Program Reforms and Poverty in Canada

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Abstract

This paper uses the methodology of Program Dominance (PD) curves to analyze program reforms that reduce poverty. The PD curves can be decomposed into Targeting Dominance (TD) and Allocation Dominance (AD) curves. The analysis is mainly based on the paper of Duclos, Makdissi and Wodon (2005) and applies the data of Canada in 2006. The marginal reforms of the Employment Insurance Program, the Old Age Security Program and the Social Assistance Program are also discussed in this paper.

Keywords: Poverty; Program reforms; Program Dominance curves

1. Introduction

Poverty occurs in both developed and developing countries, and it draws government's attention of reducing poverty and narrowing the gap between the rich and the poor. Therefore, the government published different kinds of policies and programs to reduce and prevent poverty. Some policies focus on price subsidies on food, education, transportation and health care, while others offer help to low-income workers. Some strategies also take special groups into account, including children, senior and the disabled. However, each program provides distinct benefits. Some programs are better than others because, except for their impact on poverty, these programs provide indirect social welfare. For example, employment-related benefits help to decrease the unemployment rate, which benefits the growth of the entire economy. Similarly, other programs such as the Children Education Program have a positive

impact on human capital.

The main purpose of this paper is to propose some constructive advice on reforming the existing programs so as to help policy makers better reduce poverty.

This paper builds on the methodology of the Program Dominance (PD) curve. This curve was first proposed by Duclos, Makdissi and Wodon (2005). The establishment and development of this methodology goes through several steps.

Before 1975, many economists and analysts focus on finding the optimal tax systems. However, according to Martin Feldstein (1975) it is impracticable. He states that actual tax changes are "slow and piecemeal" and points out that the emphasis should change to tax reform (Santoro 2007). Later, Ahmad and Stem (1984) come up with the idea of marginal commodity tax reforms. Estimating the impact of marginal tax reforms does not require to estimate the demand and utility function of each individual, but analyze the observed data directly (Duclos, Makdissi and Wodon 2008). Ahmad and Stem (1984) define the marginal tax commodity tax reforms as "vectors of welfare-improving and revenue-neutral small tax changes". Several years later, Mayshar and Yitzhaki (1995) propose the Daltonian tax reform. This reform is based on the assumption that households can be socially ranked, and that the concentration curve exists. The Daltonian tax reform is an improvement of the marginal tax reform presented by Ahmad and Stem (1984). Recently, Makdissi and Wodon (2002) reinterpret the marginal tax reform as a poverty-reducing reform.

Makdissi and Wodon (2002) first propose the concept of Consumer Dominance Curve and advance it in their Duclos and Makdissi (2004) paper. The CD curve is a tool to evaluate the impact on poverty of marginal reforms on commodity tax. The Duclos, Makdissi and Wodon

(2005) propose a new tool named the Program Dominance Curve which has a similar spirit to the Consumer Dominance Curve. However, PD curves focus on the poverty impact of marginal reforms on program benefits. Furthermore, PD curves can be decomposed into Targeting Dominance Curves that care about the targeting performance of the program and Allocation Dominance Curves which pay attention to the allocation among benefit recipient in the program.

In this paper, I use the methodology of PD and TD curves to assess how to use program reforms to reduce poverty in Canada. The dataset comes from the Canadian Survey of Labour and Income Dynamics. I try to analyze three programs: the Employment Insurance Program, the Old Age Security Program and the Social Assistance Program. I will test them in pairs. In addition, different cases in first, second and third order of stochastic dominance need to be taken into account. The critical poverty line will also be introduced in this paper.

The structure of the paper is as follows: Section 2 will introduce the background information of Canada, focusing on demographics, economy and some social programs. Section 3 clarifies the analytical framework of program reforms, including the measurement of poverty, the definitions and propositions of PD, TD and AD curves as well as the critical poverty line. Section 4 is the empirical illustration. I test the poverty-reducing program reforms in Canada. Employment Insurance, Old Age Security and Social Assistance are my target programs and I only discuss the PD and TD curves of these three programs. Section 5 is the conclusion.

2. The Background of Canada

Canada is the second largest country in the world by total area. The population of Canada is 31,612,897 as calculated by the 2006 census. Among that 17.7% of the population is 14 years of age and below. 68.6% of the population is between age 15 and 64. The percentage of 65-and-over is as high as 13.7%. Moreover, 3.7% of the senior group is 80-and-over. Obvious with many other developed countries which have more people retired and less people in the working age, Canada is also trapped by the problem of population aging. So how to assist this huge group of seniors is one of the major concerns of Canada government.

Canada is one of the wealthiest countries in the world with a GDP of 1,191,403 million CAD in 2006, which increased to 1,233,930 million CAD in 2010 (Statistics Canada 2011). Canada is also a member of Organization for Economic Co-operation and Development (OECD) and the Group of Eight (G8).

Even though Canada is a developed country, poverty still exists. In 2006, the percentage of persons in Canada living in low income was 11.9% based on the Market Basket Measure and was 10.5% using the LICO-IAT (Low Income after tax Cut-offs). The Gini coefficient for Canada is 0.315 in 2004 which implies that inequity of income distribution still need to be reduced in Canada. According to the OECD, Canada's poverty rate has increased rapidly and is now above the OECD average. All the information shows that how to reduce poverty and narrow the difference between rich and poor is still a problem in Canada. Therefore, we need to reform the existing social programs to better reduce poverty.

Employment is also an issue. According to Statistics Canada (2008), the labour force in Canada was more than 17 million in 2006. Because of the development of mining, oil and gas

extraction and construction industries the employment rate increase between 2001 and 2006 (1.7%) and unemployment rate decrease from 7.4% in 2001 to 6.6% in 2006. In 2006, Newfoundland and Labrador province has the highest unemployment rate of 18.6% and Alberta is the lowest of 4.3%. However the unemployment rate increases because of the global financial crisis and reach 8.6% in 2009. The fluctuation of employment rate and unemployment rate shows that employment and economic development influence each other. Therefore, solving the problem of employment not only reduce the poverty but also improving the economy growth.

As one of the highly-developed countries, Canada offers a number of programs and policies that help reduce poverty and support different groups. For example, the Social Assistance, the National Child Tax Benefit and the Employment Training program will help the lower-income families and young families. Old Age Security, Canada and Quebec Pension plan and RRSPs will contribute to seniors. Individuals of working age also can get assistance from Employment Insurance, Workers' compensation benefits or Retraining programs.

In this paper, I plan to choose three programs and apply the approach of Program Dominance (PD) curves to illustrate the poverty-reducing program reforms in Canada.

3. Methodology

"Program reforms that decrease poverty 'robustly' will be called 'poverty dominant' (Duclos, Makdissi, Wodon 2005)." The purpose of this paper is to estimate the impact of programs on poverty and give suggestions about how to reform them. So let's start with the

measurement of poverty.

3.1. Measuring the poverty

First, I define the Additive Poverty Index. According to Duclos, Makdissi, Wodon (2008), the Additive Poverty Index can be expressed as:

(1) $$P(z) = \int_0^a p(y,z)dF(y)$$

where y is the equivalent (or real) income assessed in the basis of the reference price (King 1983), and z is the poverty line defined in the real income space, $F(y)$ is the cumulative distribution of income at range of 0 to a, and $p(y,z)$ represent the amount of contribution to total poverty of an individual with income y. $p(y,z)$ is zero for all income higher than z and non-negative for those with income lower or equal to the poverty line.

Then consider to define the classes of poverty indices $P(z) \in \Pi^s$:

(2) $$\prod^s(Z) = \left\{ P(z) \middle| \begin{array}{ll} p(y,z) = 0 & \text{if } y > z, p(y,z) \in \hat{C}^s(z), \\ (-1)^i p^i(y,z) \geq 0 & \text{for } i = 0,1 \ldots, s, \\ p^{(t)}(z,z) = 0 & \text{for } t = 0,1, \ldots, s-2 \text{ when } s \geq 2, \end{array} \right\}$$

where $\hat{C}^s(z)$ is the set of functions that are s-time piecewise differentiable in the range [0, z], and where the superscript (s) represent the s-th order derivative with respect to y.

Duclos and Arrar (2006) provide an ethical interpretation of the different classes of

poverty indices. When s=1, an increase in the income of an individual will weakly reduce poverty ($p^{(1)}(y, z) < 0$). The first-order poverty indices obey the Pareto Principle of transfer. Therefore, these indices are "Paretian" indices: increase someone's income will weakly reduce the poverty indices while income of other individuals keeps unchanged. The indices also obey the Symmetry principle: when two individuals interchange their income level, the poverty indices remain unchanged.

When s=2, the poverty indices are convex since $p^{(2)}(y, z) > 0$ and comply with the "Pigou-Dalton" principle of transfer. This transfer illustrates that a mean-preserving transfer of income from a richer individual to a poorer one will weakly reduce poverty. The second-order poverty indices are called the "distribution-sensitive" poverty indices. These distribution-sensitive indices have more ethical preference for the lower income individual than for the higher income individual which means the more equality there is in income distribution among the poor, the lower level of poverty.

The third-order indices respect to the "transfer-sensitive" principle of transfer. In this case, a beneficial Pigou-Dalton transfer in the lower part of the distribution associated with an adverse Pigou-Dalton transfer within the higher part of the distribution will decrease the poverty if the variance of the distribution does not increase. Obviously, the transfer occurring at the lower part of distribution is favorable and unfavorable within the higher part. This kind of "favorable composite transfer" shows that people with lower income will be more sensitive about the distribution.

Based on the generalized transfer principles of Fishburn and Willig (1984), as "s" increases, the effect of transfers occurring at the bottom of the distribution assigned more

weight and when s→ ∞, only the income of the poorest person matters.

A particular class of poverty indices is called the Foster-Greer-Thorbecke (FGT) indices. These indices were proposed by Foster et al (1984). The FGT indices are a subclass of additive poverty indices and can be defined as:

(3) $$FGT_F^{\alpha}(z) = \int_0^z \left(\frac{z-y}{y}\right)^{\alpha} dF(y).$$

where $\alpha \geq 0$. α is an ethical parameter of poverty aversion. For $\alpha = 0$, $FGT_F^0(z)$ is called the poverty headcount which is the most widely used and simplest poverty index. The poverty headcount measures the proportion of people under the poverty line. For $\alpha = 1$, $FGT_F^1(z)$ gives the average poverty line. It measures the average shortage of income from the poverty line. For $\alpha \geq s - 1$, $FGT_F^{\alpha}(z)$ belongs to $\Pi^s(z)$.

3.2. Notation and definitions

Before discussing the program reforms we need to first define some notation. As discussed in the last part, y is the equivalent (or real) income, and F(y) is the cumulative distribution of equivalent income which means the proportion of individual with income lower than y. And $f(y) = \frac{\partial F(y)}{\partial y}$ is the density of income at y.

Based on Duclos, Makdissi, Wodon (2005), the "targeting function" for an existing program k can be defined as:

(4) $$\phi_k(y) = \tau_k(y) \cdot f(y)$$

where $\tau_k(y)$ is the proportion of the population that benefit from the program k at income y. Therefore, $\phi_k(y)$ represent the number of individual benefits from the program k, and $\Phi_k = \int_0^a \phi_k(y)dy \leq 1$ shows the overall share of the population that benefits from the program k. Then they defined the cumulative distribution function of beneficiary as $G_k(y)$ where $G_k(y) = \frac{\int_0^y \phi_k(y)dx}{\Phi_k}$, and the density of the beneficiary at y should be $g_k(y) = \frac{\partial G_k(y)}{\partial y} = \frac{\phi_k(y)}{\Phi_k}$.

Meanwhile, the mean transfer across the population at program k can be denoted as:

(5) $$T_K = \int_0^a t_k(y)\, \phi_k(y)dy,$$

where $t_k(y)$ represents the average monetary amount that transfers to per beneficiary at income y. T_K can be regarded as the total amount of transfers to the benefit recipient with income lower than y. The average transfer among each benefit recipient at program k should be:

(6) $$\bar{t}_k = \frac{T_K}{\Phi_k} = \int_0^a t_k(y)\, g_k(y)dy.$$

3.3. Program reforms

After define the notation, I begin to analyze the program reforms and only consider the marginal (proportional) changes in the initial transfer. Following Duclos, Makdissi, Wodon (2005), the program reforms can be express as:

(7) $$t_k(y)\Delta t_k = \underbrace{\bar{t}_k \Delta t_k}_{\text{Targeting}} + \underbrace{(t_k(y) - \bar{t}_k)\Delta t_k}_{\text{Allocation}}$$

In equation (7), $t_k(y)\Delta t_k$ means if an agent has already received a transfer $t_k(y)$ then his income will increase by $t_k(y)\Delta t_k$ affected by the reform. Those who have not received the transfer will not be impacted by this reform.

$\bar{t}_k \Delta t_k$ is the targeting component of this reform which means all the existing beneficiary will get the same absolute marginal benefit based on the mean benefit.

The allocation component $(t_k(y) - \bar{t}_k)\Delta t_k$ shows the income of the recipient will increase proportionally by the difference between benefits of the existing recipient and the mean allocation. Such reform states that an agent who is far from the mean allocation will get more benefit.

Since the impact of this reform composed by the targeting and allocation components, the relative distribution of benefit $t_k(y)$ remains unchanged because everyone's benefit increased by the same proportion Δt_k.

3.4. Poverty impact in program changes

Combining the knowledge of additive poverty indices and the marginal program reforms, the next step is to compare the impact on poverty (measured by FGT indices) with three types of program changes (defined by Duclos, Makdissi, Wodon 2005).

The first type of change is to increase the transfers allocated to program k by the

proportion Δt_k. Thus, the impact of the FGT indices will be:

$$(8) \qquad \frac{\partial FGT^{\alpha}(z)}{\partial t_k} = \begin{cases} -t_k(z)\phi_k(z) & \text{if } \alpha = 0 \\ -\alpha z^{-\alpha}\int_0^z t_k(y)(z-y)^{\alpha-1}\phi_k(y)dy & \text{if } \alpha > 0 \end{cases}$$

Equation (8) shows that the impact of the poverty in this "proportional" program changes will leave the relative distribution of benefit unchanged for the existing beneficiary, because all the transfer increased by the same proportion.

From equation (7) we know that the impact of the program reform is composed by the impact of targeting and allocation components, so does the poverty impact in equation (8). The second case is the targeting components. Replacing $t_k(y)$ by $\bar{t}_k$, then get:

$$(9) \qquad \left.\frac{\partial FGT^{\alpha}(z)}{\partial t_k}\right|_T = \begin{cases} -\bar{t}_k\phi_k(z) & \text{if } \alpha = 0 \\ -\alpha z^{-\alpha}\int_0^z \bar{t}_k(z-y)^{\alpha-1}\phi_k(y)dy & \text{if } \alpha > 0 \end{cases}$$

It demonstrates the poverty impact of a "lump-sum" program change. That is, increasing all the transfer by the same absolute amount will keep the numbers of benefit recipients unchanged.

Consider the allocation component:

$$(10) \qquad \left.\frac{\partial FGT^{\alpha}(z)}{\partial t_k}\right|_A = \begin{cases} -(t_k(z)-\bar{t}_k)\phi_k(z) & \text{if } \alpha = 0 \\ -\alpha z^{-\alpha}\int_0^z (t_k(y)-\bar{t}_k)(z-y)^{\alpha-1}\phi_k(y)dy & \text{if } \alpha > 0 \end{cases}$$

The impact of poverty of an "allocation" program change will increase the transfer by the

same proportion (Δt_k) of the spread from the mean transfer $(t_k(y) - \bar{t}_k)$ for all recipients, and keep the mean transfer unchanged.

Obviously, we can see from the formula that the impact of the FGT indices is determined by three factors which are the targeting function $\phi_k(z)$, the distribution of the poverty gap $\int_0^z (z-y)^{\alpha-1} dy$, and the allocation of transfer below z.

3.5. Impact of government budget and economic efficiency cost

Now I want to know how government budget is affected by the marginal program reforms. Defined the government budget as B. Assuming that there exist two programs, program k and program l, and consider a marginal program reforms that decreases marginally the transfers to program l and increases marginally the transfer to program k. Ahmad and Stem (1984) defined the marginal tax commodity tax reforms based on the assumption of revenue-neutral. In Duclos, Makdissi, Wodon (2005) this assumption still holds in analyzing the marginal program reforms. Thus, the budget neutrality of the program reforms requires that dB=0, and they describe the impact of the government budget on marginal program reforms as:

(11) $$dB = \frac{\partial B}{\partial t_k}\Delta t_k + \frac{\partial B}{\partial t_l}\Delta t_l = 0$$

Now consider the economic efficiency costs (γ). In the case of marginal program reforms we discussed above, there are two situations: First, if program k and program l are funded by the same source and the behavioral response on the benefit recipients of both programs are the

same. Then, the cost of the government by transferring \$1 to an individual in program k is same as the cost of transferring \$1 to an individual in program l. However, there also exists another case that the government budget financed by different ways of taxation and the behavioral reactions are different for the individual in different programs. In this case the different economic efficiency costs (γ) exists. Considering this situation, Duclos, Makdissi, Wodon (2005) defined γ as:

(12) $$\gamma = \frac{\left(\partial B/\partial t_K\right)/T_K}{\left(\partial B/\partial t_L\right)/T_L}$$

The numerator of (12) gives the marginal cost of a marginal increase in the per capita income by reforming program k. The denominator shows exactly the same measures for reforming program l. Therefore, γ measures the ratio of marginal costs between two program reforms.

For example, if $\gamma = 1$, the marginal cost for reforming program k and program l are the same. If $\gamma > 1$, then the cost for reforming program k is larger than reforming program l, so running program k is less economic efficiency and costly. The opposite conclusion holds if $\gamma < 1$.

By substitute (12) into (11), we can simplify equation (11) as:

(13) $$\Delta t_l = -\gamma \cdot \left(\frac{T_K}{T_L}\right) \cdot \Delta t_k$$

3.6. Poverty-dominant program reforms

As mentioned above, a program reform that can reduce the poverty "robustly" will be called poverty-dominant. The goal of the paper is to identify the program reforms that decrease the poverty for all additive poverty indices $P(z) \in \Pi^s(z)$ and for all poverty line $z \in [0, z^+]$.

Based on the poverty impact of three types of program reforms mentioned before, Duclos, Makdissi, Wodon (2005) proposed three curves to examine the poverty-dominant program reforms.

First is the PD curve (Program Dominance Curve). It estimates the impact of poverty of a "proportional" program reforms, Based on equation (8), the PD curves for program k is:

$$(14) \qquad PD_K^S(z) = -T_k^{-1} \frac{\partial FGT^{S-1}(z)}{\partial t_k}$$

$$= \begin{cases} \frac{t_k(z)}{\bar{t}_k} g_k(z) & \text{if } s = 1 \\ (s-1) z^{1-s} \int_0^z (z-y)^{s-2} \frac{t_k(y)}{\bar{t}_k} g_k(y) dy & \text{if } s > 1 \end{cases}$$

The first-order PD curve $PD_K^1(z)$ gives the density of public spending on individual at income z. The Second-order PD curve $PD_K^2(z)$ is the cumulative share of public spending on program k of those individual with income equal or less than z. For s=3,4,..., larger weight is given to those shares with higher poverty gap. Hence:

Proposition 1: *A revenue-neutral marginal policy reform that increases proportionately all transfers under program k and reduces proportionately all those*

under program l will reduce poverty for all poverty indices $P(z) \in \Pi^s(z)$ *and for all poverty lines* $z \in [0, z^+]$ *if and only if* $PD_k^s(y) - \gamma PD_l^s(y) \geq 0$ *for all* $y \in [0, z^+]$ (Duclos, Makdissi and Wodon, 2005, p. 62).

Assume $\gamma = 1$, Proposition 1 shows that increases proportionately transfers of program k and decreases the transfer to program l by the same proportion will reduce poverty, if and only if the PD curve for program k is higher than the PD curve for program l. This must be the case for all the income level up to z^+ and for any given ethical order of the poverty indices. If $\gamma \neq 1$, we still can compare the PD curves of program k and program l by multiply the latter one by γ. For s=1, the transfer on individual in program k must higher than transfer on individual in program l at income level y and for s=2, the transfer on individual in program k must higher than transfer on individual in program l with income y and below.

The PD curve can be decomposed into the sum of the TD curve and the AD curve. By using equation (9), the TD curve (Targeting Dominance curve) assesses the poverty impact of the "lump-sum" marginal program reform:

$$(15) \qquad TD_K^S(z) = -T_k^{-1} \frac{\partial FGT^{S-1}(z)}{\partial t_k}\bigg|_T = \begin{cases} g_k(z) & \text{if } s = 1 \\ (s-1)z^{1-s} \int_0^z (z-y)^{s-2} g_k(y)dy & \text{if } s > 1 \end{cases}$$

TD curves focus on who benefits from the program. $TD_K^1(z)$ gives the density of the population of benefit recipients at income z and $TD_K^2(z)$ gives the proportion of population of beneficiary at income level no larger than z. For $s \geq 3$, $TD_K^S(z)$ is a linear transformation

of the $FGT_{Gk}^{s-2}(z)$ index. A program can be regarded as "good" targeting when $g_k(z)$ is large for s=1. It express the idea that program is focusing on the individual under the poverty line. For s>1, $(z-y)^{s-2}g_k(y)$ is large. Therefore, Proposition 2 is as follows:

> **Proposition 2:** *A revenue-neutral "lump-sum" marginal policy reform that increase by the same amount of the income of all recipients of program k and decreases by the same amount the income of all recipients of program l will decrease poverty for all poverty indices* $P(z) \in \Pi^s(z)$ *and for all poverty lines* $z \in [0, z^+]$ *if and only if* $TD_k^s(y) - \gamma TD_l^s(y) \geq 0$ *for all* $y \in [0, z^+]$ (Duclos , Makdissi and Wodon, 2005, p. 63).

Proposition 2 means that for any poverty indices belongs to $\Pi^s(z)$, increase expenditure on program k and decrease expenditure on program l by the same amount will reduce poverty for all poverty line up to z^+, if and only if the TD curve of program k is above γ times the TD curve of program l at the threshold under z^+. For s=1, the number of individuals who benefit from the program k should be larger than the number of individuals who benefit from the program l at income level y. For s=2, the proportion of the population of benefit recipient in program k should be greater than the proportion in program l for all income level y and below.

AD curves can be used to assess whether the revenue-neutral "allocative" reform of a single program is poverty dominant or not. From equation (10), the AD curve is:

$$AD_K^S(z) = -T_k^{-1} \frac{\partial FGT^{S-1}(z)}{\partial t_k}\Bigg|_A \tag{16}$$

$$= \begin{cases} \dfrac{t_k(z) - \bar{t}_k}{\bar{t}_k} g_k(z) & \text{if } s = 1 \\ (s-1)z^{1-s} \displaystyle\int_0^z \frac{t_k(z) - \bar{t}_k}{\bar{t}_k} (z-y)^{s-2} g_k(y)dy & \text{if } s > 1 \end{cases}$$

$AD_K^1(z)$ gives the spread of the transfer of individual at the income z, and $AD_K^S(z)$ represent the cumulative distribution of the spread of transfer for individual with income level z or less. Proposition 3 is as follows:

> **Proposition 3:** *A marginal reform of program k that increases proportionately the spread of all transfers from their mean value will decreases poverty for all poverty indices* $P(z) \in \Pi^s(z)$ *and for all poverty lines* $z \in [0, z^+]$ *if and only if* $AD_k^s(y) \geq 0$ *for all* $y \in [0, z^+]$ (Duclos, Makdissi and Wodon, 2005, p. 64).

AD curves value the spread of benefit allocation among benefit recipient, and this spread increasing reform will be poverty dominant if and only if the spread $(t_k(z) - \bar{t}_k)$ have a positive relationship with the poverty contributions $(z-y)^{s-2} g_k(y)$ for any order of poverty indices.

Note that $AD_k^s(y)$ is the difference between $PD_k^s(y)$ and $TD_k^s(y)$, and $AD_k^s(y)$ can be regarded as the result of poverty reduction that is caused by proportional program reform under the condition of existing allocation rule.

3.7. Critical poverty line

If we fail to test the dominance and there is no agreement under the initial maximum poverty line z^+, then two solutions can be taken into consideration according to Duclos,

Makdissi and Wodon (2005). One is to increase the order of dominance until we get an appropriate result. Another solution is to find a critical upper poverty threshold z^s. For a given value $\gamma = \gamma^+$, they define the critical poverty line z_P^s, z_T^s, z_A^s for program dominance, targeting dominance, allocation dominance respectively, as:

$$(17) \qquad z_P^s = \sup\{z: PD_k^s(y) - \gamma PD_I^s(y) \geq 0, \ \ y \in [0, z]\},$$

$$(18) \qquad z_T^s = \sup\{z: TD_k^s(y) - \gamma TD_I^s(y) \geq 0, \ \ y \in [0, z]\}$$

$$(19) \qquad z_A^s = \sup\{z: AD_k^s(y) \geq 0, \ \ y \in [0, z]\}$$

where z_P^s, z_T^s, z_A^s are the maximum poverty line to make the condition (17) (18) (19) hold respectively.

Figure 1 illustrates this idea. For $\gamma = \gamma^+$, assume z^+ is the initial maximum poverty line. Obviously, some choices of poverty line below z^+ did not satisfy the condition in Proposition 1 since curve $\gamma^+ PD_I^s(z)$ is above $PD_k^s(z)$ within the range of $[z_P^s(\gamma^+), z^+]$ and we cannot get the conclusion about whether marginal program reform is poverty dominant or not. Therefore, we should find another maximum poverty line z_P^s so that any choices beyond this threshold make the condition do not hold. Same situation happens in TD and AD curves.

4. Empirical Illustration

4.1. Introduction to programs

I consider three programs and compare them. The three programs are the Employment

Insurance Program (EI), the Old Age Security Program (OAS) and the Social Assistance Program (SA).

The Employment Insurance Program (EI) was created in 1940 with the name of Unemployment Insurance (UI). After undergoing several significant changes, the program was renamed the Employment Insurance in 1996 and be used untill now. The aim of this program is to offer temporary financial assistance to eligible unemployed Canadian. For example, Canadians who have lost their job through no fault of their own or who are able to work but cannot find a job yet; or Canadians who are sick, injured; or individuals who are pregnant, have recently given birth, need to care for newborn baby; or those who must take care of gravely ill relative.

The program is financed from premiums. Both employees and employers need to pay the EI premiums and the amount is based on their insurable earning. Yet, they need not to pay once the premiums reached the Annual Maximum Premium. If Canadian workers lose their jobs, they can get benefits from the program. The amount of benefits that an individual can receive and the duration he can get the benefit from this program depend on several conditions, including his previous salary, how long he works before lose his job and the unemployment rate in their area. The maximum amount of EI benefit can reach the level of after-tax LICO for individual in a large Canadian city (Hay 2009).

The second program is the Old Age Security Program (OAS). OAS is a retirement income system including the Old Age Security Pension, the Guaranteed Income Supplement and the Allowance for the Survivor. This program provides different pensions to seniors as early as age 60. Note that the OAS is financed from Government of Canada general tax revenues.

Specifically, the Old Age Security Pension provides to Canadian citizens or legal residents of Canada who have lived in Canada for at least 10 years after reaching age 18 and he (or she) must be 65 years old or over. Applicant's employment status and history will not be the restriction. Even unretired seniors can receive the benefits. The amount of pensions for each person is determined by how long he or she has lived in Canada. The Old Age Security Pension is a taxable income.

The Guaranteed Income Supplement gives to individual who have little or no income and who receive an Old Age Security Pension. This supply is aimed at seniors aged 65 years and over, and these seniors must have lived in Canada for a minimum of 10 years. The amount of the Guaranteed Income Supplement each person can receive depends on his or her marital status and income.

The Allowance for the Survivor designed for survivors whose spouse has died and for those couples that only get one pension. The applicant must be between the ages of 60 and 64 and must have lived in Canada for at least 10 years after reaching age 18. The Allowance is paid to the survivor or to spouse of an Old Age Security Pension receiver and it will stop when the recipient can get benefit from the Old Age Security Pension at age 65. The amount of allowance to those couples that only get one pension should not be higher than the combined full Old Age Security Pension and not higher than the maximum Guaranteed Income Supplement for couple.

The third program is the Social Assistance Program (SA). This is an income-support program. This program focuses on different kinds of groups. For instance, for employable persons who are willing accept employment, SA will offer employment support services and

different exemption on assets and income so as to encourage entry or re-entry into the labour force. SA also supports Single-Parent Families and considers them as employable persons. Besides, persons with disabilities are also eligible to in this program. SA helps them by offering higher exemption levels on assets and income, special disability allowances and supplementary and health and medical benefit. Another eligible group is persons with multiple barriers to employment. For example, a person who have substance abuse, or has childcare or transportation problem will get support from this program. For an aged person who is ineligibility for Old Age Security benefit or who have some age-related special needs, SA will also assist them. The last eligible group is post-secondary students not attending the college.

There exist several types of benefits. Such as basic assistance which covers costs of food, clothing, shelter, personal and household items; special benefits related to age, disability, education and other persons who need special assistance; transitional assistance which encourages benefit recipient entry the labour market and less relies on social assistance.

4.2. Data analysis

The dataset comes from the 2006 Survey of Labour and Income Dynamics (SLID). This survey is conducted by Statistics Canada and offers longitudinal information on individuals and families. This survey supports studies on the determinants of the economic well-being of individuals and families and the changes of their well-being. For instance, the SLID can be used to study the topics like employment and unemployment dynamics, life cycle labour

market transitions, job quality, family economic mobility, dynamics of low income, life events and family changes or educational advancement and combining school and work.

The SLID focus on all the individuals living in Canada, except for people living in the Yukon or Northwest Territories; Indian reserves; residents of institutions and full- time member of the Canadian armed forces living in barracks. Individuals selected for the survey are interviewed once or twice per year. The interview contains many kinds of topics which may influence people's labour market experiences and income situation. The information from the survey can help researcher better understanding the economic well-being of selected individuals.

The duration of each panel is six years. The first six-year panel began in 1993, the second panel introduced in 1996 and the third reference year of the survey was 1999. New panel will be selected every three years and two adjacent panels will always be overlapping. The sample of the SLID was selected from the Labour Force Survey (LFS). For the first panel, the sample size is approximately 15,000 households including 31,000 adults aged 16 years and over. The sample size for the second panel is two times as large as the first panel (Statistic Canada 1997).

In this paper, we mainly use the data of the income sources. First of all, we need to generate a variable named "Living Standard". Note that the living standard (per capita income) can be estimate by using the total income divided by the numbers of household. And we use the data of Market Basket Measure of poverty (MBM) income as the total income. The MBM income measures:

"the remaining of the total family income after deducting the total income taxes paid; the personal portion of payroll taxes; other mandatory payroll deductions such as contributions to employer-sponsored pension plans, supplementary health plans and union dues; child support and alimony payments made to another family; out-of-pocket spending on child care; and non-insured but medically-prescribed health-related expenses such as dental and vision care, prescription drugs and aids for persons with disabilities" (Human Resources and Skills Development Canada, 2008, p.7).

Therefore, the MBM income represent the net income that household can really disposable.

4.2.1 First-order poverty dominance

Employment Insurance (EI) versus Old Age Security benefit (OAS)

First, I estimate $PD^1_{EI}(z)$ and $PD^1_{OAS}(z)$ curves. The $PD^1(z)$ curves measure the density of public spending spent on individuals at income z. Assume that the economic efficiency costs for EI and OAS are the same ($\gamma = 1$). Two $PD^1(z)$ curves cross at $\hat{z}^1_p$ and $\hat{z}^1_p$ is equal to 12890.993 with a standard error of 289.054. Hence, the true value is $z^1(1)$=[12324.447,13457.539]. Note that $\hat{z}^1_p$ is the first-order critical poverty line listed in the Table 1 for $\gamma = 1$. Figure 2 shows that for all poverty lines below the maximum poverty line $\hat{z}^1_p = 12890.993$, the $PD^1_{EI}(z)$ curve is everywhere above the $PD^1_{OAS}(z)$ curve. Thus based on the Proposition 1 we can get the conclusion: *if $\gamma = 1$, a policy maker could be 95%*

confident that increase the funding for EI proportionally and decrease the funding for OAS proportionally will reduce poverty for all poverty indices $P(z) \in \Pi^1(z)$ *and for all poverty lines below* z^+*=12324.447.*

Now consider the situation when the economic efficiency ratio γ changes. If γ changes to 1.5, which means running EI is 1.5 times costly than running OAS, the $PD^1_{OAS}(z)$ curve shifts upward in Figure 3. Then at some choices of poverty line below the initial maximum poverty line $\hat{z}^1_p = 12890.993$, the $PD^1_{EI}(z)$ curve is below the $PD^1_{OAS}(z)$ curve. Therefore, $PD^s_k(y) - \gamma PD^s_i(y) \geq 0$ does not hold. My solution is to find a new critical poverty line. Obviously, the new critical poverty line is the cross point of the $PD^1_{EI}(z)$ curve and the $1.5*PD^1_{OAS}(z)$ curve in Figure 3. In this case, *for* γ*=1.5, a proportional increase in funding for EI and a proportional decrease in funding for OAS will reduce poverty for all poverty indices* $P(z) \in \Pi^1(z)$ *and for all poverty lines below our new critical poverty line* $\hat{z}^1_p$*=11159.007 (with a standard error of 223.462).*

If γ=0.5, the $PD^1_{OAS}(z)$ curve shifts downward, then value of the new critical poverty line is $\hat{z}^1_p$=54776.000 (with a standard error of 552.644). Table 1 lists all the values of critical poverty line with different economic efficiency ratio. Therefore, *for* γ*=0.5, a marginal policy reform that increases proportionately all transfers under EI and reduces proportionately all transfers under OAS will reduce poverty for all poverty* indices belongs to $\Pi^1(z)$ *and for all poverty lines below the critical poverty line* $\hat{z}^1_p$*=54776.000 (with a standard error of 552.644).*

After studying the $PD^1(z)$ curves, now I test the targeting performance of EI and OAS by examining $TD^1(z)$ curves. In Figure 4, two $TD^1(z)$ curves intersect at $\hat{z}^1_T$ and $\hat{z}^1_T$ is equal to 14285.417 for $\gamma = 1$ and the estimated standard error is 300.261. Thus *a policy*

maker could be 95% certain that a revenue-neutral "lump-sum" marginal policy reform that increases by the same amount the income of all recipients of EI and decreases by the same amount the income of all recipients of OAS will reduce poverty for all poverty indices $P(z)$ *belongs to* $\Pi^1(z)$ *and for any choice of poverty line z below 13696.905.*

For $\gamma = 0.5$ the estimated critical poverty line is $\hat{z}_T^1$=45598.809 and for $\gamma = 1.5$ the estimated critical poverty line is $\hat{z}_T^1$= 12084.293 respectively.

Therefore, EI is better targeted than OAS and it is also the better program for proportional reforms. The increase of the transfers for EI is more favorable for poverty reduction whether a policy maker adopts proportional program reforms or "lump-sum" program reforms.

Employment Insurance (EI) versus Social Assistance (SA)

Assume the economic efficiency of these two programs is the same ($\gamma = 1$). Two $PD^1(z)$ curves intersect at $\hat{z}_p^1 = 13241.600$, with a standard error of 255.336. The true value is $z^1(1)$ =[12741.141, 13742.059]. *So under the 95% confidence interval, we states that for all poverty line* $z \in [0, 12741.141]$*, increase proportionately the expenditure on SA and reduce the expenditure on EI in the same proportion will reduce poverty for all poverty indices* $P(z) \in \Pi^1(z)$.

The value of γ still influences the value of critical poverty line. For $\gamma = 0.5$ the value of estimated $z^1(0.5)$ is 15813.569 (with a standard error of 528.131) and for $\gamma = 1.5$ the value of estimated $z^1(1.5)$ is 11555.272 (with a standard error of 364.509).

I now we analyze the $TD^1(z)$ curves under the assumption of $\gamma = 1$. Figure 6 demonstrates that the $TD_{SA}^1(z)$ curve is always above the $TD_{EI}^1(z)$ curve for the poverty line

with a range of [0, 13216.570] and two curves cross at $\hat{z}_T^1 = 14722.277$. The standard error of the sampling distribution of $\hat{z}_T^1$ is 226.599. On the basis of Proposition 2, the following conclusion holds: *under the 95% confidence level, it is first-order poverty dominant to increase the funding of SA by the same amount and decrease the funding of EI by the same amount for any choice of poverty line below* $z^1(1)=14278.143$.

The value of critical poverty line should be 22597.664 for $\gamma = 0.5$ and 11399.480 for $\gamma = 1.5$ respectively.

In brief, SA is not only a better targeted program but also performs well in proportional reforms, compared with the EI. For this reason, in order to achieve poverty reduction, a policy maker should choose to increase the funding in SA and decrease the funding in EI.

Old Age Security (OAS) versus Social Assistance (SA)

Now I focus on the $PD^1_{OAS}(z)$ and $PD^1_{SA}(z)$ curves. Again assume $\gamma = 1$. Given Figure 7, two $PD^1(z)$ curves cross at $\hat{z}_P^1 = 13103.118$, which is the first-order critical poverty line. The standard error is 144.428. So a 95% confidence interval for the true value $z^1(1)$ would be [12820.039,13386.197]. Based on Figure 7 and Proposition 1, we summarize that *for all choice of poverty line up to* $z^1(1)=12820.039$, *it is first-order poverty dominant to decrease proportionately the transfer on OAS in order to subsidize SA.*

Now observe the "lump-sum" program changes measured by $TD^1(z)$ curves. The point of intersection for two $TD^1(z)$ curves is $\hat{z}_T^1 = 13644.267$ and the standard error is estimated to be 132.329. Thus, *if there is no differences of the economic efficiency ratio*

between two programs, the government is 95% sure that injecting by the same amount the resources into SA at the expense of OAS can reduce poverty for all poverty indices belongs to $\Pi^1(z)$ *and for all ranges of poverty line up to* $z^1(1)=13384.902$.

The critical poverty lines under different economic efficiency ratio are provided in Table 1. For $PD^1(z)$ curves, $z^1(\gamma)$ is equal to 14744.273 for $\gamma = 0.5$, 12238.192 for $\gamma = 1.5$, respectively. And for $TD^1(z)$ curves, $z^1(\gamma)$ is equal to 16032.502 for $\gamma = 0.5$, 12685.548 for $\gamma = 1.5$, respectively.

The analysis above provides the following results: supporting the SA program rather than the OAS program is good for poverty reduction.

4.2.2 Second-order poverty dominance

The second-order dominance cares about the "distribution sensitive" poverty indices. So policy makers will transfer resources from richer individual to poorer individual.

Employment Insurance (EI) versus Old Age Security Benefit (OAS)

Assume $\gamma = 1$. In Table 1, the value of critical poverty line is $\hat{z}_P^2 = 46810.379$ with a standard error of 4552.819. The $PD_{EI}^2(z)$ curve is always above the $PD_{OAS}^2(z)$ curve in Figure 8. Two $PD^2(z)$ curves cross at point $\hat{z}_P^2 = 46810.379$ which is not show in the Figure. Consequently, *a policy maker should increase proportionately the resource inject into EI and reduce proportionately the resource into OAS for a range of poverty line up to* $\hat{z}_P^2$*=46810.379 and for all poverty indices belongs to* $\Pi^2(z)$.

It is notable that the range of feasible poverty line is larger than the range for s=1 and the poverty indices obey the "Pigou-Dalton" principle of transfer.

While $PD^2(z)$ curves measures the cumulative share of program benefits by individual with income equal to z or less, the $TD^2(z)$ curves gives the proportion of the population that benefit from the program with income equal or below z.

Figure 9 exhibit that in the second-order dominance EI is still better targeted than OAS since the $TD^2_{EIC}(z)$ curve is above the $TD^2_{OAS}(z)$ curve and the cross point cannot seen in the Figure. The critical poverty line for $\gamma = 1$ is $\hat{z}^2_T = 137894.125$. Hence, *it is second-order poverty dominant to increases by the same amount the income of all recipients of EI and decreases by the same amount the income of all recipients of OAS for all poverty lines up to* $\hat{z}^2_T$*=137894.125.*

The value of economic efficiency ratio still influences the critical poverty lines when s=2. For second-order dominance, there is no critical poverty line for $\gamma = 0.5$. The absence of $z_2(\gamma)$ for both $PD^2(z)$ and $TD^2(z)$ curves shows that $PD^2_{EIC}(z)$ and $PD^2_{OAS}(z)$ do not intersect, $TD^2_{EIC}(z)$ and $TD^2_{OAS}(z)$ do not intersect. When γ increase to 1.5, the value of critical poverty line exists. The critical poverty line is $z^2(1.5) = 14943.202$ (with a standard error of 1210.874) for $PD^2(z)$ curves and is $z^2(1.5) = 16597.002$ (with a standard error 1169.644) for $TD^2(z)$ curves.

Consequently, EI is better targeted in the second-order dominance. Besides, increase the resource injected into EI and decrease the resource injected into OAS can reduce poverty. However, in the second-order, the poverty indices obey the "Pigou-Dalton" principle of transfer. Findings obtained in s=1 become stronger when s=2.

Employment Insurance (EI) versus Social Assistance (SA)

$PD^2_{SA}(z)$ is always located above the $PD^2_{EIC}(z)$ and intersection are not show in Figure 10. The critical poverty line is $\hat{z}^2_P$=200808.813 (with a standard error of 6.605) for $\gamma = 1$ and s=2. In conclusion, *enhance the funding to SA proportionately and cut off the funding to EI proportionately will decrease poverty for all "distribution-sensitive" poverty indices and for all poverty line up to* $\hat{z}^2_P$*=200808.813.*

The $TD^2_{SA}(z)$ curve is also everywhere above the $TD^2_{EIC}(z)$ curve with an intersection point at $\hat{z}^2_T$=200808.813 for $\gamma = 1$. Then there is no doubt that SA behaves well in targeting than EI. In a word, *add transfer to SA by the same amount and reduce the transfer to EI by the same amount is second-order poverty dominant for all poverty lines below* $\hat{z}^2_T$*=200808.813.*

Observing Table 2, when s=2, the critical poverty lines do not exist for $PD^2(z)$ curves and $TD^2(z)$ curves for $\gamma = 0.5$. It dues to the non-intersect of the curves. However, for $\gamma = 1.5$ the critical poverty lines for $PD^2(z)$ curves is $\hat{z}^2_P$=18044.719 (with a standard error of 775.490) and is $\hat{z}^2_T$=17724.809 (with a standard error 926.624) for $TD^2(z)$ curves.

Comparing with the first-order poverty dominance, I find that the impact of program reforms for s=1 is enhanced in the second-order poverty dominance.

Old Age Security (OAS) versus Social Assistance (SA)

In Figure 12, $PD^2_{SA}(z)$ is everywhere above $PD^2_{OAS}(z)$, two PD curves cross at the point $\hat{z}^2_P = 197833.875$ with a standard error of 1.77,. This is the critical poverty line for $\gamma = 1$ and this point is not shown in the Figure. Hence, *a marginal policy reform that increase proportionately the funding of SA and decrease proportionately the funding of OAS can*

reduce poverty for all poverty indices $P(z) \in \Pi^2(z)$ *and for all poverty lines up to* $\hat{z}_P^2$*=197833.875.*

Coincidently, two TD^2 (z) curves also cross at $\hat{z}_T^2 = 197833.875$ with a standard error of 1.120. $TD_{SA}^2(z)$ is everywhere above $TD_{OAS}^2(z)$ in Figure 12. For this reason, *a "lump-sum" marginal policy reform that enhances the transfer on SA by the same amount and downsizes the transfer on OAS by the same amount is second-order poverty dominant for any choice of poverty line up to* $\hat{z}_T^2$*=197833.875.*

Table 3 illustrates that when $\gamma = 0.5$ the critical poverty lines for the PD^2 (z) and TD^2 (z) curves do not exist. For $\gamma = 1.5$, the critical poverty line is equal to 20073.809(with a standard error of 530.992) for PD^2 (z) curve and 22068.645(with a standard error of 635.893) for TD^2 (z) curve respectively.

4.2.3 Third-order poverty dominance

The third-order poverty indices respect to the "transfer-sensitive" principle of transfer. According to Duclos and Arrar (2006) it will reduce poverty if a policy maker transfer the money from poor to poorer at lower part of distribution and transfer from rich to richer from upper part.

Employment Insurance (EI) versus Old Age Security Benefit (OAS)

Figure 13 demonstrates that two PD^3 (z) curves do not cross when $\gamma = 1$. And the $PD_{EI}^3(z)$ curve is always above the $PD_{OAS}^3(z)$ curve. Therefore, *government can reduce*

poverty for all poverty indices belongs to $\Pi^3(z)$, *if he increase proportionately the transfer to EI and decrease proportionately the transfer to OAS for any reasonable choice of poverty line.*

Now let us pay attention to the third-order TD curves. $TD^3_{EI}(z)$ is still above the $TD^2_{OAS}(z)$ as they are in the first-order dominance and second-order dominance. Two curves do not cross. *For this reason, a "lump-sum" marginal policy reform that provides a subsidy for EI by the same amount and decreases the funding for OAS by the same amount is third-order poverty dominant for all poverty lines.*

Table 1 gives the critical poverty line $z^3(\gamma)$ for s=3 based on different economic efficiency cost. When $\gamma = 0.5$ critical poverty line for both PD and TD curves do not exist due to two $PD^3(z)$ curves do not cross and so does two $TD^3(z)$ curves. When $\gamma = 1.5$, $z^3(1.5) = 19560.229$ (with a standard error of 650.628) for PD curves and $z^3(1.5)$ is equal to 23161.758 (with a standard error of 684.485) for TD curves.

As previously mentioned, some of the findings obtained for s=1 become stronger when s=2. Obviously, the findings for s=3 become even stronger than the findings for s=2.

Employment Insurance (EI) versus Social Assistance (SA)

In Figure 15, the $PD^3_{SA}(z)$ curve is above the $PD^3_{EI}(z)$ curve, no critical poverty line exist since two curves to do cross. So under the condition that two programs have the same economic efficiency cost, *it is third-order poverty dominant to inject proportionately more transfers into SA at the cost of EI, for any reasonable choice of poverty line.*

Two $TD^3(z)$ curves also do not intersect and $\hat{z}^3_T(1)$ do not exist for $\gamma = 1$. Thus

considering the "lump-sum" program reforms, the SA has better target behave than EI. *Increase by the same amount the income of all recipients of SA and decrease by the same amount the income of all recipients of EI will reduce poverty for all poverty indices* $P(z) \in \Pi^3(z)$ *and for all poverty lines.*

Now I examine cases when $\gamma \neq 1$. For $\gamma = 0.5$ the critical poverty line for PD curves should be inexistence and for $\gamma = 1.5$ the critical poverty line is equal to 29004.193 (with a standard error of 916.357). The critical poverty line for TD curves should be inexistence when $\gamma = 0.5$. However when γ increases to 1.5 the critical poverty line should be $\hat{z}_T^3(1.5)$=28388.654 (with a standard error of 856.699).

Old Age Security (OAS) versus Social Assistance (SA)

The conclusion we get from second-order dominance becomes more remarkable in third-order. As shown in Figure 17, the $PD_{SA}^3(z)$ curve is everywhere above the $PD_{OAS}^3(z)$ curve and no point of intersection exists. Consequently, *the marginal program reforms that increase the transfer to SA in the same proportion and decrease the transfer to OAS in the same proportion is third-order poverty dominant for all range of poverty lines.*

Clearly, SA is better targeting than OAS since the $TD_{SA}^3(z)$ curve is over the $TD_{OAS}^3(z)$ curve for any choice of poverty line and no intersection exist. Therefore, we get the same conclusion as in the second-order but without the restriction of poverty line. The conclusion is as follows: *a "lump-sum" marginal program reform that add more transfers for SA by the same amount and cut off transfers for OAS by the same amount can reduce poverty for all poverty indices belongs to* $\Pi^3(z)$ *and for all poverty lines.*

4.3. Further analysis

As discussed in the methodology section, there are three types of program reforms: "proportional" program reforms measured by PD curves, "lump-sum" program reforms measured by TD curves and "allocative" program reforms measured by AD curves. We analyze first two types in this paper.

For the purpose of the poverty-reduction, two approaches can be utilized no matter policy makers choose "proportional" program reforms or "lump-sum" program reforms. One is to decrease the transfer of EI in order to increase the transfer of SA. Another is to decrease the transfer of OAS and increase the transfer of SA. I also reach that no matter the policy makers adopt the "proportional" program reforms or the "lump-sum" program reforms, increase the transfer to EI and decrease the transfer to OAS is poverty dominant. It is notable that with the order of dominance increases, same conclusions hold and become stronger.

Based on the background of these programs, I can reinterpret these conclusions. Firstly, EI is better at targeting than OAS because EI gives more attention to individuals who are below the poverty line. The target of EI is the involuntary unemployment. They are truly low income individuals since they have no salary. For those who lose their jobs because of sickness, pregnant and for those who must take care of ill family members, the expenditure is much higher than for normal families. They are low income individuals or families as well.

However, seniors are the target of the OAS. Not all the segments of this program are based on the income of the beneficiaries. For example, in the OAS pension, the beneficiaries are seniors at 65 years of age and over. The employment status of these beneficiaries is not taken into consideration. Even seniors that are not retired can also get the benefits. In this case,

some high income seniors may get benefits from this transfer. Even the OAS pension is taxable beyond certain income level and other parts of the OAS Program also have conditions on income limit. It cannot be denied that EI is better targeting than OAS. The good targeting rule can provide a good basis for "lump-sum" program reforms.

EI is also a better program for "proportional" reforms compared with OAS when s=1,2,3. The superiority of EI is that benefits recipients in EI are individuals at working age, assistant them when they temporary lose their jobs can encourage them back into the labour market. Having a job is the best way to reduce the poverty. Not only that, decrease the unemployment and increase the employment promote the development of economy which may not directly reduce the poverty but have significant impact on poverty reduction. Besides, "proportional" program reform will not change the relative distribution of benefits.

The targeting performance of SA is better than OAS. The target of SA is low income groups. For instance, the single-parent family is supported by SA. Generally speaking, individuals in this group need to pay a large numbers of expenses in supporting children and their family income comes from the salary of only one individual not two as the case in normal families. Hence, single-parent families are mostly low income families. The disabled also get assistance from this program. In most case, individuals in this group have lower income than the general level, due to their incompetence. Many other low income groups are supported by SA as well. However, as we mentioned before, OAS only pays attention to seniors and may offer financial assistance to some high income seniors.

SA is better target than EI as well. The reason is EI only targeting on the unemployment. But SA focuses not only on unemployment but also many other groups below the poverty line.

Consequently, SA performs well in targeting than EI.

Compared with EI and OAS, SA is a better program in "proportional" reforms for s=1,2,3. EI only offers financial assistance to unemployment and OAS only offers financial helps to seniors. However SA offer helps to large ranges of groups including unemployment and seniors. Note that SA helps unemployment not only by offering income supports to employable low-income individuals but also by offering some services that promote them entry or re-entry into the labour force. Once they entry the labour market, their income increase and the economy may also growth due to the increases in the labour force. All these consequences impact the poverty reduction significantly. Besides, SA considers seniors who are ineligible for OAS.

Furthermore, persons with multiple barriers to employment, single-parent families and post-secondary students are supported by SA as well. People belonging to first two groups can be regarded as employable individuals, and supporting them can have positive impact on poverty-reduction. By excluding the effect in reducing poverty, assist post-secondary students will also have a positive impact on human capital.

In conclusion, a "proportional" program reform that increases the transfer to SA and decreases the transfer to EI is poverty dominant. And a "proportional" program reform that increases the transfer to SA and decreases the transfer to OAS is poverty dominant as well.

5. Conclusion

This paper tries to use graphical tools to assess the poverty dominant marginal program

reforms. PD curves focus on public spending on programs and measure the "proportional" program reforms. TD curves focus on who benefits from the program and measure the "lump-sum" program reforms. AD curves focus on the allocation between benefits recipient in a single program which are not talk in this paper. PD curve is composed by TD curve and AD curve. Different orders of dominance represent the poverty indices obey different principles of transfer. Different values of economic efficiency ratio influent the critical poverty line.

This paper applies these tools to analyze three programs in Canada. Three suggestions on reforming these programs are given in this paper, so as to help the policy makers to better reduce the poverty. First, I suggest policy makers to apply program reforms that increase the transfer for Employment Insurance Program at the expense of Old Age Security Program. Second, I suggest them to increase the transfer for Social Assistance Program and decrease the transfer for Employment Insurance Program. My third suggestion is to inject more resources into Social Assistance Program at the expense of Old Age Security Program. Policy makers can use either "proportional" program reform or "lump-sum" program reform. The reforms are based on not only the overall performance but also targeting performance of the program.

Appendix

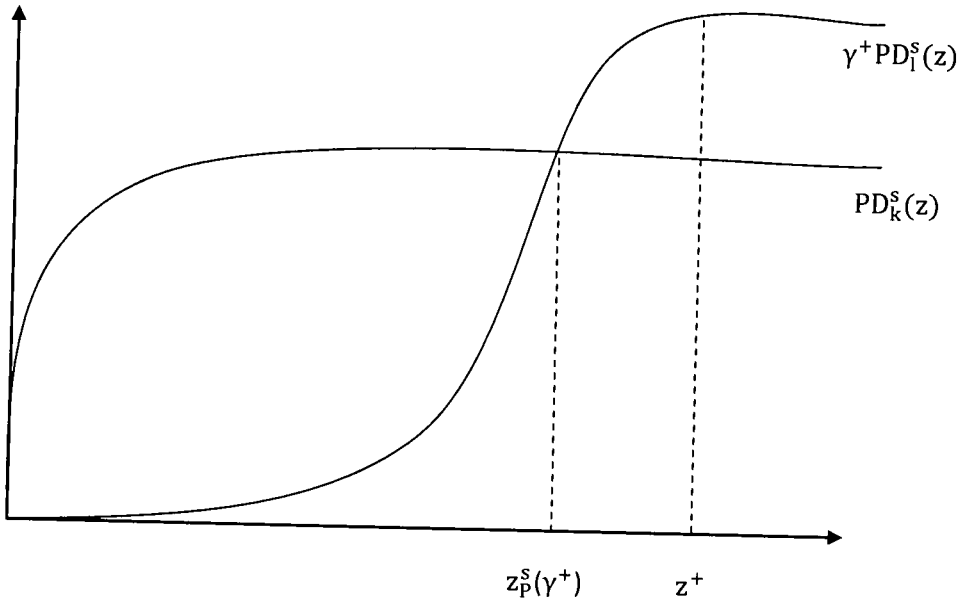

Figure 1 . PD curves and critical poverty line

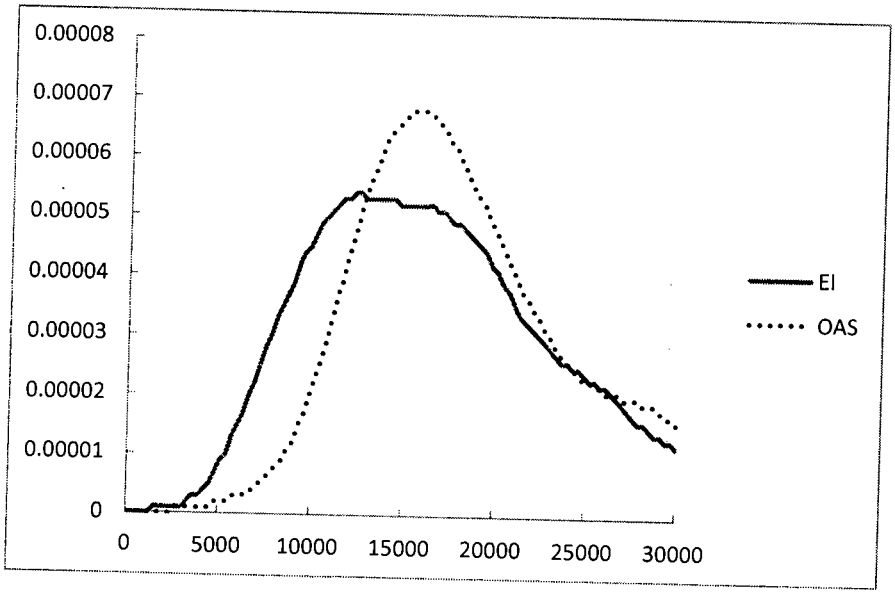

Figure 2 . PD curves for EI and OAS, s=1

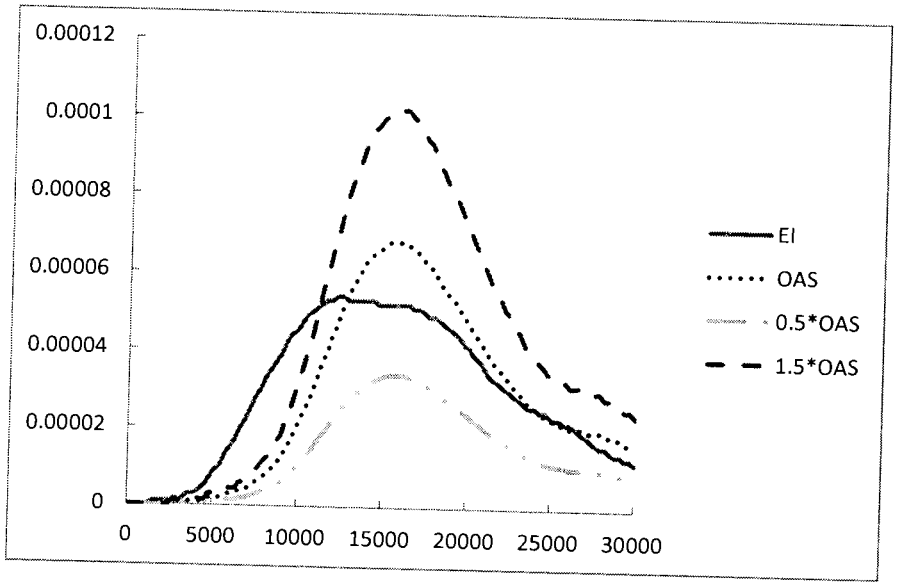

Figure 3. PD curves for EI and OAS, s=1 and γ=0.5, 1, 1.5

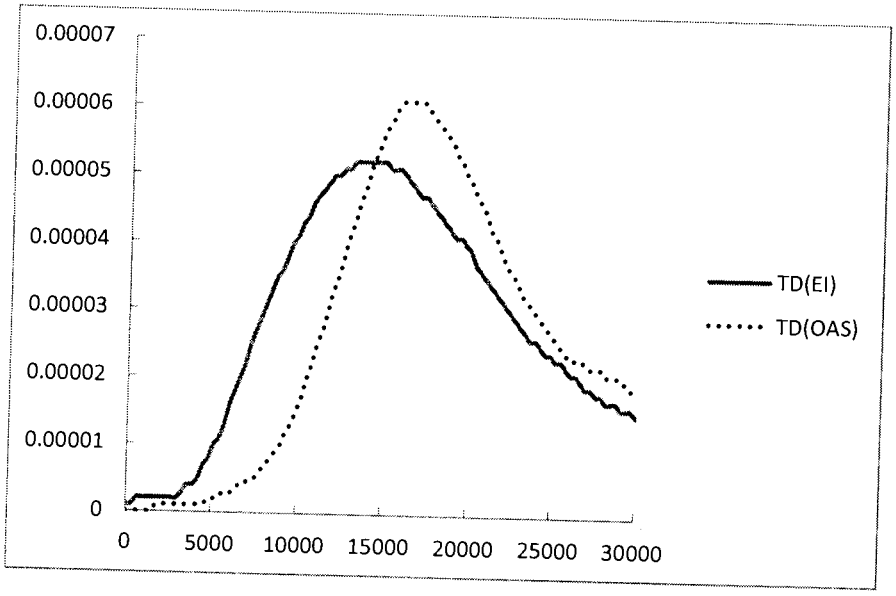

Figure 4. TD curves for EI and OAS, s=1

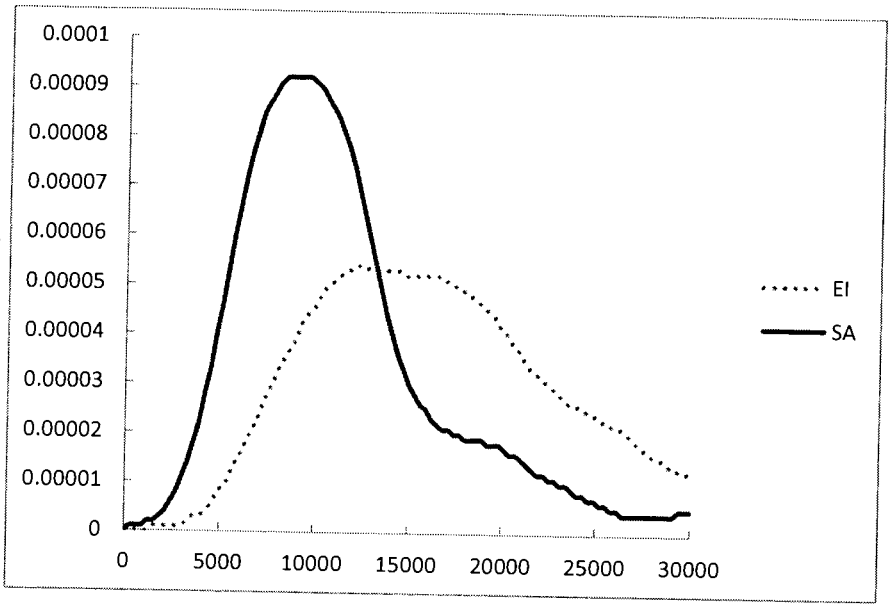

Figure 5 . PD curves for EI and SA, s=1

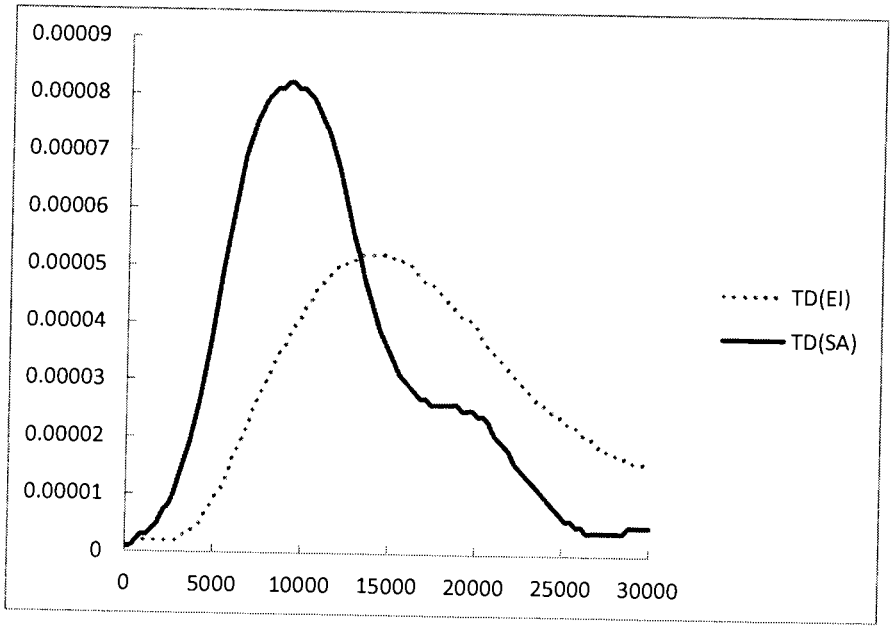

Figure 6 . TD curves for EI and SA, s=1

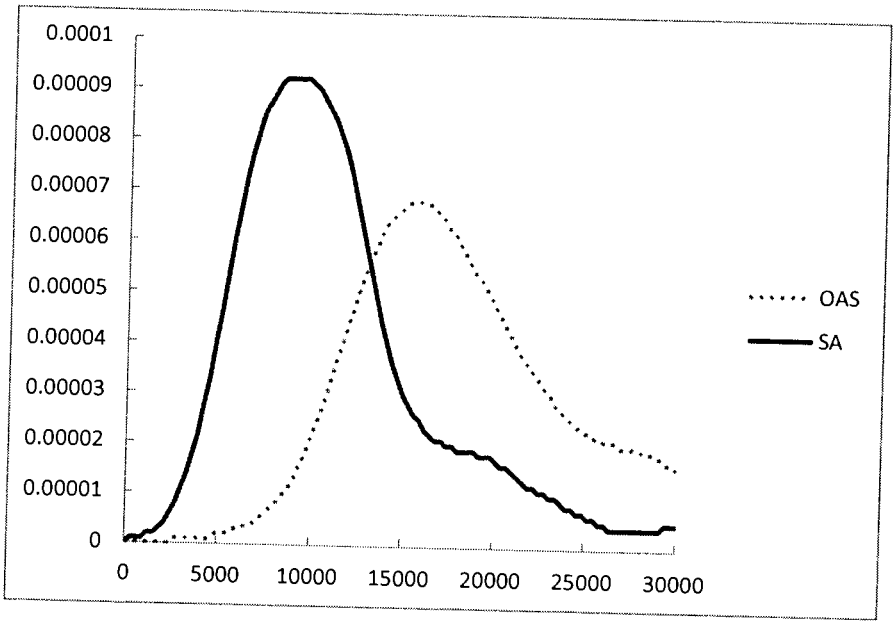

Figure 7. PD curves for OAS and SA, s=1

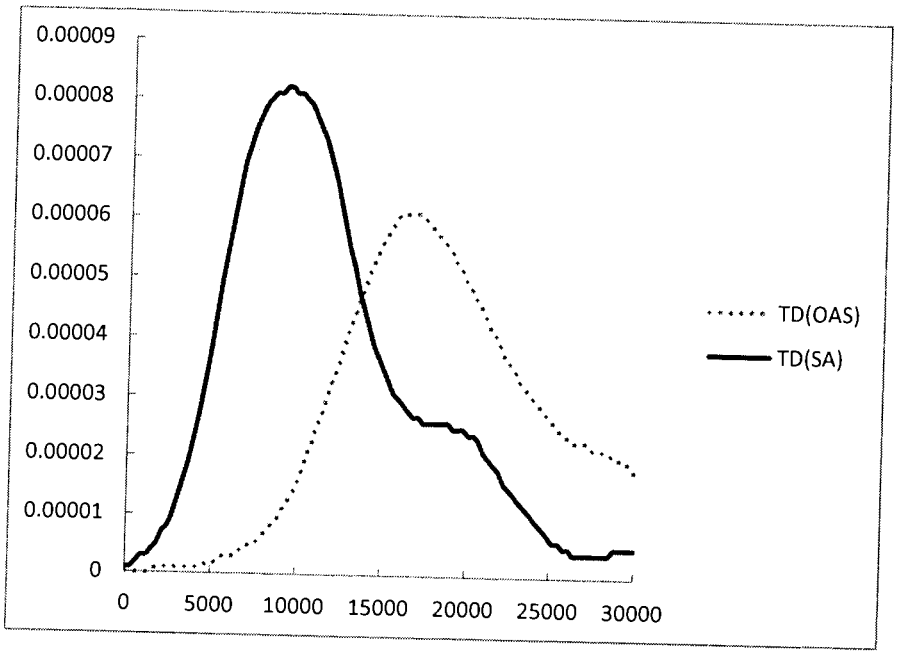

Figure 8. TD curves for OAS and SA, s=1

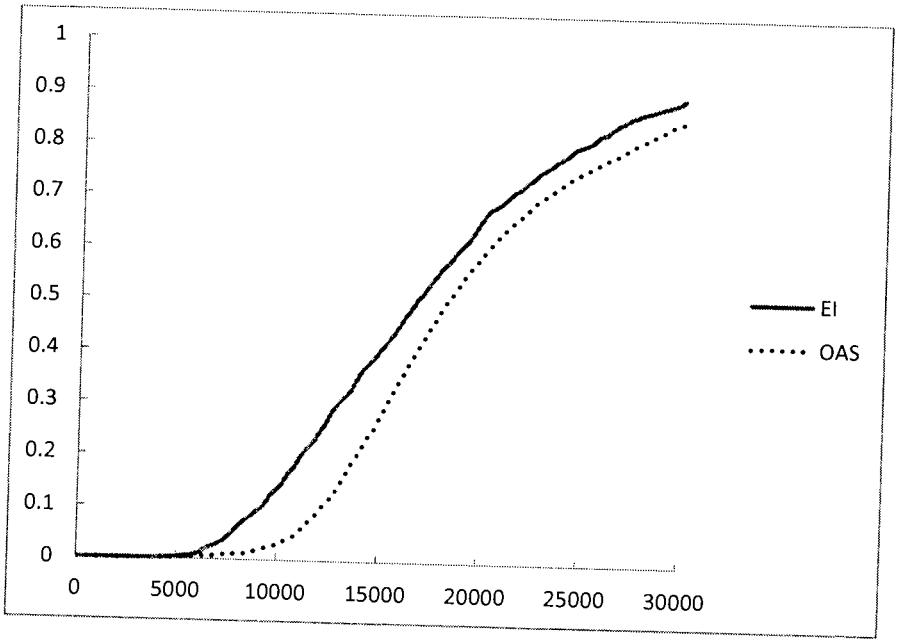

Figure 9 . PD curves for EI and OAS, s=2

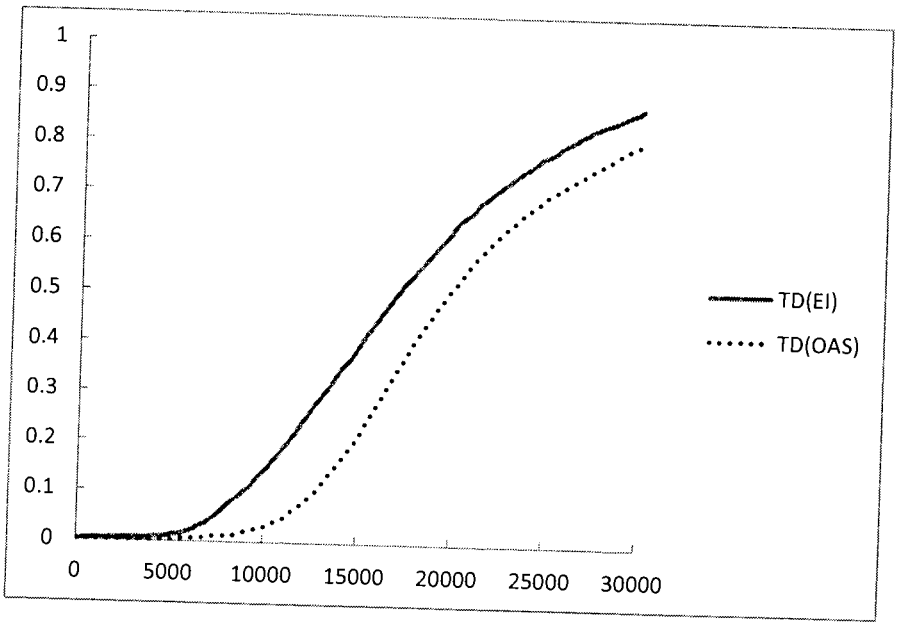

Figure 10 . TD curves for EI and OAS, s=2

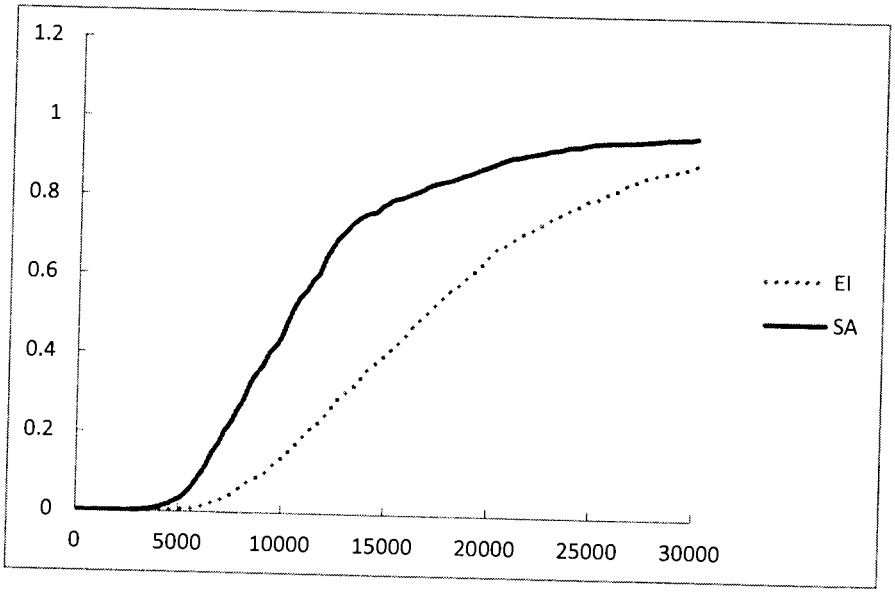

Figure 11 . PD curves for EI and SA, s=2

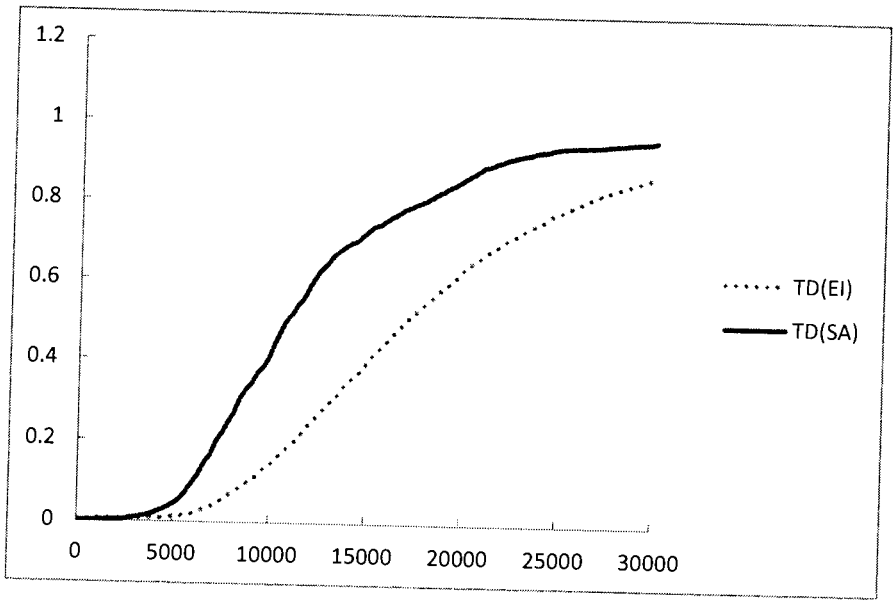

Figure 12 . TD curves for EI and SA, s=2

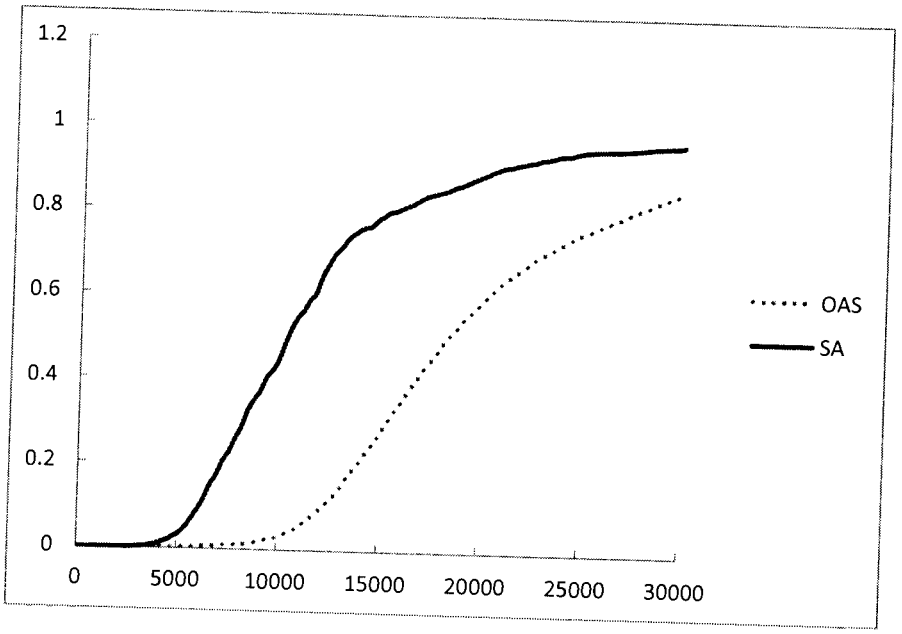

Figure 13 . PD curves for OAS and SA, s=2

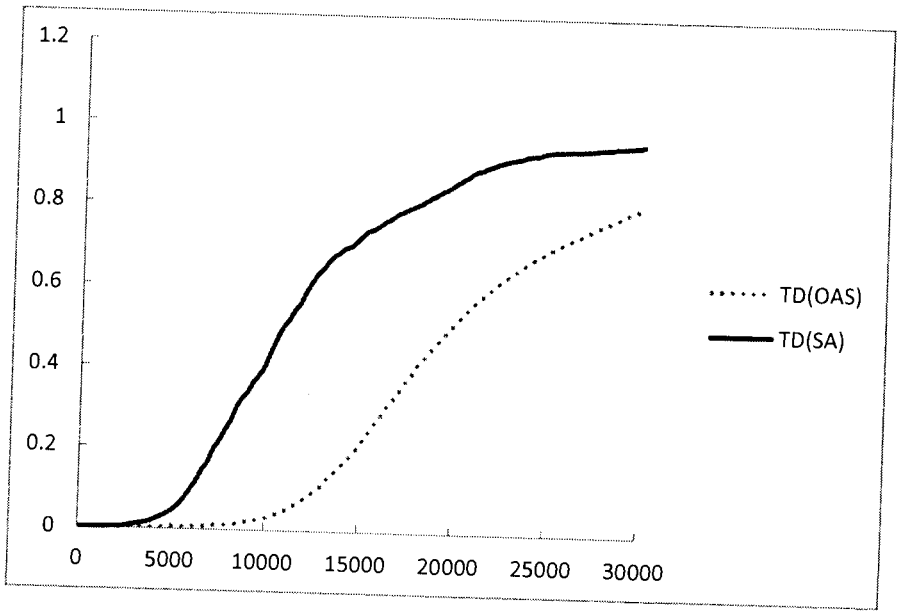

Figure 14 . TD curves for OAS and SA, s=2

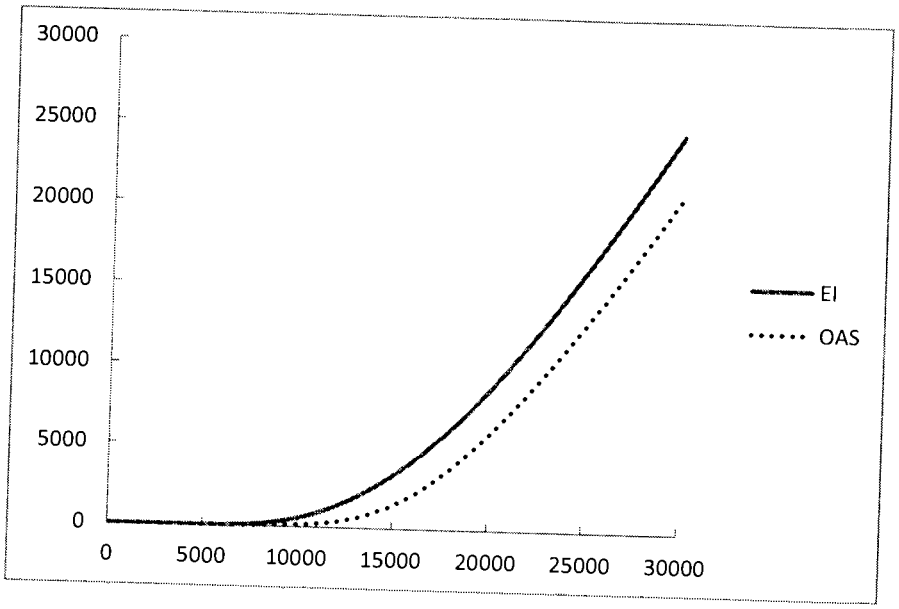

Figure 15. PD curves for EI and OAS, s=3

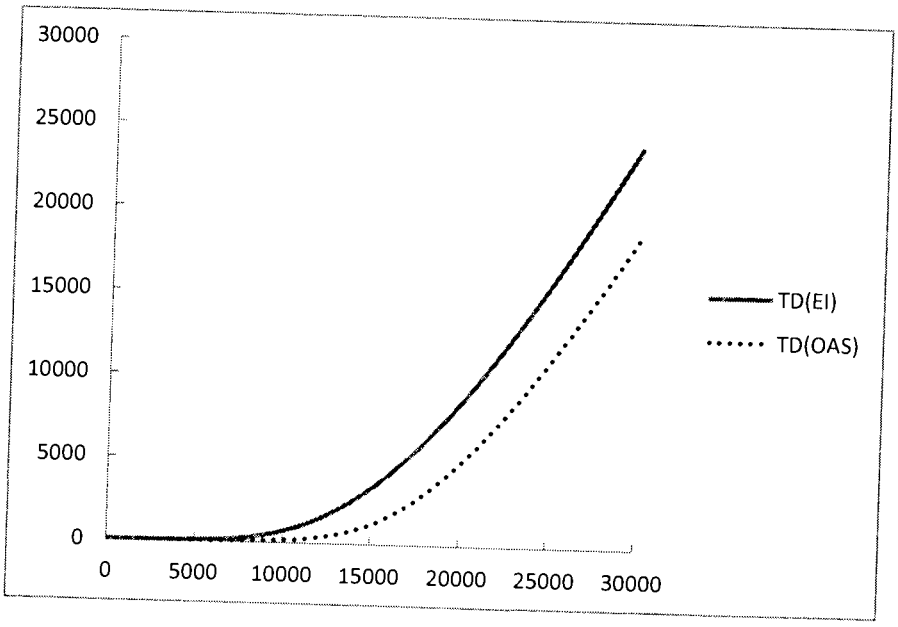

Figure 16. TD curves for EI and OAS, s=3

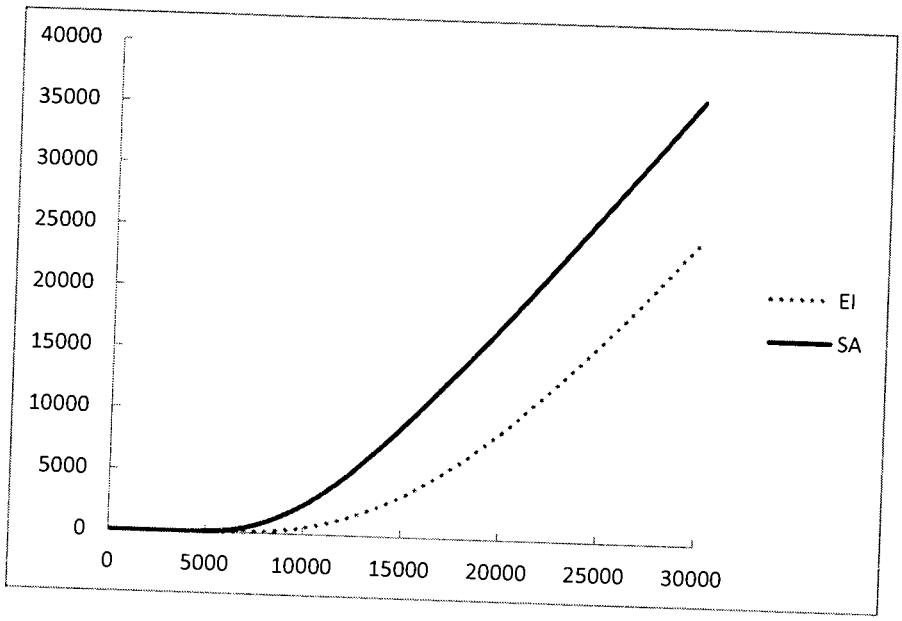

Figure 17. PD curves for EI and SA, s=3

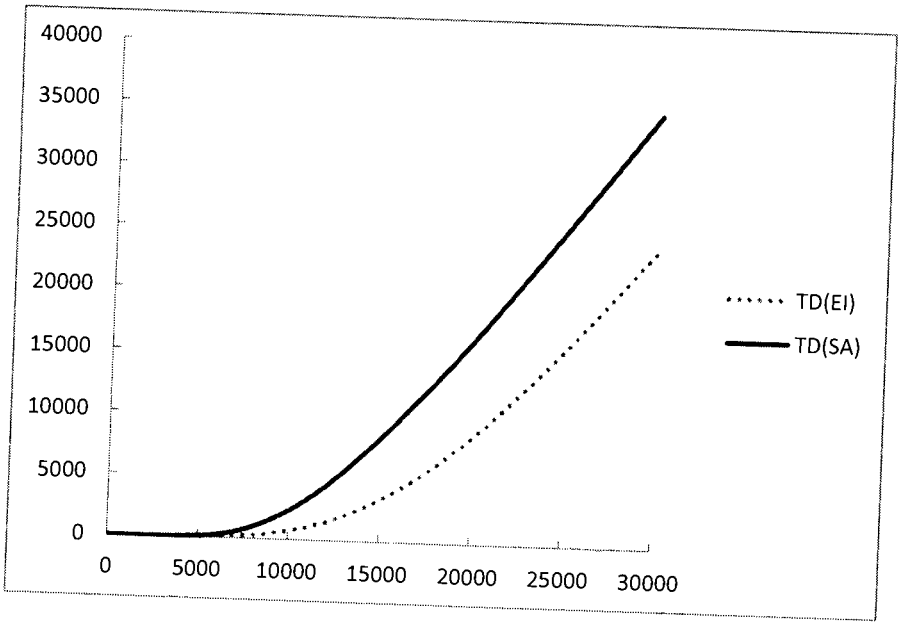

Figure 18. TD curves for EI and SA, s=3

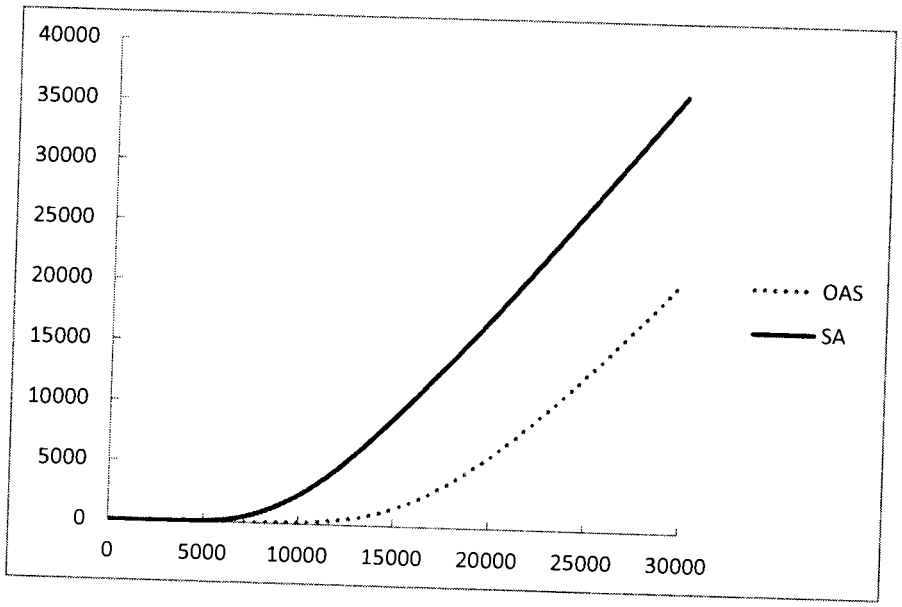

Figure 19 . PD curves for OAS and SA, s=3

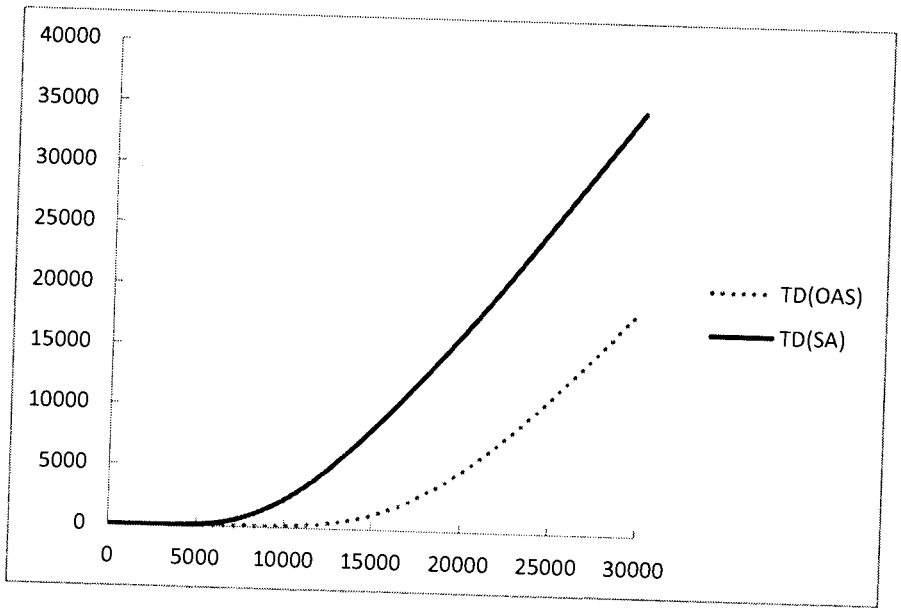

Figure 20 . TD curves for OAS and SA, s=3

Table 1. *Critical poverty line* $z^s(\gamma)$ *for different ratios of economic efficiency costs* γ *and for different orders of dominance s (EI VS OAS).*

	$\gamma = 0.5$	$\gamma = 1.0$	$\gamma = 1.5$
Program dominance(PD) curves			
$z_P^1(\gamma)$	54776.000	12890.993	11159.007
	(552.644)	(289.054)	(223.462)
$z_P^2(\gamma)$	-	46810.379	14943.202
	-	(4552.819)	(1210.874)
$z_P^3(\gamma)$	-	-	19560.229
	-	-	(650.628)
Targeting dominance(TD) curves			
$z_T^1(\gamma)$	45598.809	14285.417	12084.293
	(2041.010)	(300.261)	(217.246)
$z_T^2(\gamma)$	-	137894.125	16597.002
	-	(57719.077)	(1169.644)
$z_T^3(\gamma)$	-	-	23161.758
	-	-	(684.485)

Table 2. *Critical poverty line* $z^s(\gamma)$ *for different ratios of economic efficiency costs* γ *and for different orders of dominance s (EI VS SA).*

	$\gamma = 0.5$	$\gamma = 1.0$	$\gamma = 1.5$
Program dominance(PD) curves			
$z_P^1(\gamma)$	15813.569	13241.600	11555.272
	(528.131)	(255.336)	(364.509)
$z_P^2(\gamma)$	-	200808.813	18044.719
	-	(6.605)	(775.490)
$z_P^3(\gamma)$	-	-	29004.193
	-		(916.357)
Targeting dominance(TD) curves			
$z_T^1(\gamma)$	22597.664	13216.570	11399.480
	(603.648)	(226.599)	(265.882)
$z_T^2(\gamma)$	-	200808.813	17724.809
	-	-	(926.624)
$z_T^3(\gamma)$	-	-	28388.654
	-	-	(846.699)

Table 3. *Critical poverty line* $z^s(\gamma)$ *for different ratios of economic efficiency costs* γ *and for different orders of dominance s (OAS VS SA).*

	$\gamma = 0.5$	$\gamma = 1.0$	$\gamma = 1.5$
Program dominance(PD) curves			
$z_P^1(\gamma)$	14744.273	13103.118	12238.192
	(218.610)	(144.428)	(137.956)
$z_P^2(\gamma)$	-	197833.875	20073.809
	-	(1.776)	(530.992)
$z_P^3(\gamma)$	-	-	36779.996
	-	-	(723.144)
Targeting dominance(TD) curves			
$z_T^1(\gamma)$	16032.502	13644.267	12685.548
	(420.956)	(132.329)	(117.567)
$z_T^2(\gamma)$	-	197833.875	22068.645
	-	(1.12)	(635.893)
$z_T^3(\gamma)$	-	-	40319.621
	-	-	(727.952)

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