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# RETIREMENT SAVING AND PUBLIC PENSIONS IN CANADA

by

Kamal Dib

UNIVERSITÉ D'OTTAWA

FACULTÉ DES SCIENCES SOCIALES

DÉPARTEMENT DE SCIENCE ÉCONOMIQUE

UNIVERSITY OF OTTAWA

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

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## Introduction

This paper makes the argument that there is a public policy rationale for public pensions in Canada. Currently, individuals rely on private and public pension plans to finance their retirement years. We start by presenting the optimal conditions for intertemporal consumption path in a two-period model, in a life-cycle model, and in an intergenerational model. These models will provide us with the behavioural assumptions about a rational individual who wants to maximize his utility over two periods, a lifetime utility approach and a dynastic utility approach.

After the presentation of the optimal conditions, the argument flows in two directions. On the micro level we discuss the failure of the markets for life insurance, and then we discuss public provision of retirement income, and its impact on the macro indicators, such as aggregate savings, labour supply, retirement decisions and income distribution. The analysis takes place in a Canadian context, where we study actual public provisions of retirement income and their impact.

In Canada there are private and public pensions. For instance, the Employer Sponsored Pension Plans (ESPPs) have existed for more than 100 years. Their growth in the past forty years is phenomenal. Government-sponsored pensions such as Old Age Security (OAS), Guaranteed Income Supplement (GIS) and Canada and Québec Pension Plans (CPP, QPP) are more recent.

Pension incomes are deferred earnings. A pension system, considered as part of the actual wage of an employee, is in fact paid by her in foregoing an increase in wages which she might have obtained except for the establishment of a pension system in the private sector, or through payment of taxes towards Canada Pension Plan.

## 1. Efficiency Conditions in an Intertemporal Economy

The individual worker decides in a perfect labour market how to allocate his total earnings between current and deferred components in order to maximize his utility (U) over a lifetime, by consuming bundles ($C_o$, $C_1$, ..., $C_T$) of goods and services. Without loss of generality, it is assumed that this individual makes his retirement decision at some specific age. He behaves as if he had T years to live. He earns income $Y_t$ in each time period until retirement, and then he receives pension income. His welfare over a lifetime is based on deriving utility from the consumption of C, $U(C_t)$. Utilities are assumed separable. The utility derived from $C_t$ today is separate from the utility we get from $C_t$ tomorrow.

The worker can delay the consumption of his output until future periods, thus storing its value most probably through money or through other means. Unlike true consumer goods that are bought for instantaneous consumption, the portion of consumption saved for later periods is frozen in a form of an asset. This representative individual may hold his assets in money, government bonds of different types and

maturities, equities in private enterprises, savings and loan association shares, and physical and human capital such as a house or an education. This view has been developed along lines suggested by Hicks (1935). The individual has to allocate his personal wealth among a range of assets, e.g., consumer goods, C, and capital goods, K. Choosing the amount of each asset to be held over the period, the individual is limited by the wealth constraint $\bar{W}_t = C_t + K_t$ in each period.

The objective now is to maximize the return on this wealth over the period for which the decision is being made. Households choose the proportions of their wealth to be held in the form of C and K respectively by weighing the relative return on each. This depends on the relative rates of interest (r) and the rate of time preference ($\rho$) (Turvey, 1960).

The rate of interest reflects the rate of intertemporal substitution of present for future consumption. For a rate of interest, r, the individual can substitute 1 + r dollars in the next period for one dollar now, and the higher the interest rate, ceteris paribus, the lower will be the level of present consumption relative to future consumption*. This tendency is somewhat offset by the rate of time preference, $\rho$. The greater the premium placed upon present consumption relative to future consumption the higher will be present relative to future consumption.

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* For a discussion on the theory of interest, see Irving Fisher, 1930.

An individual consumption in a given period can, within the limits of the constraint, exceed income in that same period either by borrowing against future income or by spending saved income and interest from a prior time period (e.g., from a funded pension plan). The behaviour is explained by examining economic activity taking place over two periods of time, $t_o$ and $t_1$, with two normal commodities, present consumption, $C_o$, and future consumption, $C_1$. This individual's income is $Y_o$ in period 0, and $Y_1$ in period 1. The individual's objective function and budget constraint are:

$$\text{Max } U = U(C_o, C_1) \qquad (1)$$

$$\text{s.t. } C_o + C_1(1 + r)^{-1} = Y_o + Y_1(1 + r)^{-1}$$

The objective function is the consumer's present evaluation of the consumption patterns $(C_o, C_1)$. The consumer's preference could be represented by an indifference curve, whose slope is the marginal rate of substitution of present for future consumption, MRS. Along the 45° line $C_o$ and $C_1$ are equal. In this case the term 1/MRS - 1 is often called the rate of time preference ($\rho$) since it is the proportionate increase in consumption in the future that is required to compensate for a given reduction in consumption now. It indicates the premium that the individual places on present consumption over future consumption because of the time factor alone as shown in figure 1.

On the production side, a production possibility curve between $C_o$ and $C_1$ indicating the rate at which future consumption goods could be produced by abstaining from present consumption. Resources which could

otherwise have been used to produce consumption goods are instead invested to produce consumption goods at some future date. The slope of the production possibility curve at any point is the marginal rate of transformation, MRT, the rate at which $C_1$ could be transformed into $C_o$ at the margin. The conditions for Pareto optimality then are:

$$MRS = MRT \quad \text{or} \quad \Delta C_o/\Delta C_1 = MU_1/MU_o$$

Perfect markets ensure that a Pareto optimal allocation of resources can be achieved in an intertemporal economy. In particular, this requires perfect capital markets, which allow firms and consumers to lend or borrow as much as they desire in the present period, at the market rate of interest, r. Our individual can choose any pattern of present and future consumption that satisfies his budget constraint. The budget constraint (2) shows that the present value of a two-period consumption must equal the present value of a two-period income, discounted at the interest rate, r. The budget line is represented by the line AB, with the slope $(1 + r)^{-1}$. The consumer maximizes his utility over the two periods by choosing the point on the budget line at which his indifference curve is tangential to the budget line:

$$MRS = (1 + r)^{-1}.$$

Rearranging the constraint in (1) we obtain:

$$C_1 = Y_1 + (Y_o - C_o)(1 + r) \qquad (2)$$

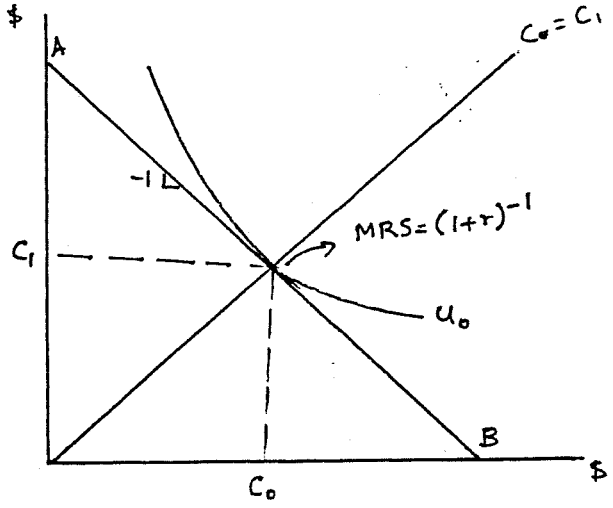
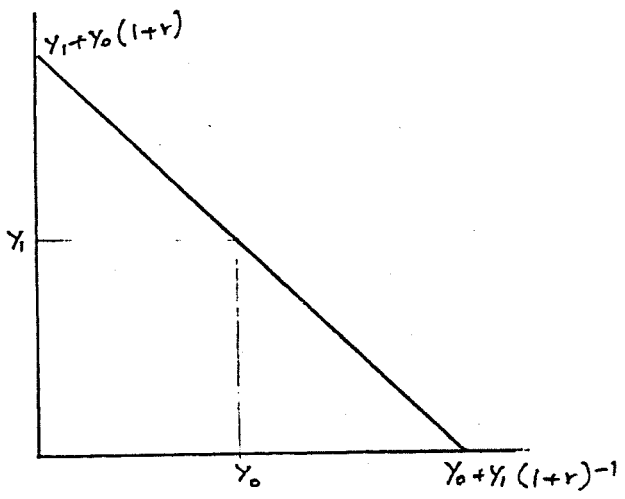



Figure 1 Optimal Consumption Choice overtime.




The Consumption Constraint

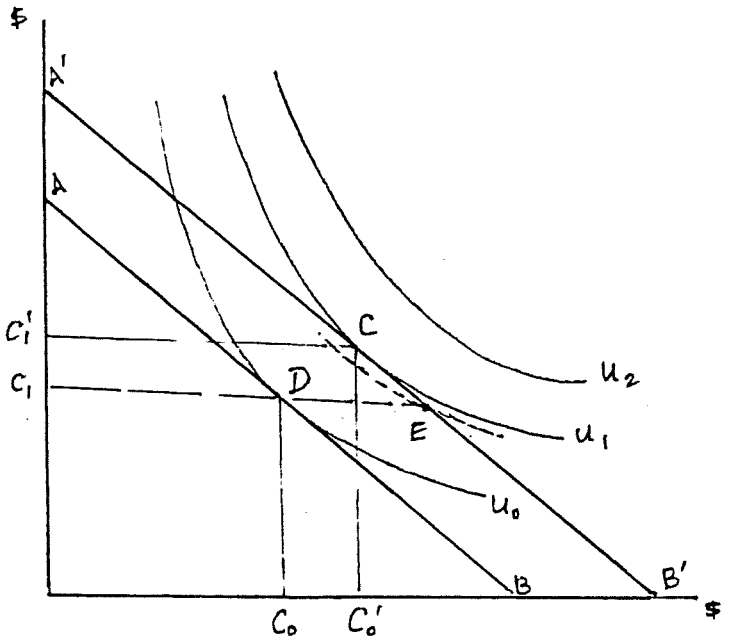



Figure 2 A Lump Sum Transfer for one period.

where $C_1$ is future consumption and is equal to future income plus savings augmented by interest earnings. If $Y_o > C_o$, then the resulting saving can be lent at an interest rate of r. If $Y_o < C_o$, then the consumer borrows in the present period. It is therefore possible that consumption in period $t_o$ is greater than $Y_o$.

Assume now that we have increased the income of our representative individual through a lump sum transfer for one period, from $Y_o$ to $Y'_o$. The budget constraint will shift to the right by a distance that is equal to $Y'_o - Y_o$, with the new budget line parallel to the old one. The new utility maximizing point will lie above and to the right of the old one, with normally shaped indifference curves. This indicates that a lump sum increase in income in one period produces an increase in consumption not only in that period but in future periods as well. Another observation is that consumption in a given period increases by a smaller amount than the increase in income in that period. In figure 2, this is indicated by point C lying above point D. Otherwise, if the increase in income is totally consumed in the same period and nothing is saved, then point E, on a lower utility curve, is attained. Therefore, the marginal propensity to consume is positive but less than unity ($0 < mpc < 1$).

## 2. Multiperiod Utility Maximization

### 2.1 Lifetime utility maximization

Having established the classical behavioural foundations of a utility maximizing individual over two periods, we introduce the case here of the utility approach to optimal consumption over a lifetime and over many generations.

Assume now that our representative individual attempts to maximize utility over a lifetime rather than over a two-period, then his utility function would be:

$$U = U\ (C_o, \ldots, C_t, \ldots, C_T) \tag{3}$$

where total lifetime utility depends on consumption in every period up to the time of death in period T. One can assume that the present value of total lifetime consumption cannot exceed the present value of lifetime income, or that

$$\begin{aligned} &Y_o + Y_1\ (1 + r)^{-1} + Y_2\ (1 + r)^{-2} + \ldots + Y_T\ (1 + r)^{-T} \\ &= C_o + C_1\ (1 + r)^{-1} + C_2\ (1 + r)^{-2} + \ldots + C_T\ (1 + r)^{-T} \end{aligned} \tag{4}$$

Then in effect equation (4) is the budget constraint to the objective function (3), so that this individual is in equilibrium over a lifetime, where

$$\sum_{t=o}^{T} Y_t (1 + r)^{-t} = \sum_{t=o}^{T} C_t (1 + r)^{-t}$$

On the average, income and consumption will be equalized over a lifetime but in a given period, an individual's consumption can, within the limit of the budget constraint, exceed income in that same period either by borrowing against future income or by spending saved income and interest from prior time periods (e.g., funded pension plans). For unfunded pension plans (OAS), recipients of pension incomes may realize a windfall gain if they retire soon after the program starts and realize additional lifetime earnings, similar to the two period analysis where a lump sum income in the individual's earnings pushes his budget line outward.

A market equilibrium has the same efficiency properties as in the two period case. Between periods 1 and t, consumers are just willing to substitute $C_1$ for $C_t$ at the margin:

$$MRS_{1,t} = -\Delta C_1/\Delta C_t = MU_t/MU_1$$

An additional unit of $C_1$ costs $\prod_{S=2}^{t} (1 + r_s)^{-1}$ units of $C_t$,

and in equilibrium the consumer will equate MRS to this relative price (Boadway: 45, 1984b).

Profit-maximizing firms will choose levels of output of $C_1$ and $C_t$ so that the marginal rate of transformation, MRT, is equal to the relative price ratio.

$$MRS_{1,t} = \prod_{s=2}^{t} (1 + r_s)^{-1} = MRT_{1,t} \qquad t = 2, \ldots T$$

which are the necessary and sufficient conditions for efficiency*. Therefore the rational individual will equate the marginal rates over a lifetime to maximize his utility.

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* To illustrate this point, assume that an individual wants to provide for \$1 of consumption in period t = 3, this requires that he sacrifices $[(1 + r_2)\ (1 + r_3)]^{-1}$ or $\prod_{s=2}^{3}(1 + r_s)^{-1}$ dollars worth of period 1 consumption since this sum, saved in period 1, would grow to \$1 by period 3. Thus the price of $C_t$ relative to $C_1$ is $[(1 + r_2)\ (1 + r_3)]^{-1} < 1$.

## 2.2 Utility Maximization through Intergenerational Transfers

Consumers in one generation have children who will survive them. These consumers are altruistic in general towards their children. Intertemporal decision-making for a whole sequence of generations can be treated as if it were carried out by a single life-cycle consumer whose preferences are defined over the consumption paths of each of the generations in the sequence. This can be seen as an extension of the life-cycle model to an intergenerational context, as if our representative individual never dies. The behavioural and efficiency implications of the single generation lifecycle model can be carried out directly. A qualification here is that factor endowments are growing over the generations. Due to population and to economic growth the frontiers of the economy keep expanding, with more labour and capital (n and k). Thus, under perfect conditions "rational" generations can behave in a way as to select the optimal consumption and savings paths, so that the present generation, when saving and consuming, is actually thinking about the coming generations.

The argument that intergenerational transfers (e.g., a debt burden, bequest, from young to old through OAS) can make future generations worse or better off, as long as the GNP is growing, is due to Paul Samuelson (1958) and Martin Feldstein (May 1976). They argue that the implicit rate of return on social security is the rate of growth of aggregate real income (the population growth, n, plus the rate of productivity growth n'). If an intergenerational contract can be struck in which working generations successively pay the pensions of the

retired generation, an individual in such a system can expect to receive benefits in excess of his contributions whenever GNP is growing. We will come to this point when we discuss Canada's demographic changes and the deficit problem (section 5.3).

When individuals head towards retirement, they can neither store capital goods nor work during their retirement years. If the inactive generation has a claim on some of the output produced by the active generation, this claim could be resolved by assets that act as a store of value or as an intergenerational means of transfer.

The representative individual's welfare is based on deriving utility from consumption ($C_t$, t = 0 to $\infty$) discounted at rate $\rho$.*

$$W = \int_0^\infty U\ (C)_t\ e^{-\rho t}\ dt \qquad (5)$$

The individual turns out output by using his labour and savings, i.e., his factor endowments. Part of his output is used to maintain productivity, and part to maintain the level of output, and part for own consumption. This behaviour is summarized by the following equation.

$$q(k) - (n + n' + \delta)\ k - c = \dot{k} \qquad (6)$$

$$\text{or } q(k) - (n + n' + \delta)\ k - \dot{k} = c$$

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* This presentation relies on Mathematical Theories of Economic Growth by Burmeister and Dobell, especially chapters 11, 2-7, and on The Theory of Equilibrium Growth by A. Dixit, Ch. 5.

where q(k) is the efficient output Q/L per unit of efficient labour; n is population growth, n' is the rate of improvement in efficiency levels (reflects personal savings or investment, e.g., in own education, etc.); $\delta$ is the rate of capital depreciation or decay; k is the stock of capital per unit of efficient labour (K/L), $\dot{k}$ (or dK) is the rate of growth of efficient capital, and c is the level of consumption per head.

Equation (6) suggests that after expenditure on n, n', $\delta$ and c, our individual will have $\dot{k}$, which constitutes the growth rate of capital stock. The individual attempts to find an optimal consumption path that maximizes his welfare. This path is found through the optimal conditions for this individual who lives forever (see Appendix B).

Then, for an individual with a rate of time preference, $\rho$, equation (B6) will give the equilibrium condition for the economy. As discussed earlier in the two period case, $\rho$ is the premium an individual places on present versus future consumption. If $\rho = 0$ then consumption levels of today and tomorrow are equal. If $\rho > 0$, then the individual prefers more present consumption. Individuals with positive time preferences will save less for tomorrow and consume more today. In a stable state the individual wants to have $-\dot{u}'/u' = 0$, $\rho = 0$ and $\dot{k} = q' - (n + n' + \delta + \rho) = 0$ (see appendix B for derivations).

This will make possible having optimal consumption, saving, and intergenerational transfers. The optimal levels are ideal, for we may have $\rho > 0$, and the individual wants to consume more today rather than later. In the intergenerational model the individual decides for

an eternal consumption path. That is, not only for his lifetime consumption and saving, but the saving of and the bequests to future generations, and to provide for own retirement income.

Assume a forced transfer that takes place from generation one to generation two, and the money grows at the market rate of interest until it is paid out to generation two. The first generation would be thrown out of equilibrium of the consumption path, ceteris paribus. But in fact this disequilibrium is offset by a reduction in saving and bequest, leaving the optimal consumption path unchanged. The efficiency of intertemporal resources allocation can be established here. The marginal rates of substitution in consumption are equated to the relative prices of consumption in future periods for the "dynastic" utility maximizer. Therefore, an intertemporal market equilibrium will be efficient, satisfying the usual set of marginal conditions relating substitution in consumption over time to transformation in production over time.

Consider an economy consisting of an infinite sequence of generations of consumers, each of which lives for two periods (young, old). The young is endowed with resources which cannot be stored or saved for old age. If the economy has a constantly growing population (which is not the case for Canada as we will see later), then it will increase the welfare of every generation if the young would reduce their current consumption and give some to the old. This would ensure for every household some consumption in both periods of life. A government program of forced transfers from young to old, such as OAS, could improve intertemporal resource allocation in the economy (Samuelson, 1958).

## 3. Market Failure and Other Issues

When an individual retires, she would have accumulated a given amount of wealth. To be certain of having some consumption through the remaining years of his life, this individual would consume his retirement savings at a low rate, planning to preserve some wealth for twenty years down the road. The probability of living to age 90 for example is very small so it is virtually certain that this individual will leave a portion of his wealth unconsumed when she dies. If she consumes everything long before death, she will be in destitution in old age. If she knew the date of death with certainty, which is improbable, she would consume her retirement savings.

The uncertainty associated with old age consumption path could be moderated by purchasing an annuity with the retirement savings, and this will provide a stream of income until death. In the private sector life insurance companies provide such a service. These companies often offer policies that require regular payments up to a specific age, and then the policyholder can select a pension plan. This is optimal for a small minority. Such individual insurance schemes are costly and the market mechanism often fails to provide. Another channel for financing retirement would be group insurance, organized for the workers in particular firms. In this case the workers contribute a portion of their earnings, or the employer makes such contributions as part of the overall social wage of the worker. This method is less costly than the individual insurance provided by life insurers.

However, both methods in the private sector will pay benefits that are actuarially fair, that is they provide a stream of annuity payments to each recipient over the remaining years of life, which will equal, on average, the contributions paid during the working years plus accumulated interest earnings. This is so because private plans have to be fully funded. By "fully funded" we mean that benefits accruing to retirees are limited by their actual contributions. In other words, current benefits cannot be paid out from current contributions into the program; they must be paid from accumulated past contributions.

Under the private pension plans the members of each generation are required to finance their own pension benefits by making contributions to a fund during their working years. The money in this fund would be invested, earning a market rate of return. By the time the members of the generation reach retirement age, a stock of wealth comprising both contributions and returns will have been built up. Benefits would then be paid according to actuarial principles, making the covered generation neither better off nor worse off in an overall sense, i.e., such a program would involve no redistribution to or from any other generation as an intergenerational transfer would take place in a public plan (Boadway: 462, 1984b).

Public pension plans arise because the private insurance industry is perceived as being unable to provide an adequate amount of coverage due to inefficiency. Of course private pensions still exist but they don't have merit features like universality, and elements of subsidy, which can never be provided by the private sector. Some may

present the argument for the private insurance industry for the provision of pension schemes voluntarily entered into by each individual and operated on pure insurance principles (Diamond, 1977). However, capital market may be inefficient at providing vehicles for saving for retirement, especially in times of inflation (which affect all kinds of personal investment. e.g, housing). There are no well-developed market for either indexed bonds to save for retirement, or indexed annuities after retirement. Private pensions do not provide a form of retirement insurance against the risk of having to retire early due to many unforeseen circumstances. In inflationary periods there is no market for this risky environment, neither indexation of pensions is available.

The optimal conditions arrived at in section 2 assume the efficiency of the price system in perfect certainty. Both buyers and sellers of insurance know with certainty the prices that would prevail now and in the future. But in the real world, events are uncertain (Arrow, 1970). Assume the future can be classified according to various "states of the world", each of which yields its own particular circumstances. Each individual can attach subjective probabilities to each of the states of the world, with all the probabilities summing up to unity.* An individual endowed with a given amount of resources will know the allocation of resources the endowment would provide him in each possible state in the future.

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* See the example of the farmer with two states of the world: rain, no rain, and the outcome attached to each state in Layard and Walters: 374, 1978.

In this world of uncertainty there exist insurance markets against the uncertain outcomes. They provide claims for each type of commodity in each possible future state of the world and they are called "contingency markets" (e.g., car insurance, death, fire, etc.). Arrow presents conditions under which even those uncertain markets could generate efficiency. Unfortunately, market failure is still present because in the real world a complete set of such contingency markets does not exist. Insurance policies do allow one to purchase claims against certain contingencies in the future, as mentioned earlier, but in general, relatively few commodities have anything near complete markets for future claims contingent on the state of the world. In particular firms find it difficult to buy off risk of changes in monetary policy (e.g. changes in general price level).

For retirement insurance there are at least two important reasons why perfect contingency markets may not develop. One is that the transaction costs of establishing such markets might be high relative to the number of traders. There are substantial administrative costs, owing to selling and advertising expenses. The other reason is the phenomenon of asymmetric information, or the principal-agent problem. This refers to the fact that individuals who wish to take insurance, say against old age, may possess information (e.g. on their health) that insurers do not. The insured persons (the agents) can exploit this informational advantage in dealing with the insurers (the principals) in various ways.*

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* The other way around is the market for "lemon cars". Akerlof, G.A., "The Market for 'Lemons': Qualitative Uncertainty and the Market Mechanism", Quarterly Journal of Economics, vol. 84, pp. 488-500, August, 1970. See Appendix C.

Two ways in which the principal-agent problem manifests itself in market breakdown are known as the moral hazard and the adverse selection problem. Moral hazard, e.g., the difficulty of monitoring the reason of retirement, occurs when the insured can, through actions not known to the insurer, influence either the probability of a loss occurring, or the magnitude of the loss, to his advantage. For example, the insured can influence the probability of an accident by the degree of preventive action taken. If the quality or dose of prevention is not known to the insurer, market failure can result (Feldstein and Friedman 1977). In this case the insured can overuse the services provided through the policy he bought.

Adverse selection occurs due to the various degrees of risk attached to each client. There are several different types of insured persons, distinguished from one another by the probabilities of a bad state of nature occurring. Some persons might be high risk and others low risk, but the insurers cannot tell one from the other. An equilibrium may not exist in the presence of adverse selection; even when they do exist, they are inefficient and have strange properties (Rothschild and Stiglitz, 1976). Sales offers, at least those that survive the competition process, do not specify a price at which customers can buy all the insurance they want, but instead consist of both a price and a quantity - a particular amount of insurance that the individual can buy at that price. Life insurance companies would not have the menu out to the client to study at home. Both sides hide information essential for the conduct of an optimal market. If

individuals were willing or able to reveal their information, everybody could be made better off through a Pareto improvement (Rothschild and Stiglitz present a model, 1976). Pareto efficiency assumes perfect information by the market participants. Compulsory insurance for all, through public provision, can be a welfare gain for society (see Appendix C for a demonstration).

Assume that the firm was able to study all levels of risk and could associate them with a monetary value so that they can attach a price tag to different levels of risk and then calculate an expected average price, P=E(MC), then the failure arises if there are low risk persons who would find the price too high, $P > MRS_{LR}$, compared to the benefit they obtain. The same goes for the firm whose marginal cost of providing the insurance to the low risk person is lower than the price which is based on the calculated average of the marginal cost, $MC_{LR} < P$. Therefore under this situation there is a market failure, and exchange may not take place. And this violates Pareto optimality. Due to the non-existence of perfect contingency markets, Pareto optimality, as discussed in sections 2 and 3, does not exist in the real world. An example would be the market for unemployment insurance which fails due to the uncertainty of the future income of the insured person. The insurer is not sure that the insured may not quit his job in order to enjoy the earnings from the insurance.

## 4. Public Policy and Public Pensions in Canada

### 4.1 Retirement Savings and RRSPs

Public provision may take place due to market failure (section 3), and to merit, egalitarian reasons. The intergenerational model provided in section 2 assumes that the present generation is altruistic vis-à-vis future generations, assuming an individual who lives forever and maximizes utility over a "dynasty". A current example shows us that the Canadian government effort to deindex partially pension payments to help reduce the deficit and decrease the burden of the debt on future generations was met with public outcry. Therefore, even if the present generation is a dynastic utility maximizer, and that capital markets allow the borrowing, lending, and intergenerational transfers that result in efficiency, one might still object that the wishes of future generations are represented only by the present one's feelings of altruism toward them, where it could be the case that the current generation is too selfish to provide adequately for future generations. In this case public provision is called for on behalf of future generations.

The government might want current generations to do more, even if they become worse off, in order that future generations might benefit. For example, the government may follow policies that encourage private savings in order to augment the wealth in the hands of future generations. But, as discussed in section 2, if dynastic utility-

maximizing parents are compelled to save more for the sake of their children, they may offset the potential loss in consumption by reducing the bequests they would otherwise have made, thus neutralizing government policy.

The government could also encourage voluntary savings through RRSPs. A 1966 report on taxation explains the rationale of old age pension:

> It seems to be generally agreed that individuals should set aside a portion of their income in their working years to ensure an adequate command over goods and services in their retirement years. Such private pensions for retirement are thought to foster self-reliance and to reduce the need for the state to provide relief. If in fact this is a desirable social goal, the tax system is one tool available to government to influence retirement saving (Royal Commission on Taxation: 409, 1966).

Daly (1981) developed a small model which incorporates tax features and voluntary retirement savings through funded pension schemes. The model and its solution are presented in Appendix A. Our representative individual plans his consumption and RRSP contributions over a lifetime (T years) so as to maximize his wealth

$$\int_0^T u\,(C_t)\; e^{-rt}\, dt + e^{-rt}\, v\,(W_T) \qquad (7)$$

where $W_T$ is the individual's bequest at time T, while u and v are the utilities to be maximized. Equation (7) shows that the individual wants to maximize his utility from consumption discounted at rate r, plus the utility from bequests. It is assumed that he acts as if he knows T with certainty.

The consumer receives a given stream of income Y(t) over his working life, from $t_o$ until retirement D, and during retirement from D to T. During his life he receives bequests, the value of which, discounted back to birth, is denoted by $W_o$. He makes no gifts while he is alive. Y(t) is defined as earnings, E(t), net of contributions to Canada Pension Plan, CPP(t), and possibly an Employee Sponsored Pension Plan, ESPP(t). At retirement benefits are payable from both OAS and CPP, or a private pension income. The amount an individual contributes to an RRSP between t and t + dt is R(t)dt, and RRSP wealth is Z(t). Interest earned on RRSPs is taxable when withdrawn from the plan. The current maximum on RRSP contributions is $3500. One can decide the amount to deposit in an RRSP just in time before filing the income tax return.

The individual faces a progressive tax schedule, T(S(t)), where S(t) denotes taxable income, i.e.,

$$S(t) = Y(t) + iW(t) - R(t) \tag{8}$$

In summary, the budget equations are

$$\dot{W}(t) = Y(t) + iW(t) - R(t) - T\,[Y(t) + iW(t) - R(t)] - C(t) \tag{9}$$

$$\dot{Z}(t) = R(t) + iZ(t) \tag{10}$$

From the solution in the appendix, an individual is free to choose his marginal tax rate in any particular year by varying his RRSP assets (i.e., along the optimal path defined by equation A4). The marginal benefits from contributing an additional dollar to an RRSP, is $iT'(1 - T')$, and is equal to the marginal cost $T'$. The tax tables in the income tax guide inform the taxpayer about his/her tax margin, and then one can decide on the optimal RRSP contribution. RRSPs are becoming very popular instruments for savings. In the early 1980s almost 20% of all tax returns included deductions for contributions to RRSPs, compared to 2.7% in 1970. Daly and Wrage (1981) argue that these contributions are more popular with the high income group, because it is most likely to accumulate savings and to gain because of higher marginal tax rates for higher income brackets. The progressivity of the tax schedule, i.e., the higher the taxable income, the higher the marginal tax rates, is due to the assumption made by both economists and tax policy makers that the rich person derives less utility from the marginal dollar earned than the poor (the Carter Commission, 1966).

If the individual is a lifecycle saver only, he will leave no bequests intentionally, with no provision for future generations. As discussed earlier, if the individual accumulated enough wealth upon retirement to last him, say, until age 80, and he dies before he reaches that age, then he will leave an unintentional bequest. Aside from this case, non-dynastic lifecycle savers will not provide for a stock of capital for the next generation. The unintentional bequests could be eliminated, as discussed earlier, if the worker participates in a retirement annuity program (see section 3).

Now working from the assumption that consumers are non-dynastic life-cycle savers, the scope for government intervention to redistribute income across generations is greater. For example in the intergenerational transfer case, forced saving by government would lead to a reaction by the dynastic-utility maximizer to offset this policy through reducing their bequests. This is not true of the life-cycle savers who will make no bequests and cannot offset government policy. Thus their consumption path will inevitably be affected negatively.

In a world of uncertainty, it could be argued that the life-cycle savings model and the intergenerational planning model of dynastic utility maximization assume too much sophistication on the part of consumers. People may thoughtlessly spend for today and make no plans for the future. Even if they think about the future, they will not engage in present value calculations of costs and benefits of consumption assumed in the life-cycle model. Boadway argues that "it may be hard to accept as being other than arbitrary the intra- and intergenerational time paths of consumption and saving" (p. 72, 1984b).

Any saving taking place could be explained in a simpler fashion. People may be following the simple Keynesian assumptions, saving a certain percentage of each one dollar earned, or saving passively by contributing to their company savings plan, or the dividends they receive on investments, etc. Nearsighted as they are, if the government forces consumers to save for their own retirement, this might keep them from arriving at old age penniless and destitute. This in itself is a desired end.

## 4.2. Public Pensions in Canada

The social insurance system is by far the largest channel of expenditure in Canada today. In 1984 social programs cost $40 billion out of a total federal government expenditure of $100 billion for the same period. The major universal social assistance programs cost $12.6 billion, $7.6 billion of which went to old age pension programs, and was received by 2.6 million recipients (Department of Finance, 1984). These programs provide monthly cash benefits to retired workers and their families, and upon the death of the worker, to surviving family members.

Although limited municipal and provincial transfers were available before the First World War, the first major federal initiative was the Old Age Assistance Act of 1927. This was a federal-provincial shared cost program to provide an allowance to individuals over seventy. In 1916 a Board of Pension Commissioners was established to make pension payments available to war veterans, and in 1952 both the Old Age Security Act and the Old Age Assistance Act were introduced. Canada Pension Plan was not initiated until 1966 followed by the Guaranteed Income Supplement in 1967. The Old Age Assistance Act was repealed in 1975 (Canada Tax Foundation, 1978).

Old Age Security payments* are lump sum payments to all persons over 65 who satisfy residence requirements. The current payment is based upon $100 per month in 1973 and is fully adjusted for inflation

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* Information and figures are based on interviews with Canada Pension Plan employees and government publications.

on quarterly basis. Thus in the second quarter of 1985 the OAS allowance was $280.14 per month. OAS payments are taxable as ordinary income, and they were extended to 60-64 years old spouses of pensioners in 1975. The OAS program does not operate on insurance principles, that is, pensioners' receipts are not funded by contributions during their working lives. They are pure transfers financed out of current general tax revenues.

The Guaranteed Income Supplement (GIS), started in 1967, is an income supplement to the OAS payments. Under guaranteed income schemes the amount of transfer is related to the income of the recipient such that the amount received is lower the higher the income. Single pensioners with no outside income receive the OAS and the maximum GIS, which in 1985 stood at $328.66 per month. For every dollar of other income earned the GIS is reduced by 50 cents. The GIS is also fully indexed to the inflation rate on a quarterly basis. The maximum payment under the GIS for a married couple is somewhat lower than that for two single persons. This is so because of "the economies of living together". The married couple would receive $214.05 each in 1985. GIS payments are not treated as taxable income, since GIS recipients do not make any taxable income, by definition, after allowing for the exemptions.

Supplements to OAS and GIS are also available in several provinces. Aged persons are eligible for welfare assistance programs administered by the provinces under the Canada Assistance Plan. In

addition, most provinces provide various services in kind ranging from homes for senior citizens to subsidies on such expenditures as housing, dental care and medical expenses, income supplements (detailed provincial GIS in Boadway and Kitchen 1984).

The Canada Pension Plan was introduced in 1966 to supplement the existing OAS scheme and private pension plans. Quebec operates its own pension plan but on the same principles as the CPP. In the CPP the benefits are at least partly related to contributions and partly a transfer program. That is, an individual's contributions during working years is not expected to cover fully the benefits received upon retirement. Thus, in the long run, the CPP incorporates intergenerational transfers, i.e., from the working to the retired, but not immediately like the OAS scheme.

CPP contributions are compulsory for almost all Canadian workers, who are almost all eligible for benefits. These benefits include retirement benefits starting at age 65, various sorts of survivors benefits, and disability benefits. The CPP is financed by a proportional payroll tax with a fixed exemption level and an upper limit. In 1985 the exemption level was $2,300.00 per year and the maximum pensionable earnings were $23,400.00 per year. For persons employed, both the employer and the employee pay 1.8% of annual gross employment earnings above the exemption level and up to the maximum pensionable earnings for the year. Self-employed persons must pay both

shares or 3.6%. Contributions are compulsory for all persons between the ages of 18 and retirement and they are tax deductible. From the above information, the maximum contributions for persons earning a gross income above $23,400.00 would be 1.8% of ($23,400.00 - $2,300.00) or $379.80 annually.

Contributors become eligible for retirement benefits at age 65. Persons retiring in the early years of the plan are obviously receiving a substantial net transfer from the current working population, because benefits paid are not directly related to the amount contributed in the past by a person, that is the plan is not actuarially sound. Benefits are related to the ratio of a person's pensionable earnings (on which contributions have been paid) to the maximum pensionable earnings over the person's working life, and are based on an individual's annual maximum pensionable earnings for the last three years of work.

The pension payments are indexed on an annual basis using the CPI as of 1974. The above rules may be relaxed to allow for the fact that some persons may be out of work occasionally after age 18 for a variety of reasons, especially as Canada experiences a record high unemployment (approx. 10%). Without the relaxations, the lifetime average would be reduced. Also some may choose to work after 65 and thereby postpone their retirement.

TABLE 1

Maximum CPP, OAS and GIS Payments
($ per month)

| Year | CPP | | | | OAS | GIS[b] |
|---|---|---|---|---|---|---|
| | Retirement | Spouse Under 65 | Orphan[a] | Disability | | |
| 1966 | - | - | - | - | 75.00 | - |
| 1967 | 10.42 | - | - | - | 75.00 | 30.00 |
| 1968 | 20.97 | 64.82 | 25.50 | - | 76.50 | 30.60 |
| 1969 | 31.88 | 65.85 | 26.01 | - | 78.00 | 31.20 |
| 1970 | 43.33 | 67.16 | 26.53 | 92.22 | 79.58 | 31.83 |
| 1971 | 55.21 | 68.47 | 27.06 | 109.88 | 80.00 | 55.00 |
| 1972 | 67.50 | 69.79 | 27.60 | 111.98 | 82.88 | 67.12 |
| 1973 | 80.21 | 70.34 | 28.15 | 114.09 | 100.00 | 70.14 |
| 1974 | 98.33 | 76.73 | 33.76 | 125.95 | 108.14 | 75.85 |
| 1975 | 122.50 | 88.31 | 37.27 | 139.35 | 120.06 | 84.12 |
| 1976 | 154.86 | 99.51 | 41.44 | 157.59 | 132.90 | 93.22 |
| 1977 | 173.61 | 109.94 | 44.84 | 175.05 | 143.46 | 99.13 |
| 1978 | 194.44 | 121.11 | 48.19 | 194.02 | 153.44 | 107.62 |
| 1979 | 218.06 | 134.28 | 52.51 | 216.06 | 167.21 | 137.28 |
| 1980 | 244.44 | 148.92 | 57.25 | 240.58 | 182.42 | 149.76 |
| 1981 | 274.31 | 165.78 | 62.91 | 268.64 | 202.14 | 202.94 |
| 1982 | 307.65 | 186.17 | 70.68 | 301.42 | 227.73 | 228.63 |
| 1983 | 345.15 | 208.03 | 78.60 | 337.46 | 251.12 | 252.10 |

a Reduced by 1/2 for each orphan in excess of four.
b Amount for a single person.
Source: The National Finances, Toronto; Canada Tax Foundation, 1983.

As can be seen from Table 1, the size of the maximum CPP payment has been growing rapidly since 1975, since its size is geared to the growth of the average industrial earnings. OAS grows with the rate of inflation. The combined OAS-GIS was larger than the CPP but eventually this will be reversed (note). Survivors benefits are paid to surviving family members of contributors to the CPP, and they include

lump sum death benefits, benefits to spouses and benefits to orphans. To be eligible for these benefits, individuals must have contributed for either ten years or 3 years plus 1/3 of the years since age 18. Disability benefits for those who become permanently disabled before 65, provided they have contributed for at least 5 years.*

Since its inception in 1966, contribution to the CPP have exceeded benefits by a considerable amount so that a pension fund has accumulated over the years. Full benefits began being paid out in 1975, so current recipients are receiving more than their contributions, for whoever was over 18 in 1966 will contribute for fewer years than the subsequent population. Moreover, benefits payments are not based on average lifetime contributions but on earnings during the last three years of work, which are usually above the lifetime average. Contrary to the private life insurance firms' practice, high risk persons are not charged higher contributions, and no distinction is made between single individual contributions and contributions by families with dependants. All contributors pay a uniform rate, regardless of the benefits they are expected to receive later on. In contrast with this, a private plan would charge different premiums depending on the systematic differences among various groups in the population regarding life expectancy, pensionable earnings, retirement age, or any of the other variables that influence the relation between contributions and benefits.

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* Methods for calculating both survivors benefits and disability benefits are to be found in Boadway and Kitchen, p. 227, 1980.

The CPP is a combination of an insurance plan and a transfer program. It is partly funded, but partly based on current revenues, that is, partly based on a pay-as-you-go basis. The transfer takes place between the working population and the retired population on the one hand, and between the working population and families of contributors on the other.

TABLE 2

Revenue and Expenditure of the CPP Account
($ million)

| Year | Revenue | Expenditure | Net Increase in Account |
|---|---|---|---|
| 1966 | 94.9 | 5.5 | 89.4 |
| 1967 | 599.0 | 8.5 | 590.5 |
| 1968 | 684.7 | 12.8 | 671.9 |
| 1969 | 785.0 | 30.1 | 755.0 |
| 1970 | 889.6 | 65.0 | 824.5 |
| 1971 | 1,020.1 | 108.7 | 911.3 |
| 1972 | 1,102.1 | 167.3 | 934.9 |
| 1973 | 1,243.4 | 228.4 | 1,014.5 |
| 1974 | 1,443.4 | 302.6 | 1,140.7 |
| 1975 | 1,757.4 | 428.9 | 1,328.6 |
| 1976 | 2,129.0 | 621.5 | 1,507.4 |
| 1977 | 2,461.6 | 874.6 | 1,587.1 |
| 1978 | 2,766.6 | 1,104.7 | 1,661.9 |
| 1979 | 3,213.3 | 1,378.5 | 1,834.7 |
| 1980 | 3,656.5 | 1,693.5 | 1,963.0 |
| 1981 | 4,208.1 | 2,077.6 | 2,130.4 |
| 1982 | 5,132.2 | 2,532.0 | 2,600.3 |

Source: Statistical Bulletin, Canada Pension Plan, 1983.

Table 2 shows the size of the CPP fund from 1966 to 1982. The account has continued to increase right up to 1982, but as the proportion of the retired increases and as they receive in pension much more than they contribute, the CPP fund will eventually balance out. At that point, the current contributions will have to be more closely geared to current benefits payments and the plan would be effectively run on a "pay-as-you-go" basis. Pesando and Rea (1977) estimate that the CPP fund will reach a maximum in 1990 and decline to zero somewhere between 1995 and 2000.

In the case of OAS, the benefits paid to a worker are not directly tied to the contributions (or taxes) paid into the system, either by the individual worker or by the worker's generation or age cohort. This fact allowed for full blanket-in when the program was introduced in the sixties. Historically, retirees have received benefits that are quite large in relation to their lifetime contributions. In practice the program has generally financed benefits to retirees from the contributions of those currently working. Such a system is unfunded, i.e., it is possible for workers to receive more or less than actuarially fair returns. This constitutes a major difference between private and public pension plans.

## 5. Impact of Public Pension Plans in Canada

### 5.1 On Savings and Investment

The impact of public pensions on private savings stems from the government discretionary use of funds accumulated. Over a lifetime, an individual earns a stream of income beginning at the end of his schooling period and rising until retirement. This stream of income, along with any bequests or gifts received, yields a lifetime total wealth which the individual allocates over a lifetime consumption path and bequests and gifts to his/her children, and others (including contributions to charitable institutions, most of which are tax-deductable).

In early years, consumption is supported by parents. Once self-supporting, the individual will spend more than she earns, and will acquire durable goods (e.g., housing). In the middle and late years of her working life she will earn more than he consumes or spends. With the accumulated wealth the individual will repay debts and provide retirement income. As discussed in Section 2, the lifetime consumption path decision depends on the rate of interest, the lifetime stock of wealth, and on the premium the individual places on current versus future consumption (the rate of time preference).

The lifetime wealth is the present value of the lifetime earnings. The higher the lifetime wealth, the greater will be the level of consumption maintained over a lifetime. Government policies can

either change the lifetime wealth of an individual or the rate of interest on savings. Increases in permanent income causes an individual to have a higher rate of consumption over her entire life. Early increases in wealth result in more saving for future consumption. Public pension plans have this impact on the wealth of recipients. Increases in transfer receipts would increase lifetime wealth, which in turn increases lifetime consumption levels.* Since pension income is received later in life, saving over the lifetime might be expected to decrease. The public schemes will be financed through taxes imposed on other members of society who bear the bulk of the schemes and who are in the income earning phases of their lives. Such taxes will reduce their wealth, and thus their consumption and savings fall. On the aggregate, welfare increases of the recipients would be offset by corresponding decreases in the welfare of the tax-paying population, and it is difficult to predict the net effect on savings and on private investment.

Consider the impact of public pension schemes on the savings of an individual. If pensions are financed by taxes on earnings, the individual's after-tax earnings during the working years will fall, but her income during retirement will rise by the pension payments. An actuarially-fair scheme would leave the individual lifetime wealth

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* See Section 1: a lump sum increase in income in period 0 increases consumption levels over both periods in the two-period case.

unchanged, since the present value of contributions would equal the present value of benefits. If that were the case, then public pension contributions could completely replace private savings for retirement, and the individual would not wish to change his lifetime consumption pattern.

If the scheme were not actuarially fair, that is the benefits in retirement would exceed contributions, then the consumer would obtain an increase in lifetime wealth. In this case, public pensions would displace private saving for retirement, since the individual would want to increase her lifetime consumption and reduce her saving. She will reduce her savings because she is not obliged to save as much considering that her receipts from pension payments are greater than her contributions.

Therefore, the impact of public pensions on aggregate savings depends on the manner of funding. If current pension payments are financed out of current taxes, then there would be an ongoing transfers from the current working generations to the currently retired. In this case, the impact on savings is straightforward. The contributions paid by the currently working generation, which would otherwise go into private saving and to finance investment, are transferred to the currently retired and are largely consumed. Then aggregate savings could fall by as much as the pension.

Assuming full employment conditions, if debt financing is used, some funds, which otherwise might have gone to private investment, will be diverted to financing the transfer. Therefore public pension schemes would be to some extent replacing private investment as users of savings. But this may not affect the level of investment. If the Government lends publicly to business, then it is not different from private investment, and if it invests in own debt, this will reduce borrowing requirements and free up an equivalent amount of savings for business.

When the CPP is being phased in, those of working age find their lifetime wealth to be higher since they contribute less than they receive upon retirement. If they save and pass on part of their gain to their children, then part of the impact of the pension will be offset. But once the plan is in full operation, current savings will decrease.

An alternative method of financing pensions is the one followed by private plans, i.e., the funded pension schemes, which avoid the adverse impact on aggregate investment. The consumers contribute an amount equal to what they receive during retirement less interest earnings. The contributions will go into a fund, which may then be used to finance private or public investment. Here privately-owned plans replace private retirement savings but don't necessarily decrease aggregate savings or investment as long as the accumulated funds are put into capital markets.

Therefore, whether or not a public pension plan is funded, and the fashion in which the funds are used, will determine how the plan affects aggregate savings and investment. A plan which entails some transfer of income between generations can be expected to reduce aggregate savings and investment. In Canada, the CPP is partly funded, while the OAS and GIS are not funded.

Empirical work on the effect of public pensions on saving was pioneered by M. Feldstein, who did a study on the effects of the U.S. social security system (which is partially unfunded) on personal savings. Feldstein used aggregate annual time series data to investigate the effect of social security wealth on aggregate consumption by applying a modified version of Ando-Modigliani's lifecycle consumption model, which appeared in The American Economic Review, March 1963.* Feldstein's results showed that the social security system halved personal savings in the United States, implying a reduction in total savings and capital stock of 38% (Feldstein, October 1974).

Feldstein did not use a variable for the retirement effect, which is important because social security tends to increase savings by providing a substitute form of retirement savings to replace private pension, and inducing early retirement, which tends to increase savings.

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* Feldstein ran a regression, having aggregate consumption as the dependent variable against permanent income, retained earnings, household wealth, and social security wealth. Permanent income is a weighted average of past income levels, and social security wealth is the present value of all future social security benefits.

Munnel ran a similar regression using aggregate U.S. savings on permanent income, household wealth, social security wealth, labour force, participation at age 65, and unemployment rate. Her results showed the effect of social security wealth on savings to be negative, but not to the extent of Feldstein's results. She also found that the effect of induced retirement on savings to be positive, approximately offsetting the social security effect. However, she could not establish the overall impact of social security both directly and via induced retirement on savings (1974).

Empirical studies for Canada are rare. Pesando and Rea generated a wealth series for CPP from 1966 onwards, but established no net negative impact of the CPP on aggregate savings. Even if the CPP/QPP reduced personal savings, the impact on aggregate investment is negligible, if any, since these plans are partly funded (Pesando and Rea, 1978). The RRSP program has the potential for increasing personal savings considerably. Individuals may deduct from taxable income the retirement savings put into RRSPs and pay income tax on the proceeds upon retirement.

The funds built up in the CPP are not supplied to the capital markets as would be the case with private insurance funds. Rather, they are made available as loans to provincial governments at the long term rate of interest on federal bonds. The allocation each year is determined by the proportion of contributions coming from residents in each province. If the provinces treated these loans as equivalent to

ordinary borrowing on the capital market, then lending pension funds to the provinces would have the same effect as placing them on capital markets directly (by purchasing assets or retiring federal debt). The provinces would merely reduce this borrowing from capital markets by the extent of the pension funds.

On the other hand, these pension funds may be available at more attractive interest rates than the province could obtain on its debt, thereby inducing provinces to borrow and spend more than they otherwise would. Also the provinces may consider it more urgent to repay ordinary market funds then pension funds. Therefore, the pension funds might induce provincial governments to undertake more current expenditures than they otherwise would. This would be fiscal illusion since funds are allocated in proportion to provincial contributions. If the funds had gone directly to capital markets, they would have been used to finance capital expenditures.

Considerations like these make great impact on the composition of private and public savings in the economy. It is not suggested here which saving (private or public) path is better for investment. It should be pointed out that a priori the return from private plans does not necessarily exceed the return from public plans. On the other hand individuals are risk-averse, so they are going to invest in safe ventures, while in firms it is possible to spread risk and diversify sources of financing so they may invest in more risky capital equity. Therefore overall, public plans do not cause any inefficiencies in capital markets, assuming full employment conditions.

## 5.2 On Labour Supply

The impact of public pensions on labour supply is also important, and manifests itself in a variety of ways depending on the tax rate implicit in the transfer, the amount transferred, and the ability of the individual to vary hours worked. There's a vast literature that deals with individuals' labour supply and the various taxes and government provisions. Daly and Wrage of the Economic Council of Canada made several contributions in this area in a Canadian context (1981a, 1981b). Their empirical work confirmed that the OAS program has had an adverse effect not only on retirement savings, but also on the labour supply, in the latter case reducing the pre-retirement labour supplied by individuals rather than causing earlier retirement. CPP and QPP are found to encourage earlier retirement since the opportunity cost of continuing to work after the age of eligibility includes the foregone pension earnings. Individuals who retire earlier because of the pension will save more during their working years to maintain their consumption levels during the retirement years (Feldstein, 1974). But it is not clear which is greater: the reduction in savings due to the substitution of public pensions for private savings or the increase in saving due to the induced early retirement.

Since individuals are both contributors to and beneficiaries of public pensions, the impact of those plans on savings and labour supply is to a large extent a function of attitudes towards the relationship between benefits received and contributions paid. Canada's tax laws allow the deduction of premiums paid to its social security plans, while taxing any benefits received.

Wrage's study (1980) suggests that the CPP, if anything, has induced some people to postpone retirement. This unorthodox conclusion is probably due to the manner in which CPP entitlements were calculated by the government, especially during the 1966-75 period when "blanketing-in" resulted in considerable intergenerational transfers of income to those persons becoming immediately eligible for benefits. Daly (1980) argues that the benefit formula was such that it is likely that some individuals, although entitled to it, postponed drawing the pension and continued to work past the age of 65 because the benefits foregone were more than offset by the present value of future entitlements.

Contrary to Wrage's conclusions, many would argue that public pensions would create incentives for earlier retirement than if the pension plan had not been in effect, since benefit payments make retirement more attractive.

## 5.3 Shifting Demographics

As discussed in Section 2, a positive rate of growth of population is essential in obtaining an optimal consumption-saving path. One should watch closely the impact of shifting demographics on the size and composition of social programs and savings behaviour. The rate of fertility has fallen so low in Canada that the replacement of the present population is no longer assured. A study published by Statistics Canada draws a pessimistic future for Canada. Canadians now have fewer children, later in their lives, and more may choose to forego parenthood altogether. Following a period of steady growth in the

1940s and 1950s, there has been a sharp decline in the proportion of children under 15 in the population. On the other extreme, the proportion of the aged has almost doubled between 1961 and 1981. Already there is a public concern that this aging may place considerable strain on the welfare and health delivery system (StatsCan, 91-520). The following table shows the demographic shifts (assuming a 1.7 fertility rate and a life expectancy of 75.2 years).

TABLE 3

Age Group Distribution

| Age distribution | End of Baby Boom (1961) | 1995 |
|---|---|---|
| 0-19 | 41.80% | 19.91% |
| 20-64 | 50.57% | 55.33% |
| 65+ | 7.63% | 13.00% |
| Average age of pop. | 29.56 years | 45 years |
| Birth rate (per 1000) | 26.1 | 9.04 |

Source: Current Demographic Analysis, Statistics Canada, 1984, p. 25.

Table 3 shows that the 65+ age group will increase from 7.63% in 1961 to 13% of total population in the 1990s. The under 19 age group will drop by half and the average age will increase from 29.5 to 45 years. Overall the rate of dependency will not increase, but rather it will shift towards of old age. From the table above total dependency was 49.43% of total population in 1961, while in the 1990s it will be 44.67%. The aggregate number of claimants of family allowances and child support will decline drastically, but will increase exponentially for old age benefits. On the other hand the middle age group, which is

the main contributor to social programs and the major taxpayer, will remain steady, in fact increasing slightly. Recent estimates of contractual saving in Canada indicate a general trend upwards in this use of savings funds.

Studies by Data Resources of Canada and by Statistics Canada (1984) suggest that it costs two to three times as much to support the elderly as it does to support the young (New Directions for Canada: 102, 1984; Statistics Canada: 91-524E).

The table below shows the budgetary expenditure projections up to 1991. It is clear that the costs of such programs as family allowance and education are far outweighed by the costs of such old age related programs as hospital care for the elderly and OAS. Because of the aging of the population and shifting demographics, there will be an autonomous growth in government expenditure. From the projections in the table and the changing age structure, we notice that beginning in 1985, the part of the deficit related to the aging of the population will start to increase and steadily strain resources. On the other hand family allowances will taper off and shrink as a percentage of total expenditures.

TABLE 4

Budgetary Expenditure Projections

| Year | Family Allowance | | OAP/GIS | | Public Debt Charges | | Total Expenditure | |
|---|---|---|---|---|---|---|---|---|
| | $ bln | Δ % | $ bln | Δ % | $ bln | Δ % | $ bln | Δ % |
| 1983-84 | 2.33 | 4.3 | 10.40 | 7.9 | 18.14 | 6.9 | 88.9 | 11.1 |
| 1984-85 | 2.41 | 3.8 | 11.55 | 11.0 | 22.66 | 24.9 | 99.9 | 12.4 |
| 1985-86 | 2.51 | 3.8 | 12.73 | 10.2 | 25.54 | 12.7 | 106.6 | 6.7 |
| 1986-87 | 2.57 | 3.8 | 13.33 | 4.7 | 25.93 | 1.5 | 108.8 | 2.1 |
| 1987-88 | 2.69 | 2.5 | 14.15 | 6.2 | 26.80 | 3.3 | 115.3 | 5.9 |
| 1988-89 | 2.81 | 4.7 | 14.9 | 5.1 | 29.57 | 10.4 | 123.0 | 6.7 |
| 1989-90 | 2.93 | 4.3 | 15.67 | 5.3 | 31.82 | 7.6 | 130.2 | 5.9 |
| 1990-91 | 3.02 | 3.2 | 16.5 | 5.3 | 34.04 | 7.0 | 138.0 | 5.9 |

Source: A New Direction for Canada, Table (A3).

Data Resources of Canada forecasts that if federal fiscal policy were to remain at its 1985 setting for the next 25 years, the cumulative effect of successive deficits would raise the public debt from $130 billion in 1983 to $830 billion in 2008. Future taxpayers will have to accept the annual costs of servicing such a grossly swollen federal debt added to rising social welfare costs of an aging population, constrained by a decline in both fertility rates and immigration rates.

## 5.4 Income Distribution

Public pensions redistribute income among the members of any given generation and across generations. The intragenerational transfers are in the nature of the benefit structure of the program relative to contributions, while the intergenerational transfers results from the fact that the system is financed by current earners.

The largest portion of contributions to public pensions come from the middle-age group. Since the contributions to CPP are proportional to earnings up to a maximum, the plan redistributes in favour of the low income earners over lifetime. This mechanism redistributes income within the same age group, thus equalizing both retirement and lifetime incomes within a given generation. Private plans do not have such equalizing features. An adverse selection problem would arise if they attempted to do so.

The high-income group does not favor the redistributive aspect of public pensions and they would prefer to exclude low-earning workers. But then the goal of the CPP is not merely to aid the elderly poor at the expense of the rich, for if this was the case it would have been more efficient to do it through the Guaranteed Income Supplement, which is financed from general revenues rather than from the payroll tax.*

As for the intergenerational redistribution resulting from the unfunded nature of public pensions, the plans would be favorable to those who benefit currently. This is so because the members of any given generation would contribute a fixed amount to a fund that would immediately pay out benefits to the current elderly population. To illustrate this point, suppose the program begins in period X; it will provide a windfall gain to those who are elderly at that time; they begin to receive benefits without ever having contributed to the system. Obviously such a program works much more to the benefit of those who

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* GIS benefits are paid to elderly persons with current low incomes.

retire during the start up period than does a private plan. Such windfalls diminish and vanish as the program moves into a long run equilibrium, since each generation is not only a recipient.

Bird suggests that the CPP "is in a sense a fraud" to current contributors (1976:181). Contributions are in a sense payroll taxes to finance income transfers to the currently retired and cheap loans to the provinces. There is no contractual commitments between contributor and government, and no guarantee that the schemes won't change. It all depends on the goodwill of future governments to continue to honor and perpetuate the implicit contracts between generations.

Therefore the impacts of public pensions on the economy are largely merit questions (redistribution, saving more or less, etc). The question of labour supply lies within the area of tax incidence.*

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* If one adopts a Keynesian approach, e.g., Barro and Grossman (1971), lower labour supply affects the level of investment through lower aggregate demand, and then we may have an efficiency problem here.

## CONCLUSION

This paper concludes that public provision for retirement income through public pension schemes or specific policies, such as the RRSPs plan, are justified, with some reservations that call for reforms. They are justified because of reasons discussed in part 3 on the failure of markets for insurance, and other problems related to private provision. Microeconomic theories were used to develop the arguments in parts 1, 2, and 3, especially the utility maximisation approach to consumption in an intertemporal economy and the topic of economics of information.

In part 4 the current public pension schemes and plans were presented, and then evaluated in part 5, as to their impact on capital formation, labour supply and on the federal budget deficit. In section 5.1 a survey of the literature on the impact of public pensions on the aggregate savings rate is presented, while in section 5.2 it was argued that public pensions tend to reduce the retirement age.

In section 5.3 the federal deficit problem was discussed and it was argued that due to the aging of the population of Canada, expenditure on public pensions will grow at an increasing rate, thus increasing the deficit at rates higher than its current growth. To reduce the rate of growth of the deficit many reforms should be introduced. Eligibility criteria to OAS/GIS payments should be changed so that only those who need them will be eligible. To counter this

measure, the RRSP base should be improved and expanded so that self-reliance in obtaining retirement income is enhanced. Indexation of receipts could be phased out in stages. Moreover the age structure of the country could be modified through measures which tend to increase the proportion of the younger generation out of the total population (e.g. through immigration policy). Those reforms could help reduce the growth rate of the deficit.

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## APPENDIX

### A. Solution to Daly's Model

We want to get the optimal conditions for the objective function (7) subject to (8) and (9), so that we obtain the optimal consumption path $C^*(t)$ and the optimal retirement saving path $R^*(t)$. The Hamiltonian function is

$$H = e^{-rt} \{u(C) + \alpha[Y + iW - R - T(Y + iW - R) - C] + \beta[R + iZ]\} \qquad (A1)$$

where $\alpha$ and $\beta$ are the costate variables. According to the maximum principle, if the paths, $C^*(t)$ and $R^*(t)$, are optimal, they must satisfy the following optimal conditions:

(i) $\partial H/\partial C = 0$

(ii) $\partial H/\partial R = 0$

(iii) $$\frac{-\partial H}{\partial W} - \frac{d}{dt}[\alpha(t)e^{-rt}] = 0$$

(iv) $$\frac{-\partial H}{\partial Z} - \frac{d}{dt}[\beta(t)e^{-rt}] = 0$$

Since conditions (i)-(iv) must hold along the optimal paths, differentiating them with respect to age, and substituting into (iii) and (iv), we obtain:

$$\varepsilon(C)\,\dot{C}/C = i(1 - T') - r \tag{A2}$$

$$\text{or } \varepsilon(C)\,\dot{C}/C = i - r - \frac{\dot{T}'}{1-T'} \tag{A3}$$

where $\varepsilon(C)$ is the elasticity of the marginal utility of substitution. Equating (A2) and (A3), we have

$$\dot{T}' = iT'\,(1 - T') \tag{A4}$$

Solving (A4) for T', we have

$$T' - T'_o\, e^{it}/[1 + T'_o\,(e^{it} - 1)] \equiv \tau^*\,(T_o,\, t,\, i) \tag{A5}$$

where $T'o = T'\,(S(0))$.

Hence with a given tax function T, we can derive the optimal path of RRSP contributions and withdrawals:

$$R^*(t) = Y(t) + iW(t) - T'^{-1}\,(\tau^*) \tag{A6}$$

where $T'^{-1}$ is the inverse marginal tax function. Equation (A6) can be rewritten as:

$$R^*(t) = E(t) + iW(t) - CPP(t) - ESPP(t) - T'^{-1}\,(\tau^*)$$

B. Solution to the Intergenerational Utility Maximization Model

Our objective function is:

$$W = \int_o^\infty U(C_t)\ e^{-\rho t} dt \qquad (B1)$$

and the constraint is:

$$q(k) - (n + n' + \delta)\ k - \dot{k} = c \qquad (B2)$$

Substituting (B2) into (B1) we obtain:

$$W = \int_o^\infty U\ [q(k_t) - (n + n' + \delta)\ k - \dot{k}\ (t)]\ e^{-\rho t}\ dt \qquad (B3)$$

Setting the Hamiltonian function:

$H = q(k\ ) - (n + n' + \delta)\ k - \dot{k}\ (t)$, our objective function becomes

$$W = \int_o^\infty u\ (H)\ e^{-\rho t}\ dt \qquad (B1)'$$

We solve (B1)' with respect to k and $\dot{k}$. The condition for welfare maximization is:

$$\frac{\partial H}{\partial k} - \frac{d}{dt}\frac{\partial H}{\partial \dot{k}} = 0 \qquad (B4)$$

We want a K that set (B4) to zero, so that the condition for welfare maximization is established.

Solution

i) $\partial H/\partial k = u'[q' - (n + n' + \delta)]e^{-\rho t}$

ii) $\partial H/\partial \dot{k} = u' (-1)e^{-\rho t}$

Taking the derivative of ii) with respect to time:

iii) $\frac{d}{dt}\frac{\partial H}{\partial \dot{k}} = u' (-1)e^{-\rho t} (-\rho) + e^{-\rho t} \dot{u}'$ (product rule)

Then we have the optimal condition

$$\frac{\partial H}{\partial k} - \frac{d}{dt}\frac{\partial H}{\partial \dot{k}} = u' [q' - (n + n' + \delta)] e^{-\rho t} - u'\rho e^{-\rho t} + \dot{u}'e^{-\rho t} = 0 \quad (B4)'$$

$$\frac{\partial H}{\partial k} - \frac{d}{dt}\frac{\partial H}{\partial \dot{k}} = u' [q' - (n + n' + \delta)] -u'\rho + \dot{u}' = 0$$

where $\dot{u}' = \frac{d}{dt}\frac{\partial u}{\partial c}$, is the change in the marginal utility of consumption in period t.

Rearranging we obtain the golden rule path

$$u' q' - (n + n' + \delta) - u'\rho = -\dot{u}'$$

$$\text{or } q' - (n + n' \delta) -\rho = -\dot{u}'/u' \quad (B4)''$$

The term $(-\dot{u}'/u')$ above is the proportional rate of growth of the marginal utility of consumption. It is a function of the rate of growth of consumption over time $(\dot{c}/c)$ and is diminishing, i.e., the higher $\dot{c}/c$ is, the smaller the marginal utility derived from it will be.

To maximize consumption over time we need the amount of capital that sets the differential equation (B2) with respect to capital equal to zero:

$$q'(k) - n + n' + \delta) = 0$$

$$\text{or } q'(k) - \delta = n + n' \qquad \text{(B5)}$$

Equation (B5) says that the rate of growth of productivity, q (= Q/L) is equal to the rate of growth of the economy (n + n'), or the net marginal physical product of capital is equal to the rate of growth of the economy.

Using equation (B4)" and setting $-\dot{u}/u' = 0$, we obtain optimum consumption path:

$$q' - (n + n' + \delta) - \rho = 0$$

$$\text{or } q' - \delta = n + n' + \rho \qquad \text{(B6)}$$

C. The Market for 'Lemons' Model*

Consider the market for cars and suppose there are only four qualities of cars: good new cars, bad new cars, good used cars and bad used cars. A certain proportion of the new cars, say q, are good, thus 1-q are bad. Then the probability of getting a good new car is q. We assume that a good used car is a perfect substitute of a good new car, and a bad used car is a perfect substitute of a bad new car.

The market for new cars functions with no problem. All consumers and sellers are equally informed about the quality variations in the market, and an equilibrium price can be established. The market for used cars is different. After one has owned a car for a while, he learns more about its quality and defects than the used car salesman. On the other hand the used car salesman knows more about the quality of his cars than the buyer of a used car. The market exhibits an asymmetry of information.

The buyer cannot tell the difference between a good new car and a lemon new car. Both qualities sell at the same price. The price of a used car must be less than the price of a new car. This is so because if new and used cars sold at the same price, then the consumer would buy a new car, find out whether it is 'lemon', and if it were, sell it and buy another new car. If the price of a used car were the

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* This part is largely based on Varian (1984) and Layard & Walters (1978), ch. 13.

same as the price of a new car, there would be zero demand for used cars. If the gap between the price of a new car and the price of a used car is small, some consumers might decide they are better off selling their lemon and buying a new car. If this is the only motive for selling a used car, then the only used cars that will be ever sold to the used cars market will be lemons. The fact that one offers a used car for sale is a sufficient evidence that it is a lemon. Therefore, the probability of having a lemon when buying a used car is 100%. People who want to buy good cars only will avoid the used cars market. As bad money drives out good, one expects only lemons in the used cars market, and we will have a market breakdown as illustrated in the following model:

1) $Q_d = D(P, M)$

2) $Qs = S(P)$

3) $M = M(P)$

4) $Q_d = Q_s$

Equation (1) suggests that demand is a function of own price and the average quality level (M). Equation (2) says that supply is a function of the price, (3) says that the average quality is a function of the price and they are positively related, (4) is the market clearance identity. Substituting (3) in (1) and then (1) in (4) we obtain:

5) $D(P, M(P) = S(P)$

From (3) we know that M is positively related to price and, as price goes up, this means higher quality and more people are willing to buy. This gives us a positively sloped demand curve, in figure C1. At p' in figure C1 we have excess supply and this forces the price down. Lower quality means excess supply and prices fall again. This iteration continues until we have a breakdown where demand is at zero and no exchange is possible.

Even if the probability of having a lemon when buying a used car is not 100%, lemons would still dominate, and the price of a new car is still higher. The equilibrium is inefficient, at least as compared to the full information equilibrium. A buyer of a good car is willing to pay more than the price of a used car if he were sure of getting a good one, and the seller of a good used car would definitely like to make the transaction, but the asymmetry of information rules out such trade. Here we have market failure.

In insurance markets, the lemon principle goes under the name of 'adverse selection'. Here the asymmetry of information is that the agents have a better idea of the relevant risks than does the insurance company. For example if a company wants to insure bicycles, it finds out the statistics on bike thefts and it calculates averages and sets the rates. In practice only high theft areas will buy the insurance and the low ones would not. The market fails. This provides a rationale for government intervention; it could introduce compulsory insurance (old age, medical) and make everybody buy, not only the sickest or the ones with the high risks.

Other methods at the disposal of the government to eliminate the asymmetry of information are:

1. Force sellers to provide the information, e.g. by grading meat and vegetables according to quality.
2. Establish minimum standards so that the worst qualities cannot enter the market (the Canadian Standards Association).
3. Screen professions to assure the quality of services, e.g., licensing of doctors, mechanics, etc.
4. Shift the supply curve by imposing a minimum price, as shown in figure C2.