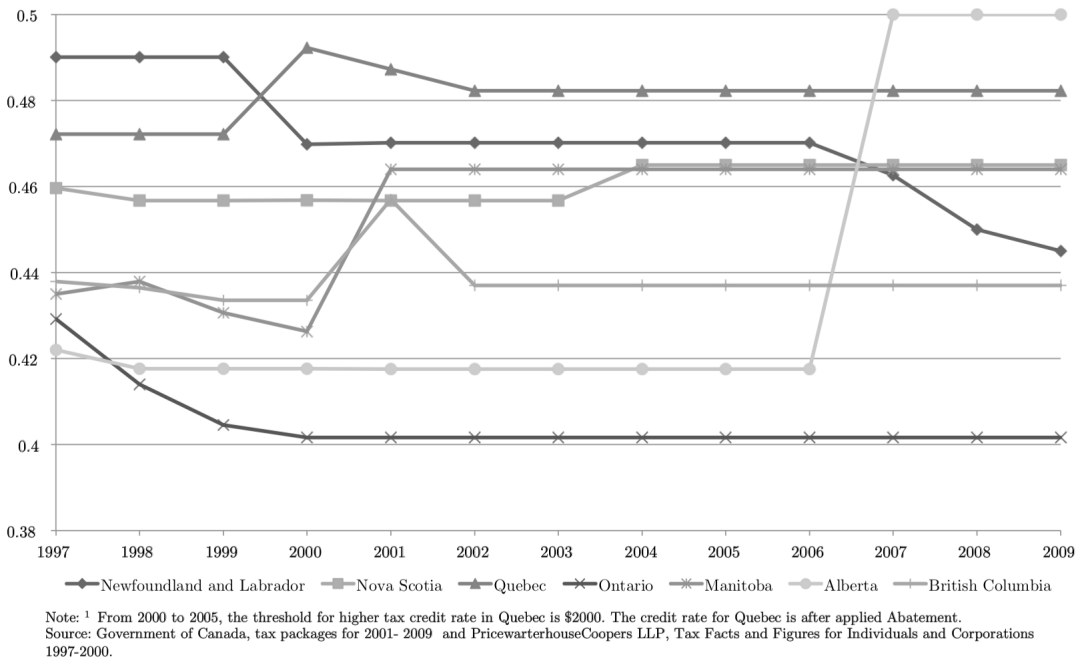


Note: [1] From 2000 to 2005, the threshold for higher tax credit rate in Quebec is $2000. The credit rate for Quebec is after applied Abatement.
Source: Government of Canada, tax packages for 2001- 2009 and PricewarterhouseCoopers LLP, Tax Facts and Figures for Individuals and Corporations 1997-2000.

donation is $0.78, and the cheapest price an individual can get is $0.51. Namely, individuals could get roughly 50% tax credit for one dollar they donate.

Figure 4.3 and Figure 4.4 depict the trends for low and high combined tax credit rates for charitable donations by selected provinces from 1997 to 2009. These two figures indicate most provinces in Canada have experienced changes in tax credit rates of charitable donations over the sample period, with more variation in some provinces than in the others. For tax credit rates for donations up to $200, most provinces experienced a decrease before 2001 and remain relatively stable afterwards.

Figure 4.4
Charitable Donation Tax Credit Rates for Donation Exceeding $200[1], by selected Provinces, 1997-2009



Note: [1] From 2000 to 2005, the threshold for higher tax credit rate in Quebec is $2000. The credit rate for Quebec is after applied Abatement.
Source: Government of Canada, tax packages for 2001- 2009 and PricewarterhouseCoopers LLP, Tax Facts and Figures for Individuals and Corporations 1997-2000.

For tax credit rates for donation exceeding $200, a similar pattern happens in which most variation takes place before 2001 when Canada switch from "tax-on-tax" to "tax-on-income" system. Among those provinces, Québec, on average, has the highest tax credit rate for charitable donation. In 2006, Québec reduced the cut-off point above which the higher rate of tax credit rate begins to apply from $2000 to $200. Consequently, the effective marginal tax credit rate for donation between $200 to $2000 increased for residents in Québec after 2006. Another significant change hap-

pens in Alberta in 2007, when the provincial government increased the provincial tax credit from 12.75% to 21% for charitable donation over $200.

4.4 Empirical Model

The main objective of this empirical analysis is to estimate the price elasticity of charitable donation across provinces and over time in Canada. To achieve this, I pool the thirteen years of observations and estimate the tax price elasticity for charitable donations with the baseline regression model below:

$$donations_{ijt} = \alpha + \beta taxprice_{ijt} + X'_{ijt}\Phi + \theta_t + \epsilon_{ijt}, \tag{4.4.0.1}$$

$$taxprice_{ijt} = \delta_0 + \delta_1 Lowcredit_{jt} + \delta_2 Highcredit_{jt} + X'_{ijt}\varphi + \gamma_t + \zeta_{ijt}. \tag{4.4.0.2}$$

The dependent variable $donations_{ijt}$ is the amount of charitable donation by household i in province/territories j in year t. As mentioned earlier, I follow the literature and take the natural logarithm transformation of donations such that $donations_{ijt} \equiv ln(totdonations_{ijt} + 1)$. The variable of interest is $taxprice_{ijt}$ which is also taken in the natural logarithm form. The coefficient β measures the percentage change in charitable donation caused by a 1% increase/decrease in the tax price of charitable donation, holding all else constant. X_{ijt} is a vector of controls including real income of the household, age group of reference person, marital status, household size, age of the youngest child in the family, tenure-ship of dwelling. I also include a variety of geographic variables in X_{ijt}: dummies for five regions in Canada, a dummy for living in urban area. Additionally, I include: number of

weeks that reference person worked as full-time, direct health care expenditure, child care expenditure, Canada/Québec pension plan, employment insurance premiums, number of youths, changes in registered retirement saving plan, provincial GDP, and unemployment rate in each province annually over the sample period in the control variables. In order to allow for "crowding out" by the public provision of public goods, I include province-year specific government spending. Finally, θ_t is the year fixed effect.

The price of donation is the price of one dollar spent after considering the tax incentives. As I discussed in section 4.3, the tax price for people who donate more than $200 depends on the donation expenditure as well as the federal and provincial tax credit rates. Therefore, the tax price of donations for this group of people is endogenously related to the charitable donation decision. As a consequence, the ordinary least square estimation would be biased because of the endogeneity. In order to address this endogeneity problem, I instead construct two instruments for the after-tax price of $1 donation following Hickey et al. (2017) and they are the lowest and highest marginal income tax rates in each provinces/territories from year 1997 to 2009. Since the tax credit rates for donations under $200 and donations above $200 are the legislative lowest and highest marginal income tax rates respectively at the provincial level, the tax price of one-dollar donation can be well predicted by those two instruments. Especially, the critical aspect of the lowest and highest marginal income tax rates are that they do not depend on the household's actual charitable donation decision and therefore take care of the simultaneous equation bias. Moreover, these two rates are not likely correlated with omitted variables in

the error term that affect donation decisions given the variety of controls used in this model. The assumptions for this identification is that those two instruments are correlated with the after-tax price for donations, but have no independent impact on charitable donation except through the after-tax price, and are not correlated with the error term. Equation 4.4.0.2 describes the instrument estimation at the first stage. I also try an alternative method of constructing the two-stage instrument estimation model which will be discussed in section 4.6.

In brief, the current chapter explores variation in the after-tax price of one-dollar charitable donation generated in four ways. First, provinces and territories in Canada have experienced changes in provincial tax credit rate of charitable donations over the sample period. Second, federal tax credit rate of charitable donations varied due to changes in federal income tax bracket. Third, residents in Québec receive different tax credit rate from the rest of the regions in Canada. Last, for those individuals who donate more than 75% of their net income, the tax price for donations are heterogeneous with the individuals who donate within the ceiling.

4.5 Estimation Results

4.5.1 Baseline Results

Table 4.6 reports four different regression estimations[2] for equation 4.4.0.1. The results indicate that most parameter estimates are strongly significant. The price of donations is the key variable of interest in the estimation. I report column one as OLS pooled cross-sectional regression estimates. The first column of table 4.6 reports the results using total charitable donations as the dependent variable. The OLS estimate of elasticity of donations with respect to the tax price is roughly -13.032, and implies a 1 per cent increase in the tax price for donations would lead to a 13.032 per cent decrease in the total charitable donations expenditure. This result suggests a large and significant negative elasticity between the tax price of charitable donation and spending on charitable donation from households. However, an elasticity of approximately -13 is clearly too large in magnitude compared with the result found in the previous literature. The coefficient for the tax price estimated from the first column reflects the fact that the OLS estimate suffers heavily from the endogeneity bias because of the way of two-tier tax credit system practised in Canada. That is, households with higher spending on charitable donations will also have a lower tax price of giving. In the event that we consider a person who is thinking about giving one more dollar to philanthropy, the marginal benefit of

[2]The characteristic controls for each household in the baseline regression also include household size dummies, number of weeks worked full-time for reference person, Number of youths in the household, expenditure of registered retirement savings plan and private health care insurance plans, child care expenses, spending of Canada and Québec pension plan and employment insurance premiums.

spending an extra dollar is much higher if that individual has given just $200 than a person who has officially given more than $201. It is worth noting that passing the $200 limit generally diminishes the expending cost of charitable giving by half.

The second column of 4.6 includes the year fixed effect for the OLS estimates. The results suggest that individuals' responses towards the tax price are unlikely correlated with the year dummies in the OLS specification. The estimate for tax price elasticity is -13.074, approximately the same with the price elasticity estimated in the first column.

Column three and column four presents results using instrumental variables. I use two instruments for the tax price of charitable donations: the lowest and highest legislated marginal income tax rates in each provinces/territories. Both instrument variables are independent of spendings on charitable donations. The IV results for the tax price elasticity are uniformly smaller than the previous OLS results. The estimated elasticity of tax price is -1.751 in column three. Column four repeats the instrument variables regression including the year fixed effect. The estimate for price elasticity of charitable donations is -0.701. By instrumenting the bottom and the top marginal income tax rates, the estimates for the effects of the tax price for charitable donations are much smaller, and more in keeping with the previous literature. Consistent with theoretical hypothesis about the tax price elasticity for charitable donations, all four coefficients for tax price are negative and are all statistically significant. However, the year fixed effect confounding with region dummies may take away the true tax price impact. To avoid omitted variables bias, I instead replace the year fixed effect with general time trend variables in column

three. These variables include the provincial GDP and the provincial unemployment rate annually, and they could control for a substantial portion of the within-province variations in charitable giving that are not due to the tax price. Therefore, given the results of IV regression in column 3, my preferred specification reveals donation will increase 1.75 per cent resulting from a one percent increase in the tax credit rate. In all specification, I compute the robust standard errors and all the data are weighted by Statistic Canada population weights.

The preferred estimation in column three also implies the household income has a positive effect on the expenditure of donations. Charitable giving will increase 2.7 per cent if the real household income rise by $1000, *ceteris paribus*. But the spending on giving are not economically responsive to household income squared, suggesting insignificant non-linear relationship between donations and household income in economic magnitude.

All socio-demographic characteristics appear significantly affect the amount of charitable donations. According to estimation in column three, males donate less to charities than females. For the most part, males gives about 21% less than their female counterparts. This corresponds to most other studies on charitable giving. Hossain and Lamb (2012) point out that female respondents are more likely to make larger total donations and health donations than males in Canada. As found in the existing literature, married individuals tend to donate more than those are not married by about 26.8%. Tenure-ship of the dwelling also has a significantly positive effect on the expenditure of donations since it is a reflection of wealth. The age group dummies indicate that charitable giving increases with age. This is not

surprising. As people get older they are typically more likely to give to charity and to give a greater fraction of their incomes (Andreoni, 2006). Age can be a good indicator of lifestyles-cycle dynamics. Disposable income of an older person will grow via time as, for instance, children leave home, mortgages are being paid off. Thus, larger donations can be made by older age people. The presence of children in the household is associated with less donation expenditures compared to household without children. In line with the conventional finding, respondents with children aged 25 and above contribute least amount of money to charities when compared to all other groups. This seems reasonable given that children at this age require financial support of schooling from parents. Besides, for households whose major source of income is from government transfer payments also donate least amount to charitable organizations among other sources.

Table 4.6
Baseline Regression Results 1997-2009

	(1)	(2)	(3)	(4)
	OLS	**OLS Year FE**	**IV**	**IV Year FE**
Tax price	-13.032***	-13.074***	-1.751***	-0.701***
	(0.000)	(0.000)	(0.014)	(0.022)
Real household income	0.004***	0.004***	0.027***	0.026***
	(0.000)	(0.000)	(0.000)	(0.000)
Male	-0.015***	-0.012***	-0.206***	-0.204***
	(0.000)	(0.000)	(0.000)	(0.001)
Marital status	0.027***	0.031***	0.268***	0.243***
	(0.000)	(0.000)	(0.001)	(0.001)
Tenure	0.073***	0.073***	0.596***	0.630***
	(0.000)	(0.000)	(0.001)	(0.001)
Urban	0.042***	0.027***	-0.139***	-0.157***
	(0.000)	(0.000)	(0.001)	(0.001)
Age group				
Ref: Less than 25 years				
25-29 years	-0.030***	-0.031***	-0.045***	-0.073***
	(0.001)	(0.001)	(0.001)	(0.001)
30-34	0.017***	0.018***	0.113***	0.101***
	(0.001)	(0.001)	(0.001)	(0.002)
35-39	0.042***	0.044***	0.217***	0.220***
	(0.001)	(0.001)	(0.001)	(0.002)

Table 4.6
Baseline Regression Results 1997-2009 (continued)

	(1)	(2)	(3)	(4)
	OLS	**OLS Year FE**	**IV**	**IV Year FE**
40-44	0.062***	0.057***	0.387***	0.405***
	(0.001)	(0.001)	(0.001)	(0.002)
45-49	0.094***	0.088***	0.523***	0.558***
	(0.001)	(0.001)	(0.001)	(0.002)
50-54	0.109***	0.100***	0.632***	0.676***
	(0.001)	(0.001)	(0.002)	(0.002)
55-59	0.126***	0.117***	0.862***	0.926***
	(0.001)	(0.001)	(0.002)	(0.002)
60-64	0.150***	0.142***	1.122***	1.220***
	(0.001)	(0.001)	(0.002)	(0.003)
65-69	0.197***	0.189***	1.621***	1.779***
	(0.001)	(0.001)	(0.002)	(0.003)
70-74	0.215***	0.209***	1.949***	2.140***
	(0.001)	(0.001)	(0.003)	(0.004)
75-79	0.262***	0.252***	2.238***	2.445***
	(0.001)	(0.001)	(0.003)	(0.004)
80-84	0.296***	0.280***	2.281***	2.490***
	(0.001)	(0.001)	(0.003)	(0.004)
85 years and over	0.298***	0.275***	2.342***	2.552***
	(0.001)	(0.001)	(0.003)	(0.005)

Table 4.6
Baseline Regression Results 1997-2009 (continued)

	(1)	(2)	(3)	(4)
	OLS	**OLS Year FE**	**IV**	**IV Year FE**
Age of youngest child				
Ref: No child household				
Age 0-4	-0.000	-0.020***	0.057***	0.123***
	(0.000)	(0.000)	(0.001)	(0.001)
Age 5-9	0.001*	-0.020***	0.056***	0.110***
	(0.000)	(0.000)	(0.001)	(0.001)
Age 10-14	-0.010***	-0.030***	-0.082***	-0.057***
	(0.000)	(0.000)	(0.001)	(0.001)
Age 15-19	-0.007***	-0.023***	-0.093***	-0.089***
	(0.000)	(0.000)	(0.001)	(0.001)
Age 20-24	-0.020***	-0.032***	-0.110***	-0.151***
	(0.000)	(0.000)	(0.001)	(0.001)
Age 25 and above	-0.032***	-0.049***	-0.335***	-0.382***
	(0.000)	(0.000)	(0.001)	(0.001)
Major source of income				
Ref: All and other source				
Wages/salaries/self employ	-0.115***	-0.099***	-0.299***	-0.443***
-ment	(0.000)	(0.000)	(0.001)	(0.001)
Investment income	-0.024***	-0.001	-0.094***	-0.078***
	(0.001)	(0.001)	(0.002)	(0.002)

Table 4.6
Baseline Regression Results 1997-2009 (continued)

	(1)	(2)	(3)	(4)
	OLS	**OLS Year FE**	**IV**	**IV Year FE**
Government transfer pay	-0.143***	-0.131***	-0.701***	-0.785***
-ments	(0.000)	(0.000)	(0.001)	(0.001)
BC	-0.212***	-0.320***	-0.541***	-0.685***
	(0.000)	(0.000)	(0.001)	(0.001)
QC	-1.196***	-1.105***	-1.162***	-1.014***
	(0.000)	(0.000)	(0.001)	(0.001)
Prairies	-0.512***	-0.819***	-0.192***	-0.643***
	(0.000)	(0.001)	(0.001)	(0.002)
Atlantic	-0.345***	-0.897***	-0.422***	-0.728***
	(0.001)	(0.001)	(0.002)	(0.003)
Territories	0.000	-0.220***	0.000	-2.106***
	(.)	(0.004)	(.)	(0.014)
Provincial government		-0.757***		-0.585***
expenditure		(0.001)		(0.003)
Provincial GDP	Yes	Yes	Yes	Yes
Unemployment rate	Yes	No	Yes	No
Year fixed effects	No	Yes	No	Yes
Adjusted R-squared	0.927	0.929	0.429	0.334

This table reports benchmark estimates associating each identification of charitable donations with tax price for the years $t = 1997 - 2009$. Standard errors are reported in parentheses. $*p < 0.05, **p < 0.01, ***p < 0.001$.

This study also includes geographic factors, as was done in the past Canadian literature. The Canadian regional specific effect is defined by six regions in the previous Canadian studies, they are: Ontario, British Columbia, Québec, the Prairies, the Atlantic and the Territories region. Geographic regions influence charitable donations at the intensive margin. Ontario in this case is the reference region. The results show that the residents of Québec donate least amount of money compared to the residents of all other regions, despite the fact that the tax credit associated with monetary donations in Québec are much higher than in the rest of the Canadian provinces. This result corroborates the finding in Devlin and Zhao (2017). Their research provides a reason why Québeckers appear to be less generous than others. The empirical analysis unveils one potential reason: Québeckers are less endowed relative to other Canadians with two important characteristics: religiosity and household income, and they are much less attached to a formal place of worship than any other Canadians (Devlin and Zhao, 2017).

For the estimations in column 2 and column 4, I include the provincial government fiscal expenditure for each year. The fiscal spending in each year is in million dollars and is taken log form. The results suggest that provincial government spending has negative impact on individuals' private donations. Although the data have a limitation on the particular type of government spending, the negative relationship between provincial government expenditure and households' donations implys government spending crowds out private donations. The crowding-out by the government spending of charitable giving has been examined in the empirical literature. Andreoni and Payne (2011) conduct a crowding-out research using Canadian tax

filer data. In this study, they show that the estimates of gross crowding out exceed 100 percent, among which 77 percent can be attributed to reduced fund-raising by the charities. In addition, Day and Devlin (1996) find evidence that the level of government spending influences the decision to volunteer in Canada.

4.5.2 Income Quintile

In this subsection, I split the the sample into five pre-tax income classes based on the income quintile generalized by Statistic Canada in 2013: less than $13000, $13000 to $37000, $37000 to $65000, $65000 to $111600 and over $111600, measured in the constant year 2007 dollars.

Table 4.7 shows the results by income quintile using my favoured instrumental variables estimator. Relative to the baseline demand price elasticity of charitable donation, the first quintile, that is the household which average pre-tax income is below $13000, is less elastic. Tax incentive has little impact on the first income quintile group because individuals in this group are not responsive to the tax price of donations. On the other hand, the second quintile and third quintile are much more elastic compared to the price elasticity of donations for the overall sample. For the second quintile, increasing the tax price of charitable donations by one percent induces donations to decrease by 3.586%. Similarly, charitable donations will decrease by 2.264% resulting from a one percent rise in the tax price for the third income quintile. However, the elasticity for the fourth income quintile is not far from the estimate of the whole sample. Finally, the top income quintile performs the smallest elasticity among all. One per cent increase in tax price for giving decrease the

Table 4.7
IV regression results by income quintile

	Income Quintile				
	(1)	(2)	(3)	(4)	(5)
	First	**Second**	**Third**	**Fourth**	**Fifth**
Tax price	-0.591***	-3.586***	-2.264***	-1.364***	-0.284***
	(0.062)	(0.015)	(0.021)	(0.041)	(0.082)
Real household income	0.011***	0.059***	0.042***	0.023***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Real household income squared	0.001***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	-0.242***	-0.160***	-0.096***	-0.165***	-0.301***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)
Marital status	0.163***	0.209***	0.103***	0.351***	0.118***
	(0.002)	(0.001)	(0.001)	(0.004)	(0.012)
Tenure	0.825***	0.426***	0.356***	0.290***	0.422***
	(0.004)	(0.001)	(0.001)	(0.003)	(0.007)
Urban	-0.341***	-0.195***	0.068***	0.117***	0.587***
	(0.003)	(0.001)	(0.001)	(0.002)	(0.010)
BC	-0.370***	-0.519***	-0.588***	-0.677***	-0.629***
	(0.003)	(0.001)	(0.002)	(0.003)	(0.009)
QC	-0.704***	-1.193***	-1.372***	-1.357***	-1.492***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.007)
Prairies	0.197***	-0.215***	-0.326***	-0.335***	0.052***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.011)
Atlantic	-0.212***	-0.466***	-0.430***	-0.570***	-0.643***
	(0.006)	(0.002)	(0.003)	(0.006)	(0.020)
Territories	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)
Provincial GDP	-0.061***	-0.134***	-0.166***	-0.160***	-0.203***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.006)
Unemployment rate	0.620***	0.250***	0.159***	0.143***	0.521***
	(0.006)	(0.002)	(0.002)	(0.004)	(0.011)
Adjusted R-squared	0.306	0.538	0.385	0.282	0.188

This table reports income quintile estimations of charitable donations with tax price for the years $t = 1997-2009$. The characteristic controls for each household also include age group of reference person, household size dummies, major source of income, age of youngest child in the household, number of youths in the household, expenditure of registered retirement savings plan, direct health care costs, child care expenses. Standard errors are reported in parentheses. * p< 0.05, ** p< 0.01, *** p< 0.001.

donations only by 0.284 per cent. Those results are consistent with the findings in (Bakija and Heim, 2011). After allowing anticipation of and gradual adjustment to tax changes, their estimates suggest there is a inverse U-shaped pattern of persistent price elasticities, with somewhat higher estimates for middle-income people and somewhat lower estimates for high-income people.

With price elasticities differing across income classes in Canada, fiscal subsidies to the charitable sectors should base on different income group in terms of efficiency, namely, the tax favoured charitable donations policy should target the middle-income class. Since price elasticity for the middle-income class is relatively more elastic and those individuals are more responsive to the tax incentives towards charitable giving, Canadian social planners could potentially raise aggregate charitable donations attribute to the tax incentive exceeding the resulting reduction in tax revenues substantially from the middle-income group. The results also suggest that direct government support may be a more appropriate method of providing charitable goods and services to low-income group. As for the top income quintile, the estimates are difficult to interpret since observations in this group are relative few in number. Because the data for very wealthy families are scarce, there are only few studies of charitable donations by the very wealthy. One major difference between the wealthy donors and the modest donors is that wealthy donors can and do apply more prominent control over how their donations are spent. For example, the exceptionally rich can regularly spurn existing philanthropies and make new philanthropies or establishments to suit their own tastes.

Table 4.8
IV regression results for religious vs. non-religious donation 1997-2002

	(1) **Charitable Donations**	(2) **Non-Religious Donations**	(3) **Religious Donations**
Tax price	-1.184***	-0.753***	-0.897***
	(0.023)	(0.022)	(0.025)
Real household income	0.025***	0.029***	0.005***
	(0.000)	(0.000)	(0.000)
Male	-0.221***	-0.201***	-0.095***
	(0.001)	(0.001)	(0.001)
Marital status	0.203***	0.122***	0.169***
	(0.001)	(0.001)	(0.001)
Tenure	0.632***	0.512***	0.412***
	(0.001)	(0.001)	(0.001)
Urban	-0.163***	-0.134***	-0.250***
	(0.001)	(0.001)	(0.001)
BC	-0.775***	-0.482***	-1.097***
	(0.002)	(0.002)	(0.002)
QC	-1.322***	-0.981***	-0.980***
	(0.001)	(0.001)	(0.001)
Prairies	0.003	0.107***	-0.311***
	(0.002)	(0.002)	(0.002)
Atlantic	-0.563***	-0.296***	-0.753***
	(0.003)	(0.003)	(0.004)
Territories	0.000	0.000	0.000
	(.)	(.)	(.)
Provincial GDP	-0.122***	-0.056***	-0.269***
	(0.001)	(0.001)	(0.001)
Unemployment rate	0.840***	0.644***	0.748***
	(0.004)	(0.004)	(0.005)
Adjusted R-squared	0.396	0.321	0.199

This table reports estimations of charitable donations for religious section and non-religious section with tax price for the years $t = 1997 - 2002$. The characteristic controls for each household also include age group of reference person, household size dummies, number of weeks worked full-time, major source of income, age of youngest child in the household, number of youths in the household, expenditure of registered retirement savings plan, direct health care costs, child care expenses. Standard errors are reported in parentheses. * p< 0.05, ** $p < 0.01$, *** p< 0.001.

4.5.3 Religious Sector and Non-Religious Sector

This subsection highlights the price elasticities of donations to philanthropy cross different charitable sectors, namely, the religious sector and the secular sector. The data that separates the religious section from the non-religious section is only available for taxation year 1997 to 2002.

Table 4.8 shows the results for religious and non-religious donation estimation. The first column presents the result of the overall charitable donations from $1997 - 2002$. The tax price elasticity for donation is -1.184 from the preferred IV estimation. The second column and third column present results for the non-religious donations and the religious donations respectively. An one per cent increase in tax credit will increase the non-religious donations by 0.753 per cent, and increase the religious donations by about 0.897 per cent. Although the overall donations are price elastic, the two separated sections are inelastic. The decrease in tax price (increase in tax credit) will result in a smaller increase in the level of donation expenditure in both religious and non-religious sections. The results suggest the amount of tax revenue forgone will exceed the rise in donations spending except for total donation expenditure. Most research recommends the price elasticity of altruistic giving is much lower for religious organizations than for the secular organizations, proposing that subsidies of any sort to religious donations are a wasteful approach to finance religious organizations. However, the results from this study do not provide strong evidence that the price elasticity of religious donations are less than that of non-religious donations. As a matter of fact, non-religious donations' price elasticity is almost identical as religious donations' price elasticity for taxation year 1997 to 2002.

The finding that people are not price-responsive to religious donations is not surprising since generally people donate to church based on their faith rather than the tax incentives. Kitchen and Dalton (1990) argue that the price of giving is seldom a significant determinant of religious donations in a Canadian empirical study.

While the tax price has no obvious different impact on different donations sectors, household income on the other hand has a relatively higher influence on the non-religious donations than on the religious donations. Non-religious donation decrease by 2.9 percent in response to a one thousand decrease in family income, whereas religious ones decrease by only 0.5. Being a male has significantly negative effect on both charitable sectors, although the estimated coefficient in absolute value is relatively smaller for religious giving. It is also very interesting to see that households live in British Columbia make least donations to religious charities among all the rest Canadian regions.

4.5.4 Additional Household Characteristics for Selected Taxation Years

The Survey of Household Spending provides additional household characteristics for taxation year 2004 to 2009. The additional household characteristics include education attainment of the reference person, disability of the reference person.

Table 4.9 shows the two-stage IV regression results[3] for year 2004 to 2009. Col-

[3]The characteristic controls for each household also include age group of reference person, household size dummies, number of weeks worked full-time, major source of income, age of youngest child in the household, number of youths in the household, expenditure of registered retirement savings plan, direct health care costs, child care expenses, Canada and Québec pension plan and employment insurance premiums.

Table 4.9
IV regression results 2004-2009

	(1) **All**	(2) **Disability**	(3) **Education**	(4) **Disability and Education**
Tax price	-1.291***	-1.331***	-1.501***	-1.534***
	(0.046)	(0.045)	(0.044)	(0.044)
Real household income	0.029***	0.029***	0.028***	0.028***
	(0.000)	(0.000)	(0.000)	(0.000)
Reference person has a disability		-0.222***		-0.187***
		(0.001)		(0.001)
High school			0.594***	0.583***
			(0.002)	(0.002)
Male	-0.193***	-0.188***	-0.176***	-0.172***
	(0.001)	(0.001)	(0.001)	(0.001)
Marital status	0.325***	0.320***	0.319***	0.315***
	(0.002)	(0.002)	(0.001)	(0.001)
Tenure	0.558***	0.550***	0.532***	0.525***
	(0.002)	(0.002)	(0.002)	(0.002)
Urban	-0.098***	-0.099***	-0.146***	-0.145***
	(0.001)	(0.001)	(0.001)	(0.001)
BC	-0.475***	-0.476***	-0.494***	-0.494***
	(0.002)	(0.002)	(0.002)	(0.002)
QC	-1.150***	-1.165***	-1.130***	-1.143***
	(0.001)	(0.001)	(0.001)	(0.001)
Prairies	-0.357***	-0.358***	-0.362***	-0.363***
	(0.002)	(0.002)	(0.002)	(0.002)
Atlantic	-0.473***	-0.471***	-0.476***	-0.475***
	(0.003)	(0.003)	(0.003)	(0.003)
Territories	-1.586***	-1.586***	-1.476***	-1.477***
	(0.012)	(0.012)	(0.012)	(0.012)
Provincial GDP	-0.188***	-0.187***	-0.194***	-0.193***
	(0.001)	(0.001)	(0.001)	(0.001)
Year fixed effects	Yes	Yes	Yes	Yes
Adjusted R-squared	0.376	0.380	0.400	0.404

This table reports estimations of charitable donations for religious section and non-religious section with tax price for the years $t = 2004 - 2009$. Standard errors are reported in parentheses. * p< 0.05, ** p< 0.01, *** p< 0.001.

umn 1 shows the estimation without including eduction attainment and disability as controls. Column 2 and column 3 incorporate disability dummy and education dummy. I define the High school dummy as whether reference person have a high-school diploma. Finally, column 4 displays the estimation with both of the two dummies. The tax price elasticity is between -1.29 to -1.53 for taxation year of 2004 to 2009. As one might expect, having a disable person in the family declines the charitable donations by about 20% compared to the family without a disabled person. Disabled individuals who want to work generally face myriad barriers. They face practical obstacles, and have fewer opportunities to get a job. Some of those individuals who have disability may rely on government transfer to make a living. Therefore, it would be difficult for them to have extra money to make donations given the fact they have to cover their own medical treatment or medical equipment.

Education has a positive and significant effect on charitable donations. Reference person with at least high school degree is more likely to make larger donations than referece person without a high school degree. The positive estimated coefficient on high-school dummy conforms to expectations. Brown and Lankford (1992) and Devlin and Zhao (2017) both find total giving increases with education level.

4.6 Marginal Rate of Tax Credit

In this section of the chapter, I will present a different approach of constructing the tax price for the estimation model. As discussed in subsection 4.3.2, I used the average tax price for a one-dollar charitable donation as the tax price for charitable

donations. The cost of the donations is the price per dollar of donation after the tax credit has been taken into consideration, also referred as the after-tax price. For individual who make a donation, the tax price is equal to one minus the tax credit, depending on the amount of their donations as well as the federal and provincial tax credit rates.

Although the average tax price for a dollar is the most common tax price of charitable donations used in the past literature, in this section, I instead apply the last-dollar (marginal) tax price as the tax price of charitable donations. Because of the uniqueness of the two-tier tax credit system in Canada, it is possible that it is the lowest and the highest tax credit rates that influence people's decision on how much to donate at the margin.

Let t_m denote the last-dollar (marginal) tax price for charitable giving:

$$t_m = \begin{cases} 1 & D = 0 \\ 1 - C(L) & 0 < D \leq 200 \\ 1 - C(H) & D > 200 \end{cases} \tag{4.6.0.1}$$

For individuals who donate less than \$200, the tax price of 1 dollar donation would be one minus the lowest federal and provincial tax credit rates. However, the tax price of 1 dollar donation for individuals who donate more than \$200 would be one minus the highest federal and provincial tax credit rates.

The results for the model by using marginal tax credit rate as the tax price are illustrated in table 4.10. The reported estimates in this table are the marginal effects of the tax price on charitable donations. Overall, the estimation results are

found to be very similar to the baseline results in section 4.5. The first column presents a pooled cross sectional OLS regression. The OLS estimated price elasticity of donations is -10.855. The OLS regression estimate for the price elasticity is fairly large compared to the conventional estimated price elasticity due to endogeneity. In the second column, I include the year fixed effect in the OLS regression. Here we can see the tax price elasticity is -10.879, which is not too far from the estimate of the first column. Column 3 and 4 present the results of instrumental variables estimates for the price elasticity. I use the statutory lowest and highest income tax rates as instruments for the last-dollar tax price. The estimated price elasticity of charitable donations in column 3 is negative and significant with an elasticity of -1.183, implying 1% decrease in the price of the donations increase the amount of donations by 1.183% on average. For the last column, I include the year fixed effect in the IV regression. The estimate for price elasticity is -0.54. Similar to the results showed in section 4.5, the reason that the elasticity decrease from being elastic to inelastic after including the year fixed effect might be that the year specific effect along with the regional dummies take away the major part of the variation in the tax credit rate in each province over time.

In line with the baseline results, income, martial status, gender, tenure-ship of home, age, age of youngest child, regional dummies and provincial government expenditure all have significantly impact on the amount of donations that households contribute.

Table 4.10
Regression results for tax price as marginal credit rate

	(1)	(2)	(3)	(4)
	OLS	**OLS Year FE**	**IV**	**IV Year FE**
Marginal tax price	-10.855***	-10.879***	-1.183***	-0.540***
	(0.000)	(0.000)	(0.014)	(0.019)
Real household income	0.005***	0.005***	0.028***	0.026***
	(0.000)	(0.000)	(0.000)	(0.000)
Male	-0.029***	-0.026***	-0.213***	-0.205***
	(0.000)	(0.000)	(0.000)	(0.001)
Marital status	0.055***	0.055***	0.278***	0.245***
	(0.000)	(0.000)	(0.001)	(0.001)
Tenure	0.090***	0.087***	0.614***	0.633***
	(0.000)	(0.000)	(0.001)	(0.001)
Urban	0.011***	0.004***	-0.147***	-0.158***
	(0.000)	(0.000)	(0.001)	(0.001)
Age group				
Ref: Less than 25 years				
25-29 years	-0.025***	-0.025***	-0.046***	-0.074***
	(0.001)	(0.001)	(0.001)	(0.001)
30-34	-0.001	0.001	0.113***	0.100***
	(0.001)	(0.001)	(0.001)	(0.002)
35-39	0.008***	0.008***	0.218***	0.218***
	(0.001)	(0.001)	(0.001)	(0.002)
40-44	0.048***	0.043***	0.395***	0.405***
	(0.001)	(0.001)	(0.002)	(0.002)

Table 4.10
Regression results for tax price as marginal credit rate (continued)

	(1) OLS	(2) OLS Year FE	(3) IV	(4) IV Year FE
45-49	0.075***	0.073***	0.534***	0.559***
	(0.001)	(0.001)	(0.002)	(0.002)
50-54	0.090***	0.087***	0.645***	0.677***
	(0.001)	(0.001)	(0.002)	(0.002)
55-59	0.118***	0.113***	0.883***	0.930***
	(0.001)	(0.001)	(0.002)	(0.002)
60-64	0.154***	0.153***	1.150***	1.225***
	(0.001)	(0.001)	(0.002)	(0.003)
65-69	0.234***	0.234***	1.666***	1.788***
	(0.001)	(0.001)	(0.003)	(0.003)
70-74	0.288***	0.286***	2.008***	2.152***
	(0.001)	(0.001)	(0.003)	(0.004)
75-79	0.344***	0.338***	2.303***	2.458***
	(0.001)	(0.001)	(0.003)	(0.004)
80-84	0.345***	0.337***	2.344***	2.502***
	(0.001)	(0.001)	(0.003)	(0.004)
85 years and over	0.367***	0.357***	2.409***	2.566***
	(0.001)	(0.001)	(0.004)	(0.005)
Age of youngest child				
Ref: No child household				
ageyoung=2	0.023***	0.005***	0.061***	0.125***
	(0.000)	(0.000)	(0.001)	(0.001)

Table 4.10
Regression results for tax price as marginal credit rate (continued)

	(1) OLS	(2) OLS Year FE	(3) IV	(4) IV Year FE
ageyoung=3	0.028***	0.007***	0.061***	0.112***
	(0.000)	(0.000)	(0.001)	(0.001)
ageyoung=4	0.008***	-0.012***	-0.082***	-0.056***
	(0.000)	(0.000)	(0.001)	(0.001)
ageyoung=5	-0.002***	-0.020***	-0.094***	-0.089***
	(0.000)	(0.000)	(0.001)	(0.001)
ageyoung=6	0.001*	-0.015***	-0.108***	-0.149***
	(0.001)	(0.001)	(0.001)	(0.001)
ageyoung=7	-0.029***	-0.046***	-0.344***	-0.384***
	(0.000)	(0.000)	(0.001)	(0.001)
Major source of income				
Ref: All and other source				
Wages/salaries/self employ	-0.107***	-0.095***	-0.303***	-0.445***
-ment	(0.000)	(0.000)	(0.001)	(0.001)
Investment income	-0.012***	0.003***	-0.093***	-0.077***
	(0.001)	(0.001)	(0.002)	(0.002)
Government transfer pay	-0.210***	-0.201***	-0.725***	-0.792***
-ments	(0.000)	(0.000)	(0.001)	(0.001)
BC	-0.221***	-0.324***	-0.551***	-0.686***
	(0.000)	(0.000)	(0.001)	(0.001)
QC	-0.899***	-0.799***	-1.128***	-0.998***
	(0.000)	(0.000)	(0.001)	(0.001)

Table 4.10
Regression results for tax price as marginal credit rate (continued)

	(1) OLS	(2) OLS Year FE	(3) IV	(4) IV Year FE
Prairies	-0.404***	-0.710***	-0.172***	-0.639***
	(0.001)	(0.001)	(0.001)	(0.002)
Atlantic	-0.377***	-0.853***	-0.428***	-0.727***
	(0.001)	(0.001)	(0.002)	(0.003)
Territories	0.000	-0.153***	0.000	-2.112***
	(.)	(0.005)	(.)	(0.015)
Provincial GDP	0.043***	0.517***	-0.158***	0.208***
	(0.000)	(0.001)	(0.001)	(0.002)
Unemployment rate	-0.248***		0.262***	
	(0.001)		(0.001)	
Provincial govern		-0.684***		-0.583***
-ment expenditure		(0.001)		(0.003)
Year fixed effects	No	Yes	No	Yes
Adjusted R-squared	0.892	0.894	0.392	0.325

This table reports estimations of a different version of equation 4.4.0.1 with tax price for the years $t = 1997 - 2009$. The characteristic controls for each household also include age group of reference person, household size dummies, number of weeks worked full-time, major source of income, age of youngest child in the household, number of youths in the household, expenditure of registered retirement savings plan, Private health care insurance plans, child care expenses, Canada and Québec pension plan and employment insurance premiums. Standard errors are reported in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In summary, the marginal effects from the IV estimations are similar to those obtained from the average tax price elasticity from the earlier estimations. The

results do not support the hypothesis that the estimates of the elasticity obtained from the average tax price are biased.

4.7 Concluding Remarks

Since the taxation year of 1988, Canada exercised a tax credit system which provides the tax incentives for charitable giving to Canadian taxpayers. The current tax credit system in Canada is different from the more common tax deduction system practiced in most of the countries around the world. The tax benefit under the tax credit system depends on the amount of charitable gifts claimed by the donors during a tax year; whereas the tax benefit under the tax deduction system, in which most countries employ, is determined by the donor's income. While there are numerous studies estimating the tax-price elasticity of charitable giving for the U.S, we know little about Canada. Given this absence of knowledge and also the distinctive role of the legislature and diverse tradition for charitable giving, estimation from U.S research on philanthropy may not apply as a direct guide to Canadian policy.

The present analysis provides new evidence from the Survey of Family Expenditure 1997-2009 in Canada. The empirical finding in this chapter demonstrates tax incentives influence the households' decision on how much to contribute to charitable giving significantly, and estimated price elasticities fall in the range as those of other literature in Canada and U.S. The results suggest that public policy can be applied to increase private provision of charitable giving by the tax credits rates. Since overall, the tax price demand elasticity is elastic and significant, the tax credit

system in Canada appears to be fiscally efficient in the sense that the amount of charitable donations induced by tax incentives is greater than the tax revenue forgone. There is no strong evidence that shows individuals that donate to different categories of charitable sectors respond differently to the tax incentives. The present chapter finds that secular sector is about the same inelasticity as the religious sector for year 1997-2002. However, there is evidence of heterogeneous impact of the tax price on different income groups.

Although the empirical specification in this chapter is to consider the across-province and the over time variation of tax credit rates to identify the price elasticity of private donations, it is also possible that unobservable factors, for instance, altruism, peer-group effect, and different colonial culture of different region may affect the level of giving. Moreover, the theory of "warm-glow giving" also offers an explanation in giving. Humans are emotional, empathic and sympathetic-they enjoy gratitude and recognition, they enjoy making someone else happy, and they feel relieved from guilt when they become a giver (Andreoni, 2006). Despite their importance, those motives mentioned above fall outside the extent of this research. Perhaps future study can base on those motivations for giving and further improve the model of philanthropy.

Another potential to extend this research is to get a closer look at the tax incentives for donating to a specific category of charity, like art, cultural property or health charity. Donations to different charities or organizations tend to reflect the social needs and preferences. Recognition of the specific charitable sector can potentially improve the tax incentive policy based on the levels of responsiveness of different

category of charity to tax incentives. Learning about certain combinations of individuals' characteristics affecting behaviour of gifts of a kind is helpful for improving policies to not only increase the amount of the donations from existing givers but also the number of new possible givers.

Chapter 5

Conclusion

The contribution of this thesis lies in the combination of the fields of applied economics and tax policy. The aim of the thesis is to closely examine the topic of the private provision of public goods. The thesis has carried out an efficiency analysis of the theory of crowding out by the public provision of the public good and the theory of subsidizing voluntary contributions to public goods in the presence of optimal non-linear income tax. The thesis also carried out an empirical study of the impact of tax incentive on charitable donations in Canada.

In chapter 2, I build on the classic crowding-out model but departed from the most previous research by incorporating the substitutional relationship between the public provision and the private provision for public goods. In chapter 3, the dissertation makes an important contribution to the contemporary literature by identifying the importance of voluntary contributions as part of the optimal non-linear income tax policy. Finally, the empirical component of the research that is presented in

chapter 4 has major implications for our understanding of the tax incentive regime for charitable donations in Canada. Therefore, I hope to offer a more complete and more accurate account of the Canadian tax credit system on the decisions of charitable giving from the main empirical findings that emerge from 4.

Voluntary contributions have for a long time been an important area of public choice. In particular, understanding the welfare impact of private contributions on the public good and the determinants of giving is essential for policymaking. The main intention of this thesis can be extended in a number of directions. First, the economic factor that influences people's decision on charitable giving concerns not only the tax credit but also the interactions between donation categories. For instance, whether cash donation is a complement or a substitute for volunteering work? If the hypotheses about the interactions between donation categories are correct, then synthesis of the insights about charitable donation with the results reported in the current thesis could shed light further on the fiscal-effectiveness; and allow us to understand better how the social planner can influence the number of individuals who make charitable donations as well as the average amount of charitable giving by the existing donors. Furthermore, with improved data, I can further investigate the impact of tax incentives on different donation types, for example, charitable donations in cash, cultural property donations, giving in the form of capital gain. Tax incentive could potentially have a very different impact on them in nature.

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