Improving the labour market incentives of Canada’s public pensions
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Abstract:

This paper examines the incentives for retirement imposed by Canada’s public pension system. A series of simulations clearly illustrate the various components of the pension system that create incentives and disincentives for continued work among the elderly. We find the largest work disincentives are generated by the income tested Guaranteed Income Supplement, as it interacts with the Canada/Quebec Pension Plan and with earned income to give the least well-off elderly a reduced financial return to working. We then illustrate how various policy reforms would alleviate some aspects of the incentives problem and partially remove barriers to continued labour market participation among the elderly.
I. Introduction

Reforms undertaken in the 1990s substantially improved the financial sustainability of Canada’s public pensions. Without diminishing the importance of these improvements, public pensions affect our economy in many ways beyond how they are financed. How and to what extent public pensions influence poverty, savings, and labour market behaviour remain largely open questions, have potentially large impact on wellbeing, and deserve careful scrutiny.

In this paper, we take up the influence of Canada’s public pensions on the labour market behaviour of the elderly. The question we address is the nature of the incentives to work faced by those considering the work-or-retire decision. Few Canadians over the age of 65 currently work—only 3.9 percent were employed all year and 94.8 percent were entirely out of the labour market. If this reflects preference for and ability to afford leisure in the later years of life, then it would be difficult to argue that policy should interfere with these decisions. However, if these decisions are driven by disincentives to work imposed by policy, then policy changes may improve the wellbeing of the elderly.

These considerations are becoming more acute for two distinct reasons. First is the well-known demographic change of an aging population. With fewer young people, the relative demand for elderly labour will increase. Labour market incentives will help determine how well labour supply responds to meet the new demand. Second, changes in some provinces to mandatory retirement rules may release an increasing number of older Canadians into a world where they have more choice about their retirement from the
labour market. Combined, these two factors have started to turn some attention to the labour supply decisions of the elderly.

Several recent Canadian studies have found that the structure of Canada’s public pension system affects the labour supply decisions of the elderly. Baker, Gruber and Milligan (2003, 2004) find that the retirement incentives in Canada’s public pensions have a substantial effect on retirement decisions. Similar results are provided by Schirle (2005), and simulations provided by Milligan (2005) suggest these incentives affect Canada’s lowest income seniors the most as Guaranteed Income Supplement clawbacks encourage them to retire too early. In contrast, Compton (2001) finds that Canada and Quebec Pension Plan program parameters do not have a significant effect on retirement decisions. However, the broad weight of the international evidence, critically reviewed by Milligan and Schirle (2006), suggests public pensions influence the decision to retire.

Our work in this paper consists of simulations that examine the incentives for retirement imposed by the public pension system. The simulations are performed for both single and married individuals of both sexes. We show how the incentives to retire change when there is more versus less private pension income, when working-age earnings levels change, and when there are different levels of work interruptions in the earnings history. Taken together, these simulations provide a good picture of what pieces of the public pension system provide the largest disincentives for continued work among the elderly. We then illustrate and examine four policy reforms that would alleviate some aspects of the incentives problem.

There are three primary findings from this work. First, the magnitude of the work disincentives in the Canadian public pension system is generally much lower than in most
other developed countries. Second, the sharpest work disincentives are generated by the income-tested Guaranteed Income Supplement, as it interacts with the Canada/Quebec Pension Plan and with earned income to give the least well-off elderly a reduced financial return to working. Finally, well-designed reforms can partially remove these barriers to continued labour market participation.

We begin the paper by describing the economics of how public pensions can affect the labour supply of the elderly. We then catalogue how each component of Canada’s public pension system influences the incentives to work. The simulations follow, illustrating the work incentives of the existing system and under four different potential reforms. We conclude with a summary and discussion of the findings.

II. How pensions affect elderly labour supply

An understanding of the effects of public pension programs on labour supply begins with a basic lifecycle model of labour supply. In the simplest model, an individual chooses a path of lifetime consumption and labour supply to maximize utility subject to the constraint that the discounted present value of lifetime income equals the discounted present value of lifetime consumption. The fundamental tradeoff that must be contemplated is between higher consumption (afforded through more work) and higher leisure. If one works more, the higher income allows one to consume more. However, more work implies less time available for leisure. Every worker therefore chooses a lifetime path for work that balances the desire for consumption and leisure.
Public pensions potentially change a worker’s decision in two ways. The first is through changing the total lifetime income of the worker (which is equivalent to his or her wealth). The discounted present value of benefits net of contributions made to the program is part of the lifetime budget constraint. If the discounted flow of benefits equals the discounted flow of contributions, then public pensions will have no effect on individual behaviour. However, if benefits exceed contributions, then a person’s lifetime income is increased by the presence of the program. Assuming leisure is a normal good, this increase in wealth induces a person to reduce labour supply and enjoy more leisure. Although in theory this reduction in labour supply could be spread over an individual’s lifespan (i.e. a reduction in the number of hours worked in each period), it is more likely to reduce the number of years that an individual works. This mechanism is called the *wealth effect*.

Another way public pensions can affect retirement decisions is through the accrual of rights to future pension income. If working an additional year raises the discounted sum of the future benefits, a worker will have a stronger incentive to continue working for the additional year, when comparing the advantages of retirement (more leisure) to the advantages of more work (even higher retirement income when she or he does retire). For example, benefits in most countries are based on some function of average lifetime earnings. More work will increase lifetime earnings, which may translate into higher future public pension benefits. Other features of public pensions that change benefits depending on the timing of retirement, such as actuarial adjustments, delayed retirement credits, and means-tested programs, can also influence how extra
years of work translate into higher (or lower) future benefits. This channel is called the 
*accrual effect*.

If pensions were paid based on contributions, then the accrual effect can be made 
to disappear since the explicit or implicit pension wealth does not depend on the timing of 
the retirement decision. This occurs in employer-provided defined contribution plans or 
in public pension plans such as Sweden’s public system of ‘notional’ accounts. Without an accrual effect, the structure of the pension can be said to be ‘neutral’ with respect to the retirement decision. That is, the decision to retire does not depend on the structure of the system, but instead reflects the individual’s undistorted choice about the tradeoff between extra leisure and extra retirement income. With non-zero accrual effects, the retirement decision will be distorted, with a different and suboptimal mix of leisure and income. This non-neutrality generates costs akin to the standard efficiency losses of taxation.

Underlying any discussion of the effects of public pensions, there is an implicit assumption that people are rational, forward looking, and well-informed of all relevant policy provisions. While it may be unrealistic to assume that all individuals fully understand and evaluate the fairly complex provisions of the public pension system, it is reasonable to believe that an average person will make some rough calculations of how their retirement income will be affected by the timing of retirement. These individuals may have learned of policy provisions from the experience of peers or from public information campaigns. Still, in principle it could be true that financial incentives have little predictive power. However, the broad weight of the existing empirical evidence suggests at least some sensitivity to pension provisions (for example Baker, Gruber and
Milligan, 2003), which leads to a conclusion that individuals account for these policies—partially, at the least.

Beyond the narrow economic variables, retirement takes place in a social context. The behaviour of one’s spouse and peers could influence the retirement decision. In addition, health may affect retirement either because current work becomes impossible or because future health affects the time period over which pension benefits may flow. The focus of much of the economics literature on the financial motivations for retirement in no way precludes the impact of other factors. However, it is the economic variables that are likely easiest for policy to manipulate and so we restrict our focus to them here.

III. Canada’s Retirement Income Security System

Canada’s retirement income security system includes four distinct components. In this section, we provide the institutional detail on each component, describing how it might affect the incentives to retire. The descriptions are not meant to be exhaustive listings of the rules governing benefits. Instead, the focus is on the elements of the public pension system that have the greatest impact on retirement incentives.

A. Canada Pension Plan – Quebec Pension Plan

The largest component of the income security system is the Canada Pension Plan and Quebec Pension Plan (CPP/QPP). The CPP and QPP are earnings-related pensions funded by payroll taxes on employees and employers. The two plans are administered separately by the federal government for the CPP and the Quebec government for the QPP. Most details across the two programs are similar.
The calculation of the benefit is the product of three parts. The first part is determined by earnings histories. The contributory period is the window of time between 1966 or age 18 (which ever is later) and age 60. If retirement occurs after age 60, the contributory period is extended, up to a maximum of age 65. Months in which a disability benefit was received, or were spent caring for a child under age 7, are dropped from the contributory period. The worker may also drop the lowest-earning 15 percent of the months in the contributory period. For work after age 65, the earnings are only included in the calculation if it results in an increased benefit.

In each month in the contributory period, the ratio of earnings to 1/12 of the Year’s Maximum Pensionable Earnings (YMPE) is calculated. The YMPE is set annually, and equaled $43,700 in 2007. These ratios are capped at one, so that earnings in excess of the YMPE are not considered for the pension benefit calculation. The final step in the earnings-rated part of the pension formula is to take the average of the ratios over all of the months in the contributory period.

The second part of the benefit calculation aims to update the earnings history to the level of earnings prevailing at the time of retirement. This is accomplished by taking the average YMPE in the five years preceding the time of retirement (the five years includes the year of retirement). We call this the pension adjustment factor.

The third part of the benefit calculation adjusts the pension for the age of retirement. The ‘full’ pension is received if retirement is at age 65. For every month before age 65, an actuarial adjustment of 0.5 percent is deducted from the full benefit. Symmetrically, retirement after age 65 receives a bonus of 0.5 percent per month of delay. These actuarial adjustments are capped at 5 years, meaning that the earliest one
can claim regular benefits is at age 60, at a 30 percent (30 percent is 60 months times 0.5) reduction from the full benefit level.

The product of these three parts is then multiplied by the CPP/QPP replacement rate of 25 percent and divided by 12 to arrive at the monthly benefit. This is summarized in the following formula.

\[
\text{Monthly Benefit} = (\text{earnings rating}) \times (\text{pension adjustment factor}) \times (\text{actuarial adjustment}) \times 0.25 \times (1/12)
\]

The monthly benefit, once initiated, is updated quarterly for changes in the consumer price index. Upon the death of the recipient, any surviving spouse may be eligible for survivor benefits.8

How does the CPP/QPP affect retirement incentives? First, there is a wealth effect embodying the total discounted amount of future benefit flows. This encompasses both the regular benefits and the spousal benefits. Higher wealth (or equivalently, a higher annual flow of retirement income) is predicted by theory to lead to earlier retirement.9

In addition, the CPP/QPP pensions have many channels of influence on the accrual incentive to retire. First, if the extra periods at work have high enough earnings so that they are included in the pension calculation, then the retirement pension will be larger when it is eventually taken. This means that more work leads to a higher pension once it is initiated. The 15 percent ‘throw-out’ rule and the earnings averaging rules help to determine the strength of this impact. Second, the actuarial adjustment depends specifically on the age of retirement. If retirement is delayed one month past age 60, then one month of pension receipt is foregone. However, the actuarial adjustment leads to a higher pension benefit once benefits are eventually initiated. The actuarial adjustment
attempts to balance these amounts. Through this actuarial mechanism, the timing of retirement has an effect on the net present value of pension benefits received.\textsuperscript{10}

\textbf{B. Old Age Security}

The Old Age Security (OAS) pension is a uniform demogrant with a maximum benefit of $491.93 per month in January 2007. The pension amount is updated quarterly for changes in the Consumer Price Index, and the income is taxable as regular income. It is available to all individuals over the age of 65 meeting residency requirements.\textsuperscript{11} There is a clawback of OAS benefits from high income individuals: the OAS for an individual is reduced by 15 cents per dollar of personal net income exceeding $63,511 (in 2007), which implies that the full OAS pension is eliminated when an individual’s net income exceeds $102,865.

The effect of the OAS pension on retirement incentives occurs mainly through the wealth effect. The OAS benefit does not depend on the date of retirement directly, so there is no direct accrual effect from working extra years. For those who are subject to the OAS clawback, however, there will be some accrual effect. The accrual effect for them arises because extra work increases the CPP/QPP benefit which then serves to decrease the OAS benefit through the clawback. The clawback appears to affect relatively few seniors, either because individuals have responded by working less after age 65 or few individuals over age 65 would have had high enough incomes (in any case) to be affected by the interaction between the CPP/QPP and the OAS.
C. Guaranteed Income Supplement

The Guaranteed Income Supplement (GIS) is paid to Canadians from age 65. It is also indexed to prices, but is not taxable income. The pension benefit was set in January 2007 at $620.91 for single individuals and $410.04 for each member of a couple. The distinguishing feature of the GIS is the income test. For each dollar of family income (excepting OAS income), the GIS benefit is reduced by 50 cents for singles and by 25 cents each for married couples. For 2006, 35.9 percent of OAS recipients also received GIS benefits.

The GIS affects retirement incentives in two strong yet distinct ways. First, for those who are age 65 or more and would receive the GIS if they retired, labour market earnings will reduce GIS payments by 50 cents on the dollar. This is in addition to the income taxes that would be payable on the labour market earnings, so continued work past age 65 is strongly discouraged by the GIS.

The second channel through which the GIS affects retirement incentives is more subtle but perhaps even more important. Extra work after age 60 leads to a higher CPP/QPP pension through the actuarial adjustment. However, each dollar of extra CPP/QPP income that is earned will lead to a decrease of 50 cents in GIS income, for those who receive GIS. Essentially, for GIS recipients, the value of the actuarial adjustment is cut in half. For this reason, extra work past age 60 can have a strong impact on the retirement income received in the future. The simulations later in the paper explore this mechanism in more detail.
**D. The Allowance**

The Allowance is paid in two circumstances. First, it is paid to the 60-64 year old spouses of current OAS recipients. Second, it is paid to 60-64 year old widows or widowers. The amount paid is equal to the OAS pension plus the married component of the GIS pension. Like the GIS, it is clawed back on family income. However, the clawback rates are 75 cents on the dollar for the ‘OAS’ portion of the Allowance, and 50 cents on the dollar for the ‘GIS’ portion of the Allowance.

The Allowance affects retirement through the same two channels as described above for the GIS. However, the direct channel of the clawback on labour market earnings is stronger here because of the 75 percent clawback. In addition, the more subtle channel of the interaction with CPP/QPP benefits is much less important for the Allowance because the Allowance can only be received for a maximum of five years. This means that only five years’ worth of CPP/QPP actuarial adjustments will be effectively reduced, in contrast to the GIS which reduces them for all ages past age 65.

**E. Summary**

The four components of Canada’s retirement income system each separately embody interesting features that influence the decision to retire. However, when the four components are combined, the interactions among the individual components provide some of the sharpest incentives to retire. Describing these interactions is made easier by reference to numerical examples, so we turn next to some simulations.
IV. Simulations

The goal of this section of the paper is to quantify the strength of the incentives to retire described in the previous section. To do so, we take a ‘typical’ individual and calculate his or her income from all four components of Canada’s income security system. We then compare the differences in the incentives when we vary his or her private pension income, amount of lifetime earnings, and continuity of lifetime earnings. Finally, we show some policy simulations to demonstrate the sensitivity of the incentive measures to small changes in policy parameters.

We do not aim to provide a comprehensive analysis of the incentives to retire, for that is beyond the scope of the paper. Instead, we use the simulations as an illustrative tool to point out how the components of Canada’s retirement income system work individually and interactively to influence the decision to retire. Because of the illustrative nature of the simulations, no attempt should or can be made to infer nationally representative results from the results presented here.

The section begins with a description of the methodology that underlies our calculations. This is followed with the presentation of the simulation results first for the base case, then for several alternative scenarios.

A. Methodology

In order to calculate an individual’s pension entitlement, we require several pieces of information. We need a complete earnings history back to 1966 (or age 18), sex, age, marital status, province of residence, and information on private pensions or other income. These pieces of information can then be combined using a pension income
calculator to arrive at public pension income in any given year. By recalculating the pension income for all ages after retirement and discounting for time preference and for mortality probabilities, we arrive at a measure of the expected net present value of public pension income. We call this the Income Security Wealth (ISW) corresponding to a particular retirement age. When this calculation is repeated for all potential retirement ages, an age profile for ISW can be described and the rate of ISW accrual from year to year can be derived. Both the level of ISW and its rate of accrual are the objects of our attention.

We use the pension income calculator developed for and described in Baker, Gruber, and Milligan (2003, 2004) for our calculations. The calculator first derives the CPP/QPP benefit, given a lifetime earnings history. Next, it calculates the retirement income for each age during retirement, by assigning the CPP/QPP benefit, OAS, GIS, and the Allowance both to the worker and his or her spouse. We project benefits into the future assuming they remain constant in real terms. All clawbacks are accounted for. The calculator then takes the taxable components of income and applies provincial and federal taxes to arrive at an after-tax measure of retirement income at a given age. The flow of retirement income across ages is discounted using an assumed rate of time preference (three percent real) and sex-specific mortality probabilities (taken from Statistics Canada 2002). The output of the calculator is an age-profile of ISW for all potential retirement ages under consideration.

For our calculations, we seek to define a ‘typical’ individual in order to characterize retirement incentives. We consider someone in 2002 who is 55 years old and lives in Ontario. This implies that the year of birth was 1947, and that the first year
of work eligible for the CPP/QPP is 1966 at age 19. The worker is contemplating retirement at some age between 55 and 70. For the earnings history, we take a series of average weekly earnings and annualize it.\textsuperscript{13} In our base case, we assume that the worker earned in every year from age 22 to the present, with no interruptions. From 18 to 21 we assume zero earnings (proxying for either years in school or years of non-employment).\textsuperscript{14} This means that there are three zeros in the earnings history, from ages 19 (in 1966) to 21 (in 1968). When projecting earnings into the future from 2002, we assume that earnings stayed constant in real terms at the 2002 level. We also assume in our base case that the worker has no income outside of earned income and public pension income—this means no Registered Retirement Savings Plans, employer-provided pensions, or other sources of income. Finally, we assume that the CPP pension is not taken until retirement and no work occurs after the CPP pension is taken.\textsuperscript{15}

We simulate our base case for married and single males and females. The married couples are assumed to each have the same birth year and earnings history. When considering the retirement age of the husband, we hold constant the wife’s retirement age at 60. Similarly, when considering the wife’s retirement age, we hold constant the husband’s retirement age at 60. Among married couples, survivor benefit provisions (which depend on the individual’s own CPP benefits) are fully accounted for. This base case is not meant to produce results that are representative for the Canadian economy. Instead, the aim here is to demonstrate how the incentives vary in one simple case. A more complete and representative analysis featuring the fullness of heterogeneity we observe in the Canadian labour force is beyond the scope of this paper.
In addition to the base case, we conducted three sets of simulations in which we varied the base scenario in different dimensions. In the first, we try adding sequentially higher amounts of private pension income to examine the effects of the GIS and Allowance clawbacks. In the second, we look at differences across workers of different wage levels by running simulations with an earnings history comprised of earnings that are only a certain percentage of the average weekly earnings. Finally, we twist the earnings history in a different way by studying the effect of ‘incomplete’ earnings histories in which the worker had absences from the labour market. These extra simulations will help to provide more information on how the retirement incentives vary across individuals.

Table 1 presents a basic description of our base simulated individuals. We consider the case of a single man or woman, with no income aside from public pensions. The first two rows show the probability of living to a certain age, given that the individual is currently age 60. Females display greater longevity, with the probability of surviving until age 95 at more than twice that for males, 0.113 to 0.039. Average life expectancy from age 55 (the age to which the conditional probability of living is 0.50) is 84 for females, and 79 for males. The full survival curves, conditional on having survived to age 55, are shown in Figure 1. Not only are females different because they have a higher probability of survival, but the shape of the survival curve is also different. For example, after age 84, the drop in probability of survival is greater for women than for men. Because the lifetime pension measures we use will compare positive and negative flows across ages, both the level \textit{and} the shape of the survival curves will play a role.
The rest of Table 1 shows pension flows at a particular age. Because the earnings for our simulated male and female are assumed to be the same, these pension flows could be for a single person of either sex. The third row displays the OAS entitlement, expressed in 2002 dollars. It pays $5,328 per year, starting at age 65. The next 4 rows of the table show the CPP entitlement (the simulated individual is from Ontario) and the GIS entitlement if the worker retires at age 60 (in 2007) or age 65 (in 2012). If taken at age 60, the CPP pays $6,335 annually. The full GIS amount in 2002 is $6,336, so the CPP payments reduce the GIS payments by $3,167.50 ($6,335*0.50), leaving $3,169 in GIS payments starting at age 65. If the same individual continues to work until age 65, the CPP entitlement grows to $9,501.16 This supplemental $3,166 in CPP leads to a reduction in the annual GIS payment of $1,583 ($3,166*0.50), which leaves GIS payments of $1,586 annually. This example gives some preliminary indication of how the GIS and CPP interact with each other to change retirement incentives. The extra CPP benefit received for delayed retirement from age 60 to 65 is reduced by half through the GIS. How this change in annual pension flows changes the lifetime totals is the subject of the simulations that follow.

**B. Base Case Results**

The results for the base case are presented in Table 2. The first column shows the level of ISW in 2002 dollars for each case at age 55. The columns across the table contain the year-to-year accrual of ISW across different potential ages of retirement, from the point of view of the 55 year old in 2002. So, for example, the age 57 column contains the difference in ISW for retirement at age 57 and at age 58. At the right end of the
column, we report the final level of ISW at age 70. Down the table we consider four family types: single and married males, and single and married females.

We start with the single male. For ages 55 and 56, the rate of accrual is $1,269 and $1,073. The dropout provision plays an important role here. Fifteen percent of months may be dropped from the CPP/QPP calculation. From ages 19 to 59, there are 41 years, which generates just over six years of dropouts. Since we assumed no earnings between ages 19 and 21, this means that someone retiring at age 55 has three ‘zero’ earnings years from ages 19 to 21, then 5 more from ages 55 to 59 before claiming the CPP/QPP at age 60. The six dropout years cancel six of the zero years, but two zero years remain in the calculation. An extra year of work at age 55 therefore replaces one of the zero years. This generates the positive accrual.

At age 57, however, the accrual changes to being very close to zero. The reason again is driven by the dropout provision. Retirement at age 57 means that there are three zero years before claiming at 60. When added to the three zero years from ages 19 to 21, the three years from ages 58 to 60 combine to total six years of zero earnings, which is equal to the number of dropout years. If retirement is delayed one year, therefore, the extra year of work no longer crowds out a zero year from the calculation but instead crowds out a high earnings year. Because the difference in earnings between the extra year of work and the year that is replaced is small, the benefit to continued work drops sharply at this age. Similar explanations underlie the small positive accruals at ages 58 and 59.

It is important to stress that the drop in the accrual at age 57 is specific to the setup of this simulation. If a different number of low earnings years were in the earnings
history, the drop would be elsewhere in the profile. The main lesson to be learned here is that the benefit to working an extra year between ages 55 and 59 depends heavily on the difference between the extra year of earnings and the year that it replaces in the CPP/QPP calculations. Later in this section, we demonstrate this more directly by showing the accrual paths for simulated individuals with several years of work interruptions.

At age 60, the accrual turns negative, reaching -$1,544. There is still a benefit from extra work through the replacement of a bad earnings year in the dropout mechanism. However, there are negative thrusts that dominate in this simulation which come from two intertwined sources. First, at age 60, extra time at work means that a year of CPP/QPP benefit receipt is foregone. In compensation, the year of delayed retirement leads to an actuarial adjustment of the CPP/QPP benefit when it is taken. Ideally, the actuarial adjustment will compensate the worker for the foregone pension income in that year. The second influence on the accrual rate after age 60 is the effect of the CPP/QPP actuarial adjustment on the GIS benefit. The extra six percent of the pension that is awarded for delaying retirement is counted as income when calculating the GIS benefit. This means that 50 cents on the dollar for the actuarial adjustment disappears from the GIS payment. This affects every GIS payment from age 65 until death. Effectively, this shrinks by half the benefit of the actuarial adjustment and tilts the incentives toward negative values. We explore this further below in simulations where the individual is not in receipt of the GIS to separate out the effects of the GIS and the CPP/QPP actuarial adjustment.

At age 65, the accrual becomes more sharply negative at -$6,503. The reason for the jump down at age 65 is again the GIS. The extra year of work at age 65 produces an
increase in the CPP/QPP benefit through the actuarial adjustment, which would decrease the GIS as discussed above. However, extra work at age 65 also produces earned income which directly decreases the GIS payment. In fact, at the assumed level of earnings, equal to the average weekly wage in Canada, the GIS is pushed to zero as it decreases by 50 cents on the dollar of earned income. From ages 65 to 69, the accrual stays negative, but diminishes in absolute value. The decrease is driven by the fact that there are ever fewer years over which the pension will be received. So the extra year of work may change future pension flows, but there are fewer years over which those flows are received.

The second row shows the same simulations, but for a married man. At ages 55 and 56, the accrual is higher than in the single man case. This occurs because the higher CPP/QPP benefit that is earned with extra work pays off not only in a higher benefit for the husband, but also in a higher survivor pension for his wife after he dies. This amplifies the accrual effect seen for the single man. After reaching age 65, the accrual is more negative for the married man, reaching -$7,904. Earned income after reaching age 65 directly claws back the GIS, and a married family has a higher GIS payment if retired. For this reason, extra work after age 65 hurts the married man more because both his and his wife’s GIS payments are reduced as he earns income.

The third and fourth rows repeat the exercise for females. Because the same earnings profile is used as for the males, the observed differences are driven solely by differences in mortality probabilities. While it is certainly not typical for females to have the same earnings history as males, forcing them to be equal in this simulation allows us to isolate the influence of non-earnings factors by holding the earnings history constant.
Because females live longer on average, changes in pensions have longer lasting effects on women. At ages before 60, the female accrual is higher than the corresponding male simulation because the increment to the CPP/QPP pension earned by an extra year of work is received over more years, on average. This makes the payoff to extra work higher.

From age 60 on, working an extra year means forgoing a year of CPP/QPP receipt, but gaining a higher CPP/QPP pension in every subsequent year. The net present value of the ‘investment’ in an extra year of work will be different for men and women not only because women are more likely to live longer, but also because the shape of their survival curve differs from men. This leads to the results for ages 60 plus that are observed in the table. The accrual for females is less negative from 60 to 64, but more negative after age 65. This result is driven solely by differences in mortality across males and females.

The difference between single and married females is less pronounced than was the case for single and married men. This is a result of the survivor pension. For males, it is more likely that the female will out-survive him. This means that any increment to his CPP/QPP pension will be reflected in her survivor pension. However, for females, it is less likely that the husband will out-survive her. While in expectation there will be some survivor benefit received by her husband, it is smaller in expected value than the survivor benefit of a surviving wife. This serves to shrink the difference between single and married females, as the extra work by the married female does not lead to a big boost in her husband’s expected future survivor benefits.
C. Extended Simulation Results

To complement the simulations in the base case, we present several extended simulation results to illuminate and clarify some of the pathways through which Canada’s retirement income security system affects retirement incentives. In all cases, we performed the extended simulations on the single male. We made this choice to try to simplify the environment, allowing us to focus more easily on the factors under consideration in a particular simulation. Without spouses, there are fewer ‘moving parts’ in the simulations. The male-female and married-single differences in the extended simulations look very similar to the corresponding difference in Table 2.

The first extended simulation considers single men with different amounts of private pension income. Because private pension income is included as income for the GIS calculation, those with higher private pension income will receive less GIS. Over some threshold, the private pension will be sufficient to completely crowd out the GIS payments. The no-GIS case is of great interest when compared to the base case, because with no GIS payments the pure effect of the CPP/QPP can be seen in isolation from its interaction effect with the GIS. This gives a better picture of the channels through which the incentives are generated.

The private pension simulations are presented in Table 3. The same columns appear as were seen in Table 2, with ISW at age 55, the accrual rates by age, and finally the age 70 ISW level. In the first row, we repeat the base case results for the single male for comparison. In the subsequent four rows we show the results for differing levels of annual private pension income, from $2,000 in the 2nd row to $8,000 in the 4th row. In all cases, we assign the private pension income to the man starting at the age of retirement.
In the rows for $2,000 to $6,000, the single male still receives GIS upon retirement. This means that the higher CPP/QPP pension resulting from the extra work between ages 55 and 59 will diminish the GIS payment. This serves to attenuate the gain from extra work in this age range relative to the no-GIS case in the last row. As one moves from the base case of $0 of private pension income to $6,000, the gain from an extra year of work is actually slightly smaller for higher private pension income. This occurs because the higher private pension income pushes the worker into a higher tax bracket during his retirement years in this simulation. This means that his gain in CPP/QPP income from working an extra year is taxed at a higher rate when he has a private pension income, thus diminishing his accrual rate between ages 55 and 59.

For the $8,000 row, the accrual is much higher than the other rows, reaching $1,603 at age 55. This occurs because at $8,000 of annual private pension income in these simulations, the single male receives no GIS payments. Thus, the differences we see in row 5 are driven by the removal of the impact of the GIS on retirement incentives. At ages 55 to 59, the worker no longer sees half of his CPP/QPP gain from continued work taken away from his GIS payment. This generates the stronger work incentives at all ages for the $8,000 case. Obviously, many Canadians earn more than $8,000 in private pension income. We do not report higher amounts because they show very little difference when compared with the $8,000 case. This is because the GIS payments are already at zero in the $8,000 case, so extra pension income only affects ISW through possibly higher income taxes, and through the OAS clawback for the top few percent of seniors.
At age 61, the ordering of the magnitude of the incentives in the base case compared to the $6,000 case is reversed. At age 60, a delay in retirement leads to an increased actuarial adjustment to the CPP/QPP pension. For those with higher private pension income, there is less GIS income to be affected by the CPP/QPP actuarial adjustment, so the accrual is less negative for those with higher private pension income. At age 61 however, the increased CPP/QPP payment the individual receives leads to the person no longer being eligible for a GIS payment. As such, the individual receives the full actuarial adjustment by delaying retirement one more year, eliminating the effect of the GIS and resulting in a positive accrual.

From age 65, the negative accrual becomes monotonically smaller with increasing private pension income. This results from the direct impact of the private pension income and earnings on the GIS. With a larger private pension income, there is less GIS to be clawed back by earned income. This diminishes the negative effect of the GIS on work incentives.

The second set of extended simulations varies the earnings history of the single man. Instead of assigning him the full average weekly earnings in each year, we study cases in which he earned 80 percent, 60 percent, 40 percent, and 20 percent of the national average. Importantly, the smaller wages in each earnings history are applied only to years prior to age 55; from age 55 we assume that earnings are at the full national average. We make this perhaps odd assumption in order to hold as much constant as possible to isolate the effect we wish to consider: What is the impact of having a low earnings history compared to a high earnings history on work incentives at older ages?
The results of this simulation appear in Table 4. Again, in the first row we have reproduced the single man base case results from Table 2. Rows 2 through 5 show the earnings histories of 80 percent through 20 percent of the average earnings. Several factors combine here to generate the observed patterns. At ages before 60, extra work generates higher CPP/QPP income at retirement through the earnings formula. An extra year of work will replace a low-earnings year in the formula, resulting in a higher CPP/QPP benefit. The differences across rows in Table 4, therefore, are driven by differences in the level of earnings in the low-earnings years that are being replaced. For the simulation with 20% of the average earnings in each year, the gain to continued work is positive up to age 61, because the extra year of work is replacing a year of very low earnings. For the simulation with earnings at 80% of the average earnings level, an extra year of work generates higher accruals than in the base case, but still turns negative at age 60 as the negative effect of the CPP/QPP actuarial adjustment and the GIS interaction still dominate.

The final simulations appear in Table 5. In this set of simulations we examine the impact of having different amounts of work interruptions on the accrual of ISW. At the top of the table we reproduce the base case. In the subsequent four rows we substitute increasing numbers of zero earnings years into the earnings history at ages before 55. In the 2nd row, we replace earnings with a zero in all years ending in a 4 or 9. In the third row we then replace all earnings in years ending in a 3 or 8 with a zero. We continue this pattern down to the last row in which earnings in four out of every five years have been replaced with a zero. For ages from 55 on, we do not replace earnings with zeros so that the potential earnings from continued work are the same across all five rows. This
isolates the effect of interruptions in the earnings histories from having low earnings years after age 55.

For ages 55 to 59, the benefit of continued work is very similar across all four rows with work interruptions. This occurs because there are so many zero years in the earnings history that an extra year of work post-55 always replaces a zero year in the CPP/QPP formula. This highlights the important impact of work histories featuring interruptions—they tend to increase the work incentives because continued work brings a larger boost in the CPP/QPP earnings rating. From age 60 to age 64, the benefit of continued work varies down the table, with less negative (and more positive) accruals for the simulations with more earnings interruptions. Again, this makes sense because these workers are more likely to be replacing zeros in their CPP/QPP calculation than workers with complete earnings histories. After age 65, the direct effect of earnings on the GIS takes all of the accruals to be negative. The accruals for the simulations with more interrupted histories are less negative because they continue to be able to use their extra years of earnings to replace zero earnings years in their CPP/QPP calculation.

**D. Policy Simulations**

The final set of simulations we present aim to illustrate the sensitivity of the incentive measures to small changes in policy parameters. It is beyond the scope of this paper to analyze or recommend any actual policy alternatives, so the interpretation of these results should remain narrowly focused on their illustrative power.

We examine the effect of four separate policy changes. We describe each policy change briefly:
• **Policy Simulation A**: Change the actuarial adjustment for early (before age 65) and later (after age 65) CPP/QPP claims, from 0.5 percent per month to 0.7 percent per month.¹⁸

• **Policy Simulation B**: In the CPP/QPP, grant a full ‘throw-out’ month for every month of work starting at age 60, adding to the ‘throw-out’ months available based on 15% of months worked before age 60.

• **Policy Simulation C**: For the GIS clawback calculation, use the CPP/QPP pension entitlement from age 60 rather than the actual CPP/QPP income.

• **Policy Simulation D**: For the GIS clawback calculation, exempt labour market earnings from the income measure.

The results of the simulations are presented in Table 6. Policy A changes the actuarial adjustment in the CPP/QPP. This should be expected to increase the annual accruals because delayed retirement results in a larger actuarial adjustment than under the status quo case. Indeed, the simulations show that accruals at every age from the age of entitlement at age 60 are higher than under the status quo system, averaging $1,307 higher.

Policy B increases throw out months ‘earned’ from work after turning 60 from 0.15 under the status quo up to 1 full month for every month worked. Because the base case worker has almost the maximum amount of CPP/QPP, the ability to throw out extra years does not have a substantial impact. In simulations not shown here, for workers with more incomplete earnings histories the impact of this policy is greater.

The third policy change is policy C. This change aims to counteract the interaction between the GIS and the CPP/QPP actuarial adjustment by making GIS
payments no longer depend on the age the CPP/QPP is claimed. This is achieved by using the CPP/QPP entitlement from age 60 in the clawback calculation for the GIS. That is, the actual CPP/QPP income received is not used but instead a ‘fictive’ amount calculated as though the individual had retired and claimed CPP/QPP at age 60 is used. As expected, this policy change has a substantial impact on the key age 60-64 range. No longer does extra CPP/QPP earned through the actuarial adjustment have a negative impact on future GIS receipts. Over the five years from 60 to 64, the average increase in the accrual is $2,582.

Policy D is the final policy change we consider. This policy exempts earned income from the GIS clawback calculation. For those age 65 and older, the clawback of the GIS on earned income provides a strong disincentive to stay in the labour force. It provides a fitting complement to Policy C and could be combined with it. Under Policy D, the final row of Table 6 makes clear that for those aged 65 and over there is a substantial improvement in the accrual with earned income exempted from the GIS calculation. The improvement averages to $3,755 over the ages 65 to 69.

These policy simulations have demonstrated that the incentive measures discussed in this paper are sensitive to small changes in policy. A full evaluation of various policy alternatives potentially would be very informative, but is beyond the scope of this paper.

**E. The Effect on Retirement**

How responsive are older workers likely to be to the retirement incentives discussed here? We simulate the effect of the various policy regimes on the labour market behaviour of our single male, using the estimates from Baker, Gruber, and
Milligan (2003) to derive predicted exit rates (the proportion of workers that exit the labour for at a given age) and compare these to a “neutral” policy regime in which there is a zero accrual rate at each age.19 These estimates are presented in panel A of Table 7. Under the existing policy regime, 12.3% of workers who are still working on reaching age 60 retire during the following year. Applying these exit rates to a set of 1000 individuals at age 59, only 877 remain by age 60 and only 298 would remain in the labour force by age 65 (in panel B). The last panel sums the cumulative person-years of work from age 60 to age 69. Of the 10,000 potential person-years of work, only 4,366 are realized. This is best judged relative to the neutral regime, under which 13% more workers are still in the labour force at age 65 and the person-years of work over the 10 years is 8% higher.

The results under each of the policy simulations demonstrate that increasing the actuarial adjustment (policy A) would move the farthest toward the neutral regime. Adjusting the GIS clawback calculations (policies C and D) also results in higher cumulative work than the current regime, despite the potentially larger exit rates after age 65. Overall, the simulations suggest that the improvements to labour market participation from incentive-improving reform would be incremental rather revolutionary.

V. Conclusions

The simulations in this paper have attempted to demonstrate how Canada’s income security system generates disincentives to remain in the work force at older ages. The profiles of the simulated individuals are not meant to be particularly representative of Canadian older workers overall, but instead were chosen to bring forward different
interesting features of the retirement income system that affect work incentives. In summary, there are several factors that account for the patterns of accruals across different individuals in the simulations. They are:

- Accruals increase when extra work replaces a low earnings year through the CPP/QPP formula.
- Accruals are larger (in absolute value) for married individuals because extra CPP/QPP benefits also increase survivor pensions.
- Accruals are different for women because any change in the flow of pension income is received over more years of life and because of differences in the shape of the survival curve.
- Accruals decrease because the CPP/QPP actuarial adjustment does not sufficiently compensate for the foregone year of pension receipt.
- Accruals decrease because the actuarial adjustment of the CPP/QPP decreases eventual GIS payments.
- Accruals decrease because earnings directly reduce the GIS and Allowance benefits received.

It is important to stress that these simulated accruals are not overly large compared to many other countries. One way to compare the accruals across countries is to calculate the implicit tax on (or subsidy to) continued work at each age as the ratio of the accrual to earnings. In our base case simulation for single males, continued work at age 55 implies a subsidy rate of 3.6% while continued work at age 65 implies a tax rate of 18%. These implicit taxes are similar for individuals in the United States (Diamond and Gruber, 1999). However, in France the subsidy rate to continued work at 55 for a
relatively comparable individual is 75% while continued work at age 60 implies a tax rate of 66% (Blanchet and Pélé 1999). In Belgium, the subsidy rate for continued work at 55 is only 0.2% while the tax rate for continued work at age 60 is 59% (Pestieau and Stijns 1999).

Within our Canadian results, the most striking feature is that the disincentives to continue working are strongest among GIS recipients, who represent the bottom one third of the income distribution among individuals age 65 and over. This is exemplified by the simulations presented in Table 3, whereby accruals are most negative among individuals with the lowest private pension income. These findings suggest that the work disincentives are strongest among the worst off retirees; perhaps those who would benefit most from a few extra years of work to bolster subsequent retirement income.

What could be gained from improving the work incentives of the elderly? More work by the elderly may not be desirable in itself. Instead, a movement toward neutrality by the removal of distortions can lead to more efficient decision making—those who do want to work should not face strong disincentives. Of course, in an economy with many other distortions, the cost of paying slightly higher benefits to improve incentives for the elderly must be measured against the cost of raising public funds or other public uses for tax revenue. However, the direct costs of reform are in part mitigated by extra tax revenue on higher employment (see Baker, Gruber, and Milligan 2007). With the demise of mandatory retirement rules as well as the demographic changes of the next few decades, the removal of fiscal barriers to elderly employment may become more of a priority.
VI. References


Guillemette, Y. 2004. “Follow Quebec’s lead: Removing disincentives to work after age 60 by reforming the CPP/QPP.” Commentary No. 199, C.D. Howe Institute, Toronto.


Figure 1: Male and Female Survival Probabilities

Source: Statistics Canada (2002)
Notes

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1 Office of the Superintendent of Financial Institutions (2006) projects that the current contribution rates for the Canada Pension Plan are sustainable until at least 2075. For the Old Age Security and related pensions, Office of the Superintendent of Financial Institutions (2005) projects that total expenditures will peak at 3.2 percent of GDP in 2030, up from 2.3 percent in 2004. While a large increase in percentage terms, a 0.9 point increase in these pensions at the peak is unlikely to result in a fiscal crisis.

2 Baker and Benjamin (2006) review the available evidence on public pensions in Canada.

3 Calculations made by the authors, using the 2003 persons file of the public-use version of the Survey of Labour and Income Dynamics.

4 For example, Ontario ended mandatory retirement on December 12, 2006. British Columbia’s Government recently received a report proposing similar action.

5 Most workers face hours constraints in that employers typically offer jobs only at standard hours of work. For example, Gustman and Steinmeier (1983, 1984) show that the majority of workers face hours constraints that would prevent them from gradually phasing out of full time jobs into retirement.

6 See Palmer (2000) for a description of Sweden’s system.

7 This and subsequent program parameters were found on the HRSDC Income Security Pan Information Card available online at http://www.hrsdc.gc.ca/en/isp/statistics/rates/infocard.shtml.

8 Survivor benefits are paid at a rate of 60 percent of regular benefits if the survivor is age 65 or more, and 37.5 percent plus a fixed amount for survivors under age 65. These amounts differ in the Canada and Quebec Pension Plans.

9 The difference between lifetime contributions and benefits should not differ strongly across income groups under the Canadian system, since the Canada Pension Plan uses the same contribution and replacement rates for people of different income levels. In contrast, the U.S. Social Security system uses a progressive benefit formula that tips the wealth effect in favour of the lower earners.

10 An actuarially fair adjustment balances the future flow of income at different dates of benefit take-up. Since death probabilities, taxes, and other variable are different across age, sex, and other demographic groups any one population-wide actuarial adjustment rate can at best be fair on average while missing the mark within particular demographic groups. In the U.S. Social Security system, the adjustment rate is slightly steeper, at 0.555% per month before the normal retirement age.

11 When first introduced in 1952 OAS was only available to individuals over the age of 70. The eligibility age was reduced to 65 over the last half of the 1960s. To be eligible for benefits, individuals must have been a Canadian citizen or legal resident of Canada at some point before application and must have resided in Canada for at least 10 years after reaching age 18 (if currently in Canada) or twenty years (if currently outside Canada). The benefit is prorated for pensioners with fewer than forty years of Canadian residence (after the age of 18), unless they are “grandfathered” under rules that apply to the persons who were over age 25 and had established attachment to Canada prior to July 1977.

12 Even if GIS income were taxable, few GIS recipients would pay much tax because a single senior in 2006 doesn’t begin to pay taxes until an income level of at least $13,905 (because of the basic amount of $8,839 and the age credit of $5,066) while the maximum income for receiving any GIS in 2006 is just over $14,000.

13 There is no consistent series covering the entire time period necessary for our analysis. We build our series from three CANSIM II series: V78310 for 1965 to 1983, V250810 for 1984 to 2000, and V1597104 for 2001 and 2002.

14 Alternatively, it would be reasonable to assume years of underemployment or lower wages for the ages 18 to 21. In such scenarios, these years would be treated as “throw-out” years in the simulations and the results would be the same.
Under the CPP and the QPP, you must have stopped work in the month the pension is taken. After that, work may begin again and the pension is not changed. It is likely that few people are able to take advantage of this provision.

Note that this is greater than the $9,465 maximum pension available in 2002. The pension for our simulated individual is higher because he or she will reach age 65 in 2012, when the maximum pension will be larger.

This occurs because the probability of surviving to very old ages drops more quickly for females than for males. Thus, the positive return to extra work at very distant ages is discounted very heavily for both males and females, while the foregone pension benefit is discounted more heavily for males than for females. This results in a more negative accrual for females. At age 69, males again become less negative, but this is driven by the exhaustion of GIS benefits—the CPP pension for retirement at age 70 is so large that the entire GIS pension is clawed back.

This change was contained in a proposal for reform to the QPP in 2004. See Guillemette (2004) for details.

The data used in Baker, Gruber and Milligan (2003) are representative of the labour force exit rate among male Canadian workers in the 1980s and 1990s. Their estimates imply that a $1000 increase in the accrual measure leads to a 0.39 percent drop in the probability of retirement. For income security, an extra $10,000 increase in wealth is associated with a 0.69 percent increase in the probability of retirement. For the neutral policy regime, income security wealth at age 65 for the base case individual is used for predicting exit rates.

Note that this implicit tax is in addition to income taxes and payroll taxes.