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PENSION PAPERS

Greener Pastures:

Understanding the Impact of Retirement Incentives
in Defined-benefit Pension Plans

Tammy Schirle



In this issue...

Provisions in defined-benefit pension plans may bring down employment rates among older workers — a concern for employers, and for policymakers projecting the impact of babyboomers' mass retirement from the labour force.

THE STUDY IN BRIEF

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Defined-benefit pension plans have traditionally been an important source of retirement income for seniors in Canada. Elements in these plans have often been criticized by those concerned with their implications for Canada's labour force needs as the population ages. First and foremost, this study focuses on concerns about the early retirement incentives contained in these pension plans. The study uses a simulation model to illustrate the implications of these retirement incentives. The model approximates the lifetime retirement benefits that would be available to individuals participating in various Canadian defined-benefit pension plans. In particular, it considers provisions in the Ontario Teachers' Pension Plan, the Federal Public Service Pension Plan, the Ford Canada – Canadian Auto Workers pension plan and the pension plan covering Steelworkers at Stelco Canada.

What appears common to these plans are clear incentives to enter retirement as soon as a person is eligible for unreduced retirement benefits. Special retirement provisions, such as the Ford-CAW "30-n-out" program, provide workers with clear incentives to enter retirement at age 60. The use of penalties for early retirement, in the form of reduced pensions, can be used to retain workers while allowing for some flexibility in the choice of retirement age among workers.

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INDEPENDENT • REASONED • RELEVANT

The aging of the Canadian population, as the oldest baby-boomers enter their 60s, has sparked a much greater focus on the labour-market behaviour of older workers and the retirement income available to them. In particular, employer-sponsored, defined-benefit pension plans traditionally have been an important source of retirement income. With their promise of predetermined benefits based on income and years of service, defined-benefit plans have been popular among workers. These plans shift the risks associated with asset returns and (perhaps more importantly) uncertain longevity onto the employer.

Nevertheless, recent developments have called into question the relative merits of defined-benefit plans. Many appear to be struggling to meet pension commitments, and these plans are expected to be further weakened by the impending retirement of more and more baby boomers.¹ Consequently, employers increasingly are reluctant to embrace or continue participating in defined-benefit pension plans.

Economists and policymakers have also criticized defined-benefit pension plans for the incentives they often create for workers to enter early retirement. From an employer's perspective, however, these incentives can be an important tool in achieving worker-retention and retirement objectives. The defined-benefit plan's advantage to employers is its ability to provide employees with

incentives to leave a firm at a time that it is in the firm's best interest.

This paper examines various provisions common to defined-benefit pension plans that influence individuals' work and retirement decisions. These arrangements, whether or not they are in the best interest of employers or workers today, may bring down employment and participation rates among older workers. Not only is this a concern for employers, but also for policymakers projecting the implications of the baby boomers' mass retirement from the labour force.

The analysis is based on a publicly available simulation model constructed by the author. Details of the model, designed for use with Microsoft Excel, are provided in the Appendix of this paper.

In the model, the approximate lifetime retirement benefits available to participants in various existing Canadian defined-benefit pension plans can be derived for each possible retirement age. Plans considered include the Ontario Teachers' Pension Plan, the Federal Public Service Pension Plan, the Ford Canada — Canadian Auto Workers pension plan and the pension plan covering Steelworkers at Stelco Canada, now U.S. Steel Canada. Users of the model can readily view the incentives or disincentives for retirement created by these pension plans. What appears common to these plans are clear incentives to enter retirement as soon as a person is eligible for unreduced retirement benefits.

I begin by providing some background regarding the extent to which older individuals are participating in the labour force and participating in defined-benefit pension plans. I then explain the measures used to describe the various incentives found in defined-benefit plans. This is followed by a series of simulations that

The author thanks Ryan Marr and Christopher Wallbank, Economics and Finance students at Wilfrid Laurier University, for their research assistance. They played a large role in the development of the simulation model used in this study. This paper has also benefited from comments provided by members of the C.D. Howe Institute's Pension Papers Advisory Panel.

1 According to the Financial Services Commission of Ontario (2007), 78 percent of plans were less than fully funded on a solvency basis at their last valuation date ranging from July 2003 to June 2006. The median solvency ratio was 86 percent. However, its report noted that the funding position is expected to improve.

demonstrate how the existing provisions of pension plans in Canada may influence retirement decisions. I then discuss some evidence suggesting these pension incentives have an important influence on retirement decisions. Finally, I place this evidence in the context of the various other factors influencing the retirement decision.

Background — Pensions and the Canadian Labour Market

It is useful to begin with an overview of the long-run trends in employment and reliance on retirement pensions among older individuals. Typically, studies of older workers have focused on men because their employment rates traditionally have been much higher than those of women. As shown in Figure 1, the employment rates of men aged 55 to 69 fell steadily throughout the late 1970s, 1980s and into the mid-1990s. By 1995, the employment rate of men age 55-59 was only 65 percent compared to 81 percent in 1976. The employment rate of men aged 60-64 is consistently lower than younger men, and was only 40 percent in 1995 compared to 64 percent in 1976. More recently, employment in this group has been trending upward for the past decade, reaching 50 percent among 60-to-64-year-old men in 2006 compared to 40 percent in 1996. Schirle (2007) suggests that a large part of the recent upward trend in men's employment rates relates to older husbands' preferences to spend leisure time in retirement with their wives. The employment rates of older women (see Figure 2) have increased over the past decade, reaching 35 percent among women 60-64 in 2006, compared to 22 percent in 1996.

How are these trends related to defined-benefit pension plan incentives to retire early? Participation in such plans has fallen steadily since the early 1980s, as shown in Figure 3. While 36 percent of the labour force belonged to a defined-benefit plan in 1978, only 26 percent was covered in 2006.² Most of this decline occurred during the 1990s and reflects a drop in plan coverage across all age groups. It is possible that this more recent decline in defined-benefit plan coverage explains some portion of recent increases in employment among older men requiring income security.

Meanwhile, there has been a slight increase in worker participation in the other common retirement schemes including defined-contribution plans. Under this approach, the income received upon retirement depends on the amount of money an employer and employee have contributed, and how these funds have been invested. Defined-contribution plans are popular among workers who wish to exercise choice about how much they want to contribute and the direction of their retirement portfolio. Still, an increase in participation in defined-contribution plans from two percent in 1982 to five percent in 2006 has not been large enough to prevent an overall participation decline in registered pension plans over that same period.³

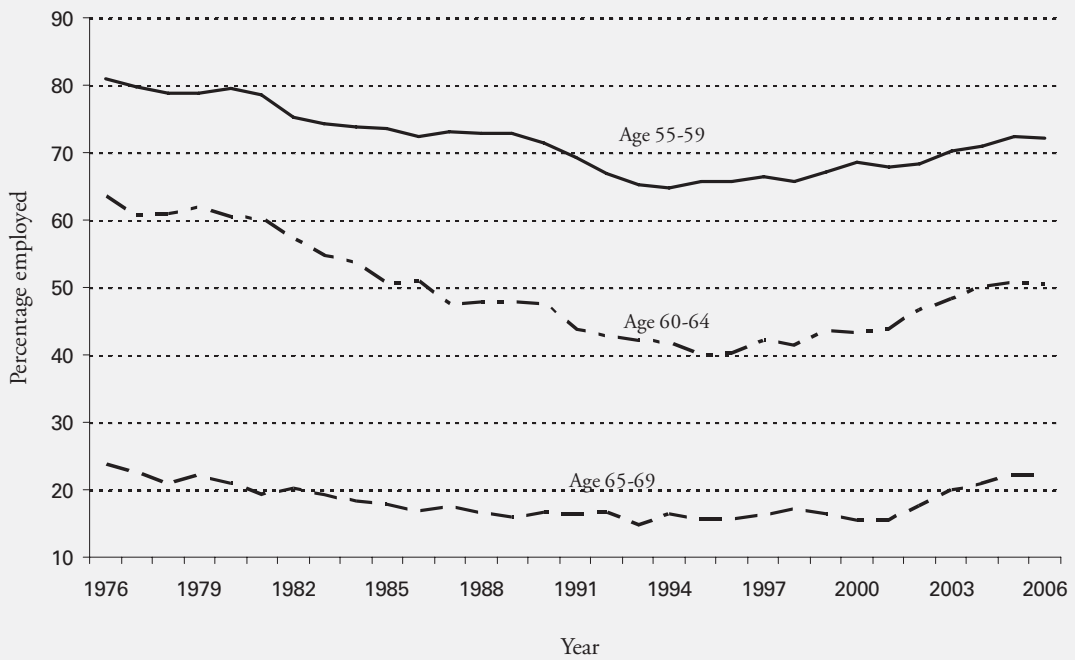
Poterba, Venti and Wise (2007) have found a similar downward trend in defined-benefit pension plan coverage in the United States. Unlike Canada, however, a remarkable US growth in defined-contribution plans (primarily in the form of 401(k) plans) has been large enough to result in an overall increase in pension coverage.⁴ In 1990, 38 percent of US private sector employees participated in a pension plan; in

2 The trends presented in Figure 3 are consistent with recent trends presented by Morissette and Ostrovsky (2007). Using the Longitudinal Administrative Databank, they found that registered pension plan coverage of men aged 35 to 54 (tax filers) fell from 39.2 percent in 1991 to 32.8 percent in 2004. Men aged 35 to 54 represent a large portion of the total labour force aged 15 to 69. They also found a drop in coverage among men aged 25 to 34, falling from 25.5 percent in 1991 to 21.4 percent in 2004.

3 Registered pension plans refer to any form of trust that provides pension benefits upon retirement. They are registered with the Canada Revenue Agency, making both employer and employee contributions tax deductible.

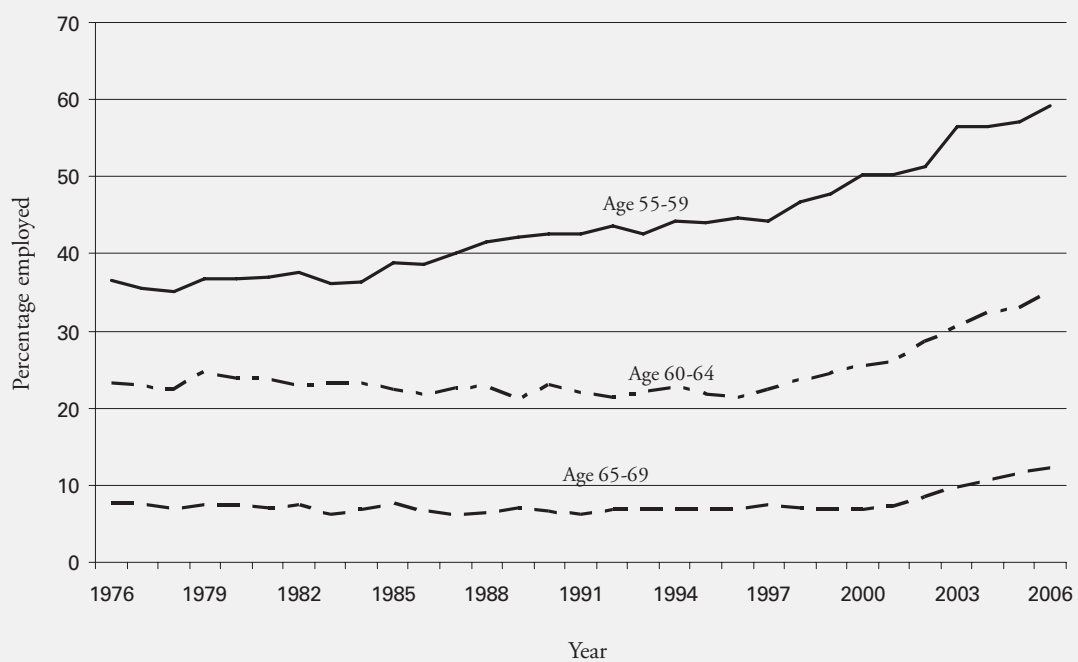
4 This is a difficult comparison to make as Canadian statistics do not include employer group RRSP arrangements, which may be comparable to 401(k) plans in the United States.

Figure 1: Employment Rates of Men, by Age Group, 1976–2006



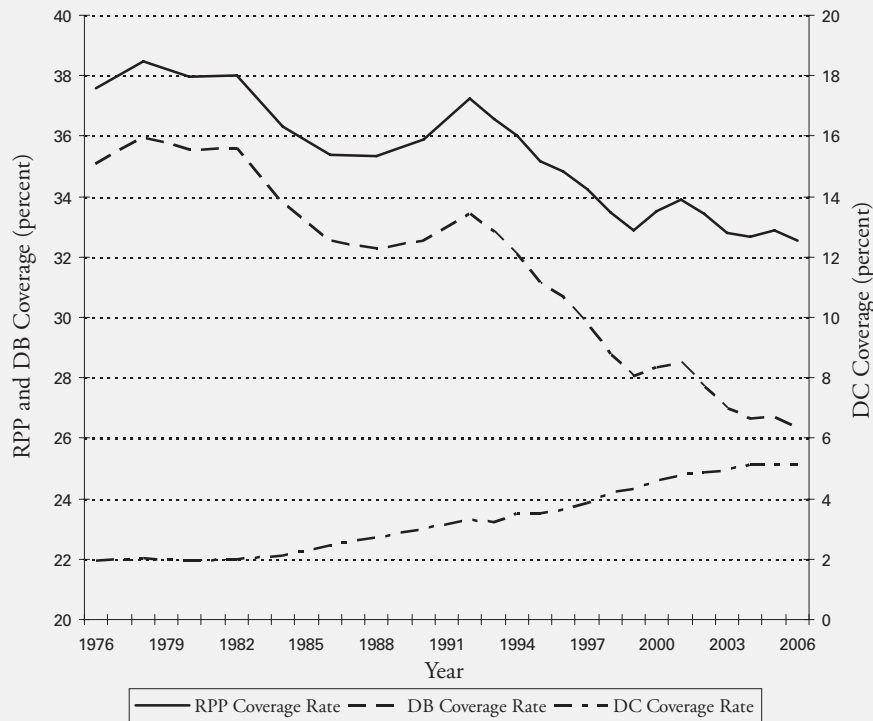
Source: Milligan and Schirle (2007) based on Statistics Canada Labour Force Survey.

Figure 2: Employment Rates of Women, by Age Group 1976–2006



Source: Milligan and Schirle (2007), based on Statistics Canada Labour Force Survey.

Figure 3: Percentage of the Labour Force Aged 15 to 69 Covered by Registered Pension Plans



Source: Author's calculations from CANSIM II series V2062810, V31200437, V31200455 and V31200461.

2003, the participation rate had grown to 48 percent.

Clearly, registered pension plans, whether defined-benefit or defined-contribution, are an important source of income for Canadian retirees. Among 65-year-old Canadians, nearly one-half receive some sort of registered pension plan benefits.⁵ Just over 10 percent of Canadians age 55 received pension income in 2003.⁶ According to Wannell (2007), pension benefits accounted for almost two-thirds of post-retirement income among young pensioners (aged 50 to 59). Pescarus and Rivard (2005) have found that among families with a member aged 50 to 64 covered by a registered pension plan, 35 percent of the member's assets were held in his/her

pension, while the family home represented only 26 percent and RRSPs 10 percent.

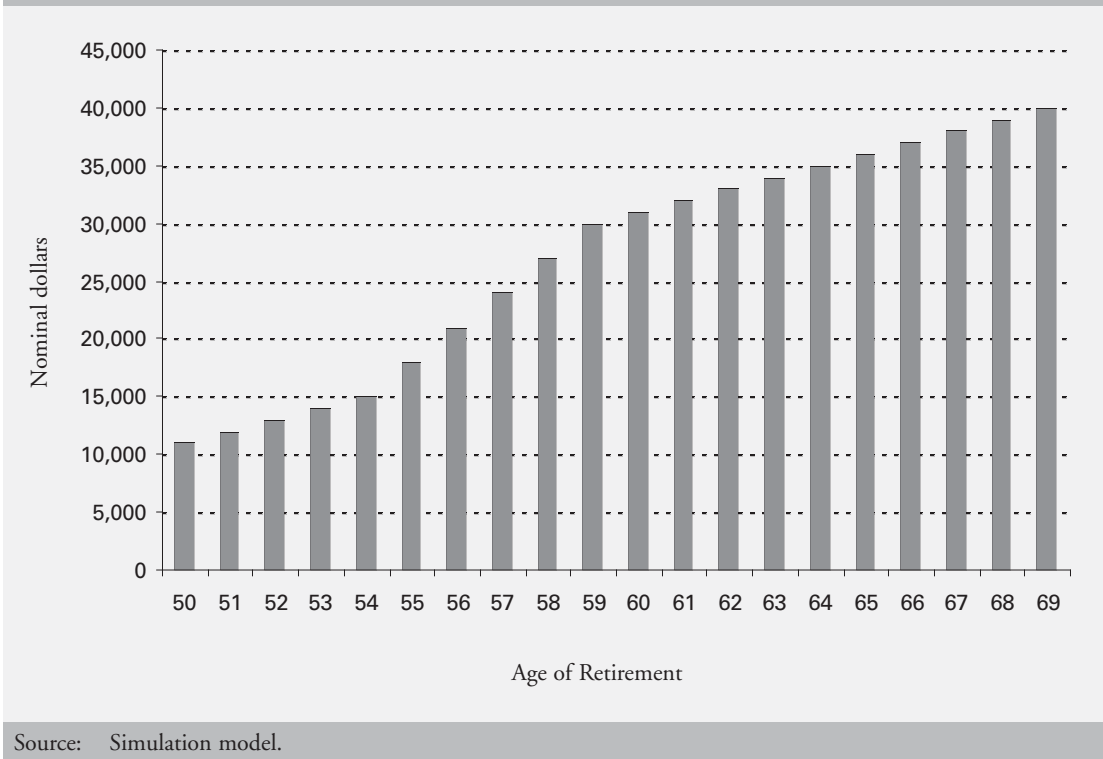
Clearly, the existence and structure of pension plans have a major influence on retirement decisions. According to Milligan and Schirle (2007), nearly 50 percent of retirees aged 55 to 69 report entering retirement because they had completed enough years of service to qualify for their pension. Among 55-to-59-year-old retirees, 25 percent cited early retirement incentives as a reason for entering retirement.

There are many ways for an employer to structure a defined-benefit pension plan and provide a secure income to retirees. The next section examines various ways of structuring these plans. In particular, I focus on how plan provisions can create incentives for employees to

5 Based on author's calculations from the Statistics Canada 2003 Survey of Labour and Income Dynamics (SLID) public use files. SLID includes benefits from registered pension plans and RRIFs in this definition of pensions.

6 Ibid.

Figure 4: Initial Nominal Annual Benefit Received Upon Retirement



continue working or enter retirement at any given age.

Retirement Incentives in Pension Plans

Measurement of Retirement Incentives

There are three commonly used measures to describe the incentives found in defined-benefit and other pension plans:

- The value of initial benefits upon retirement;
- The discounted present value of lifetime retirement benefits upon retirement; and
- The one-year accrual value.

The first measure, the value of initial benefits received upon retirement, is the cash amount received in the first year of retirement. As a purely fictional and simple example, consider the profile shown in Figure 4. (This is the default profile provided by the simulation model upon opening

the program). The amounts for each age represent the initial cash value of the benefit received by this individual when he/she retires. In this example, if this individual were to retire at age 50, he/she would receive \$11,000 in the first year. That initial benefit is increased by \$1,000 for each year of delayed retirement.

But, if the individual chooses to wait at least five years and retire between the ages of 55 and 59, he/she receives a \$2,000 bonus added to their annual pension amount. That is, someone retiring at 54 would receive \$15,000 in the first year consisting of \$11,000 plus \$4,000 for four additional years. However, the same person would receive an \$18,000 annual benefit if he/she waited to retire at 55 (\$11,000 plus \$5,000 for five years plus \$2,000 for waiting until 55).

From the perspective of a 50-year-old who is contemplating when to retire, such a scenario demonstrates when he/she would receive the largest benefits. The profile is of incredibly limited value, however, in determining the optimal age at which to retire. Important to

recognize here, these cash amounts — when viewed from the perspective of a 50-year-old — do not account for relative increases in consumer prices or the relative size of this pension benefit to potential wage earnings in the future. More importantly, the amount only represents the annual benefit provided rather than the total value of the pension benefits received over a lifetime.⁷

The second measure, the discounted present value of lifetime retirement benefits is the more important and informative measure when judging retirement incentives. For the models used in this paper, the discounted present value is represented by the following formula.

$$DPV_{rc} = \sum_{t=c}^T \beta^{(t-c)} \pi(t|c) y_t(r) \quad (1)$$

In equation (1), y_t represents the real value of retirement benefits in each year (t), and depends on the chosen age of retirement (r).⁸ These annual amounts are combined over the person's expected lifetime, from his/her current age (c) until the last year of life under consideration (T). The amounts in each year are discounted for time preferences ($\beta = 1/(1+i)$ where i is a risk-free interest rate) and the probability of surviving until each year t , given that the individual has survived to his/her current age c ($\pi(t|c)$).

When judging whether to retire, an individual at age c can calculate this discounted present value for each possible future retirement age. As the discounted present value equals the total retirement wealth an individual can expect to receive, people should tend to choose a retirement age that maximizes that wealth. One expects that individuals holding sufficient retirement wealth

(all else equal) would choose to spend fewer years in the labour force and retire earlier than their less wealthy counterparts. Therefore, a higher level of wealth implies a positive incentive to retire.

For the simple fictional pension plan benefits represented in Figure 4, the profile of an individual's discounted present value of benefits at each retirement age is provided in Figure 5.⁹ At 50, the individual expects to receive total pension benefits valued at more than \$180,000. If, however, he/she waited until 59 to retire, the discounted present value increases to more than \$270,000. Under most plans, this accrual in retirement wealth occurs for extra years of service. Here, the steep increases in wealth for retirement between 55 and 59 are due to the early retirement bonus.

The discounted present value begins to fall for retirement after 59 because the retirement bonus is no longer available and the nominal increases in initial benefits (\$1,000 per year) are not enough to compensate for the delay in receiving a pension, given a shorter expected remaining lifespan. Using this measure of retirement incentives, it would appear this individual has a strong incentive to retire at 59, before experiencing an overall drop in pension wealth.

The prospect of future pension wealth through delayed retirement will exist as long as retirement benefits depend on the age of retirement and/or years of service. In this way, the accrual of pension wealth influences the optimal timing of retirement. This study captures this incentive effect from defined-benefit pension plans using a one-year accrual measure.¹⁰

A one-year accrual represents the amount of retirement wealth an individual can gain if

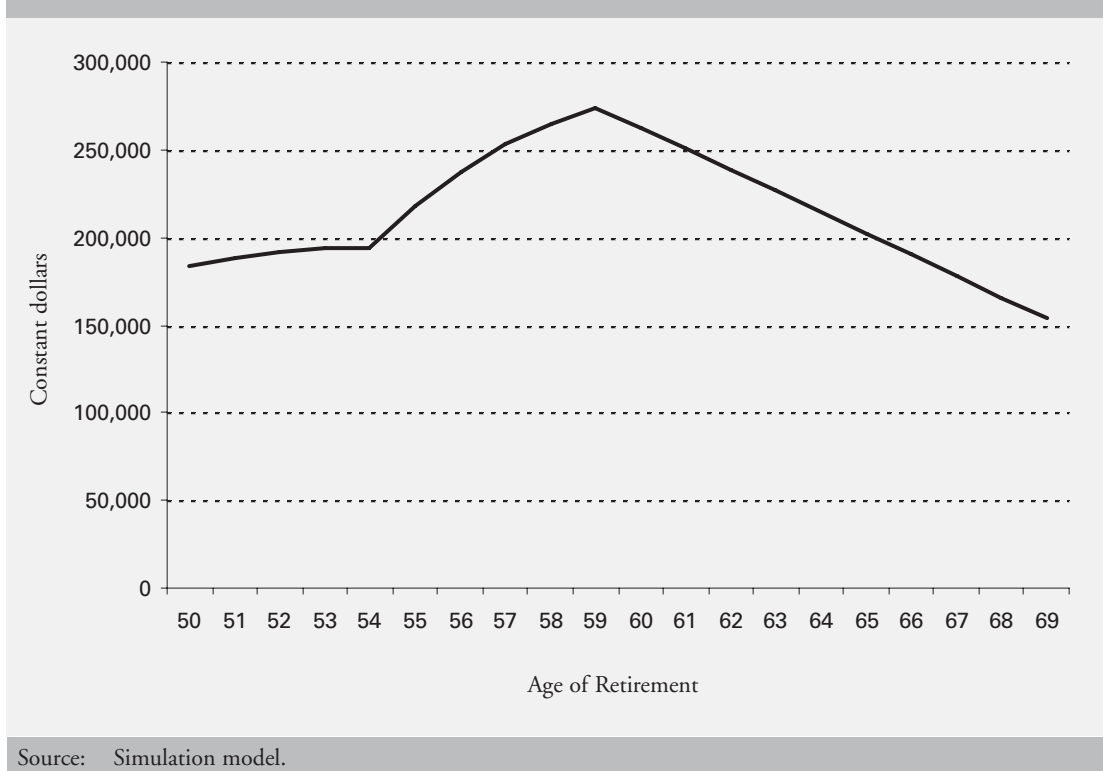
7 This nominal benefit may be important if benefits are not adequate to preserve the individual's expected standard of living. This is likely important for low-wage or low-seniority workers. This study focuses on those workers for whom retirement is considered a financially feasible option.

8 A "real" value reflects individual purchasing power and remains constant over time if pension benefits are indexed to inflation or a comparable cost of living index.

9 The fictional plan assumes the initial pension benefit is fully indexed to inflation. The simulation model incorporates survival probabilities based on Statistics Canada's Life Tables (2002).

10 As a reference point, note that retirement wealth from a defined-contribution pension plan usually continues to rise with age depending on the asset returns and contributions made by employers and employees relative to the cost of living increases and survival probabilities. Defined-contribution plans will not have the discontinuities we find in typical defined-benefit pension plans and are not designed for use by employers in the employment contract as a tool for planning worker retention.

Figure 5: Discounted Present Value of Retirement Benefits, by Age of Retirement



retirement is delayed for one year. It is derived directly from the discounted present value calculations as $OYA_{rc} = DPV_{(r+1)c} - DPV_{rc}$. This formula represents the amount of retirement wealth a person would gain by delaying retirement from age r to age $r+1$ and is often used to describe the pension plan incentives an individual has at any given point in his/her career to work at least one more year.

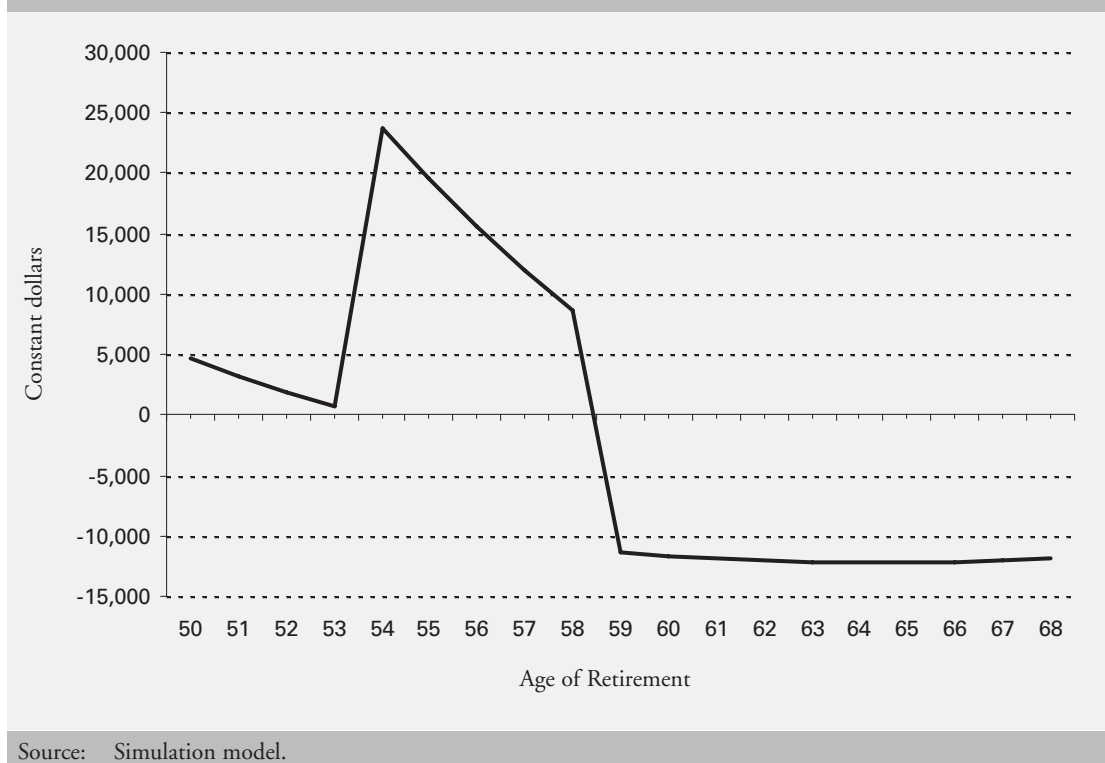
Generally, one might expect an individual to have the greatest incentive to retire before the accrual of benefits becomes negative. In Figure 6, one sees that while the accrual of retirement wealth remains positive initially in the fictional pension plan, it falls steadily from \$5,000 to almost zero with each year of delayed retirement between 50 and 53. At age 54, the accrual jumps to nearly \$25,000 since delaying retirement to 55 allows the individual to benefit from the retirement bonus.

At 58, the individual gains only a smaller amount of wealth (over \$10,000) by delaying retirement to 59, but at 59 the individual begins to lose wealth by delaying retirement. Therefore, at 59, the worker has a greater and more obvious financial incentive to enter retirement.¹¹ But used in this manner, the one-year accrual can be deceiving. As will be seen in the next section, many pension plans are structured such that a negative accrual may occur at a relatively early retirement age. However, there are subsequent positive accruals, reflecting important discontinuities in the discounted present value of retirement benefits. A forward-looking individual would rely more heavily on the discounted present values when deciding the financially best retirement age.

As the discounted present value and one-year accrual measures are the more useful guides to incentives, the following section will rely

11 Loosely speaking, the one-year accrual can be thought of as the amount a person would receive in addition to his/her current wages for continuing to work another year. A larger accrual then results in greater incentive to work for the year. A negative accrual results in a greater incentive to enter retirement.

Figure 6: One-Year Accrual of Retirement Benefits, by Age of Retirement



primarily on these indicators when discussing the incentives of various pension plans.¹²

Early Retirement Incentives Found in Existing Defined-Benefit Plans.

In this section, I use the simulation model to show how pension plans in Canada have worked to create retirement incentives or disincentives. Four plans are discussed — the Ontario Teachers’ Pension Plan (OTPP), the Federal Public Service Pension Plan (PSPP), the pension plan covering CAW members at Ford Canada and that covering Steelworkers at what used to be Stelco Canada. The structure of these plans for the simulation model, described in more detail in the appendix, relies heavily on information collected by Pescarus and Rivard (2005).

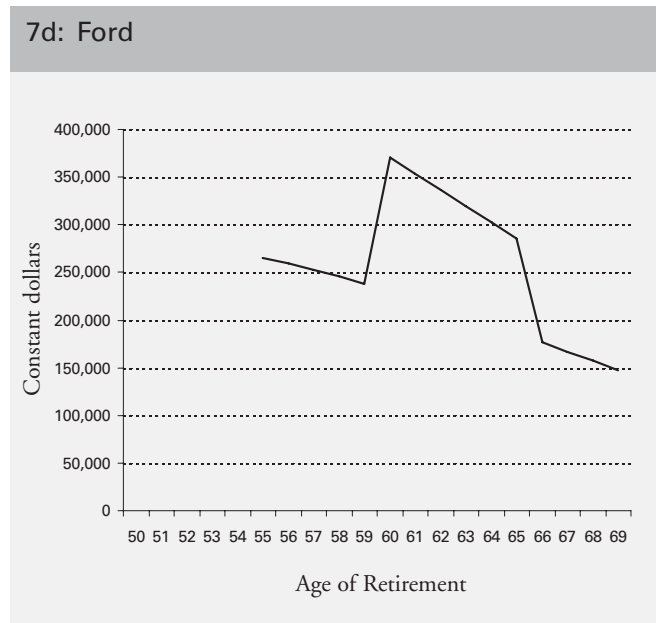
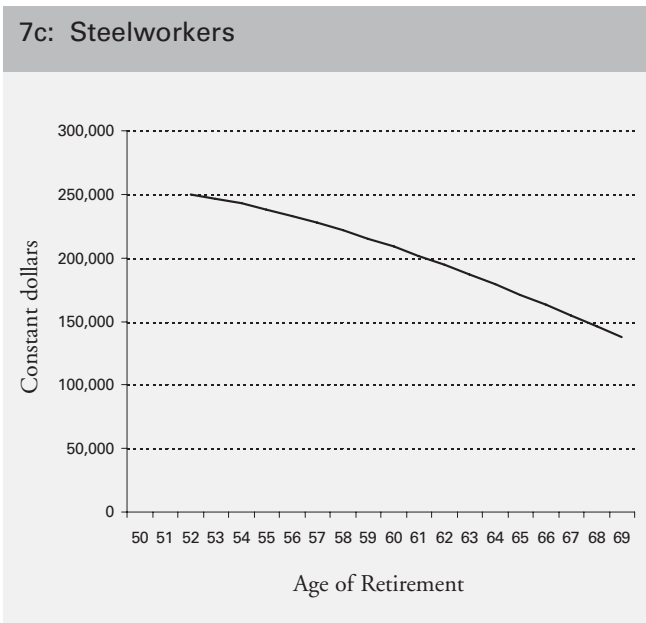
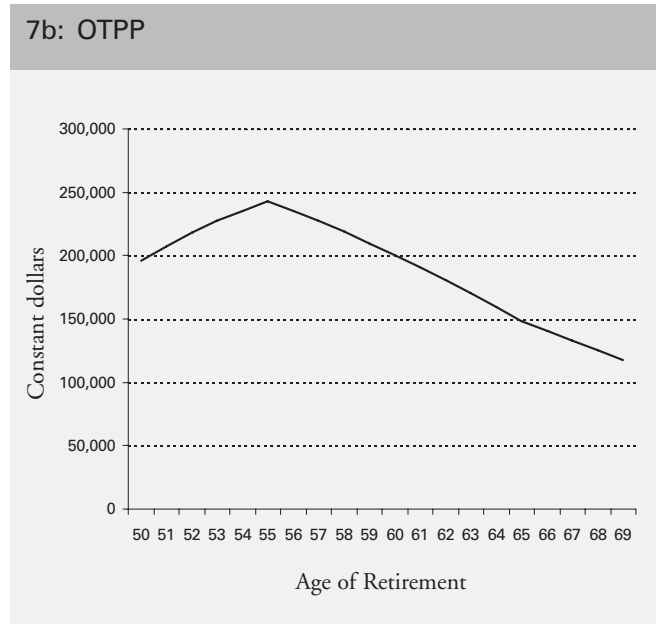
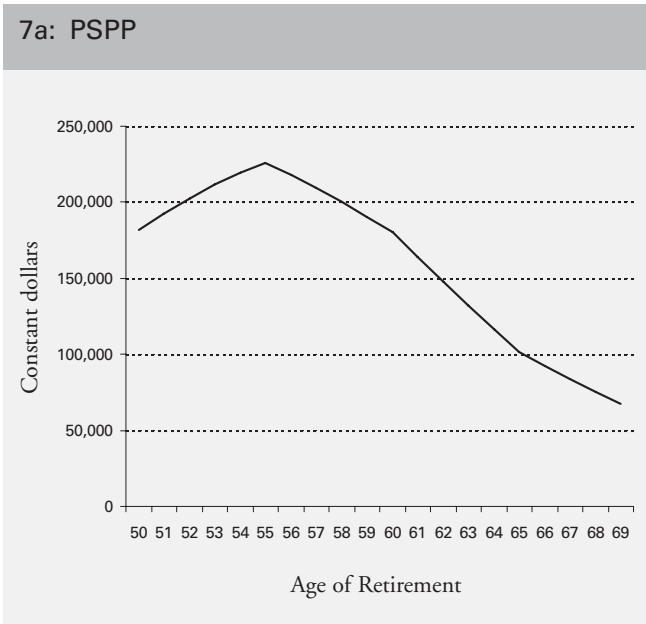
To begin, I examine the retirement incentives in each pension plan for a 50-year-old with 25 years of seniority. It is assumed this individual earns approximately \$40,000 per year and that this salary is the highest level of career earnings.¹³ Figure 7 illustrates the discounted present value of retirement benefits under each pension plan at each possible retirement age for this individual.

Under the PSPP, pension benefits are calculated as a percentage of earnings multiplied by years of service, to a maximum of 35 years. If the individual retired at 50, he/she would receive actuarially reduced benefits. With 25 years of seniority, this individual’s benefits are reduced by 25 percent — 5 percent for each year under 30 years seniority. Each year the individual delays retirement, he/she gains in two ways: by a reduction in this actuarial penalty and by extra

12 All results of this paper can be replicated using the publicly available simulation model.

13 This assumption matters for the level of benefits in the PSPP and OTPP plans, but not the resulting incentives discussed here. Average earnings of teachers and public servants are likely higher than those of workers in the manufacturing sector. For the purposes of illustrating the mechanisms at work in these plans, I have assumed the same salary across all examples.

Figure 7: Discounted Present Value of Retirement Benefits, by Age of Retirement



Note: These profiles represent the discounted present value of lifetime retirement benefits for a 50-year-old worker with 25 years seniority, earning \$40,000 annually, at each future age of retirement.

years of service applied to the basic benefit. This is easily calculated in Figure 8, where the one-year accrual of retirement benefits is provided.

At 55, the same PSPP member achieves a maximum discounted present value of benefits. At that age, the individual has enough seniority to begin receiving an unreduced benefit. If the worker chose to delay retirement one more year after 55, he/she would actually lose some retirement wealth and the one-year accrual becomes negative. Although extra years of service will increase the annual benefit, that increase is insufficient to compensate the individual for the lost years of receiving benefits from age 55.

At 60, the accruals under PSPP turn even more sharply negative as the individual reaches 35 years of seniority and his/her extra years of service do not translate into higher benefits. This results in even greater incentives to retire sooner rather than later. The larger one-year accrual in Figure 8 at 65 reflects the integration of the PSPP with the Canada Pension Plan.

The Ontario Teachers' Pension Plan has similar features creating incentives for early retirement. For the same 50-year-old individual with 25 years seniority, retirement at 50 is penalized by an actuarial reduction of 2.5 percent for each point under the 85 factor (age plus years of service). For the next five years, each year of delayed retirement increases the individual's benefits by five percent. At 55, like under the PSPP, the individual has no obvious incentive to continue working since he/she is now eligible to receive unreduced benefits, having reached the 85 factor. Any further increases in benefits for years of service do not adequately compensate for the years of forgone pension payments. Similar to the PSPP, the OTPP is integrated with the Canada Pension Plan, reducing benefit amounts at 65 and beyond.

The private sector pension plans provide the most striking early retirement incentives. The

Steelworkers' plan provides the highest retirement wealth at 52, the earliest age at which a plan member can enjoy unreduced benefits if they achieved a 75 factor (age plus years of service). (For simplicity, it has been assumed that individuals will not retire before they are eligible to collect retirement benefits.) As early retirement is no longer penalized and later retirements are not rewarded with actuarial increases, any additional years of seniority from delayed retirement do not result in increases in benefits large enough to compensate the individual for the years of forgone benefits.

The Ford Canada plan, which provides a flat benefit based on years of seniority, has similar incentives. The same worker is eligible for unreduced benefits at 55, having achieved enough points for the 80 factor (age plus years of service). This individual, however, achieves maximum retirement wealth at 60 when, with more than 30 years of service, he/she is eligible for Ford's "30-n-out" program. This program

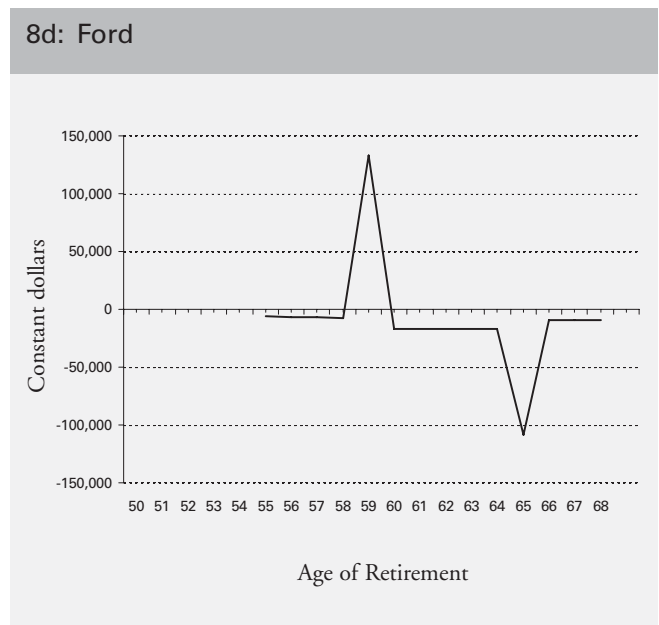
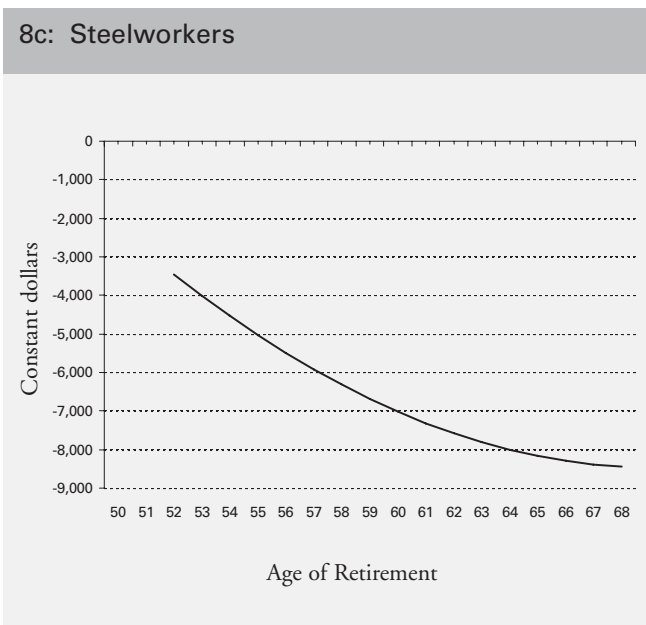
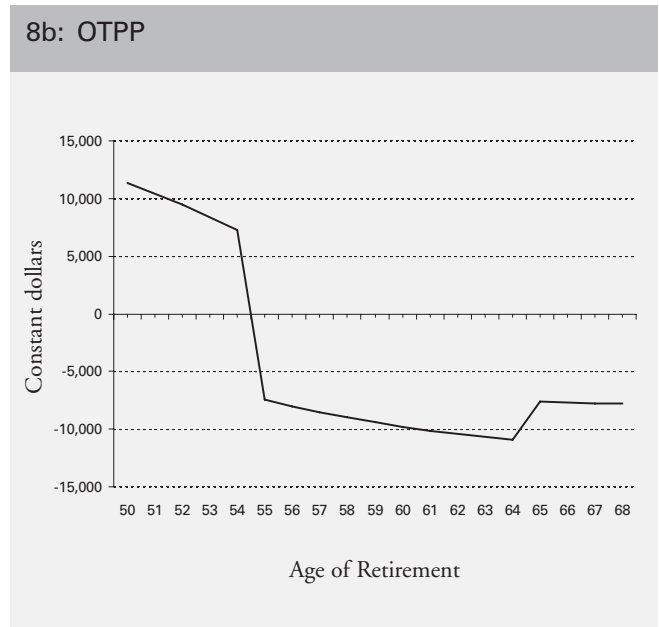
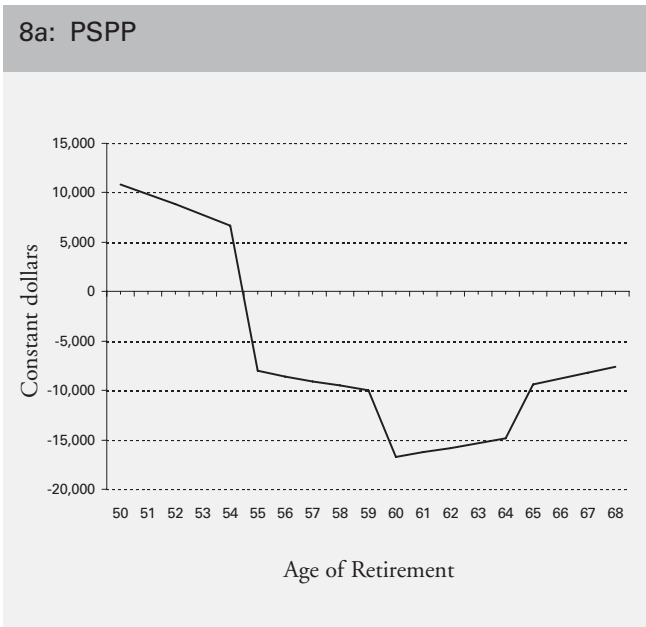
provides a substantial monthly top-up benefit to any employee retiring between 60 and 65 with more than 30 years of seniority. After 65, the program is no longer available. Initial benefit levels for retirement after 65 are much lower and accruals turn sharply negative at 65, leaving individuals with few incentives to continue working.

In each of these examples, the first year when individuals can receive unreduced pension benefits is also a year in which they have substantial incentives to retire. To further illustrate this point, the incentives contained in the pension plans are reproduced in Figures 9 and 10 for individuals considering retirement at 50 with only 15 years of seniority.

In each of these profiles, the individual has an incentive to retire at the first age of unreduced benefits. For the PSPP, this occurs at 60 (with only 25 years seniority). The same individual

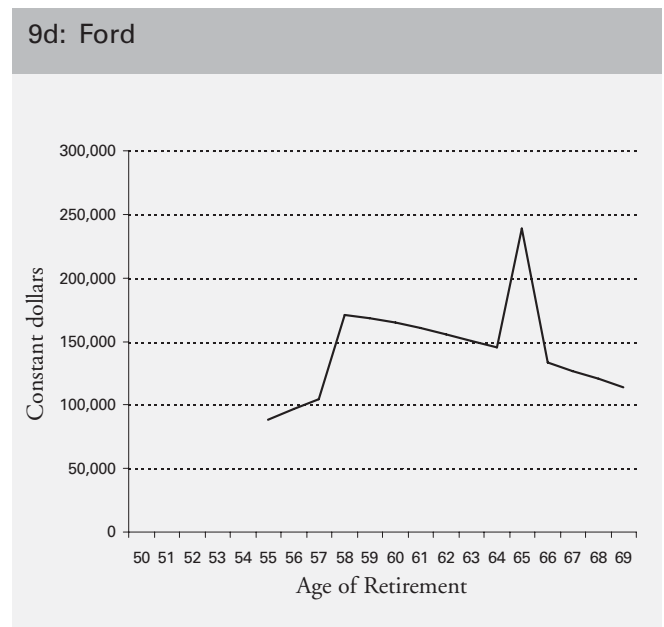
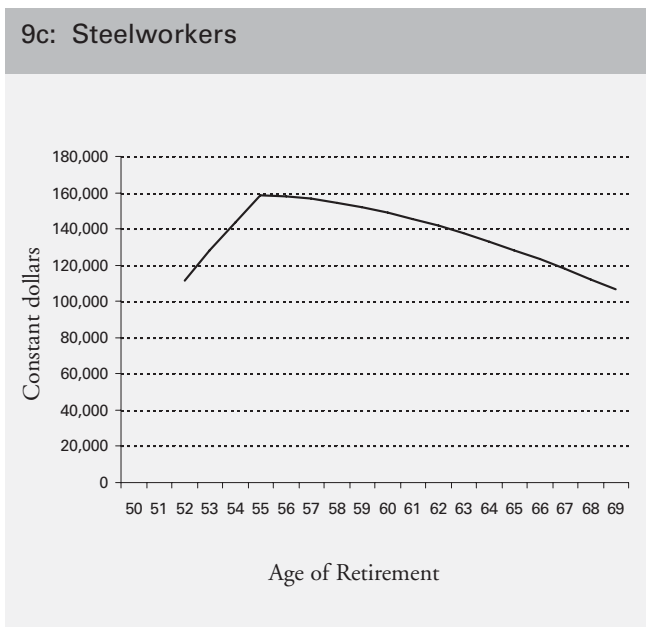
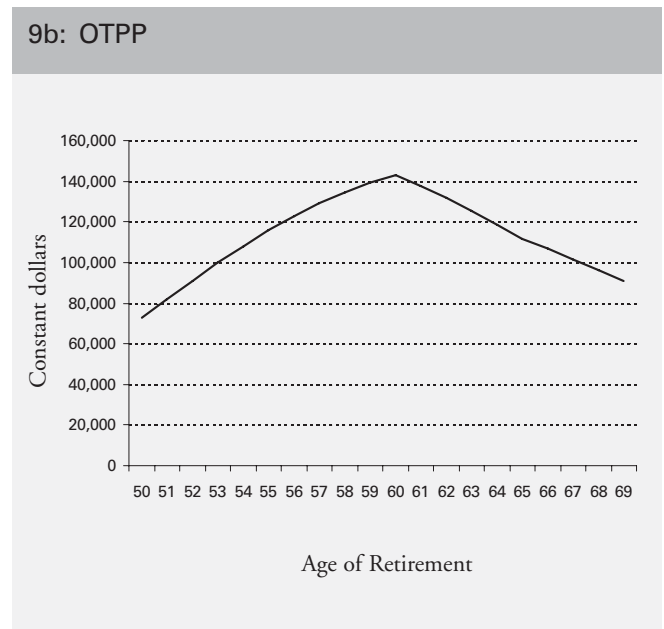
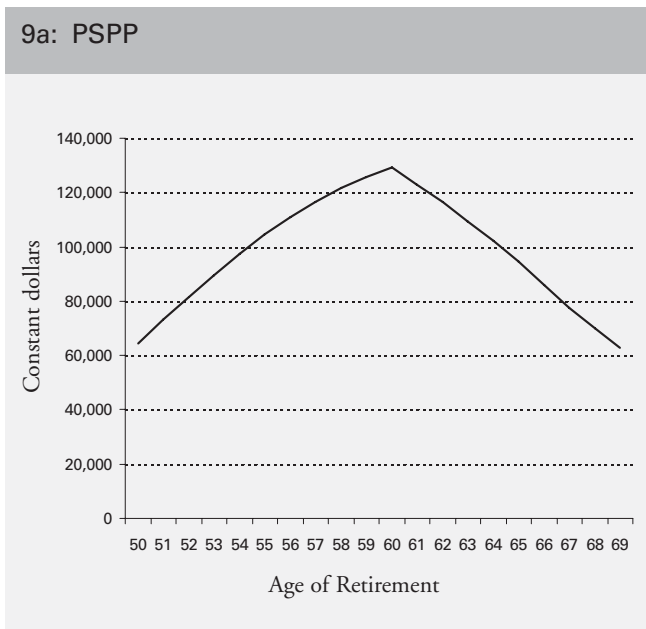
In each of these examples, the first year when individuals can receive unreduced pension benefits is also a year in which they have substantial incentives to retire.

Figure 8: One -Year Accrual of Retirement Benefits, by Age of Retirement



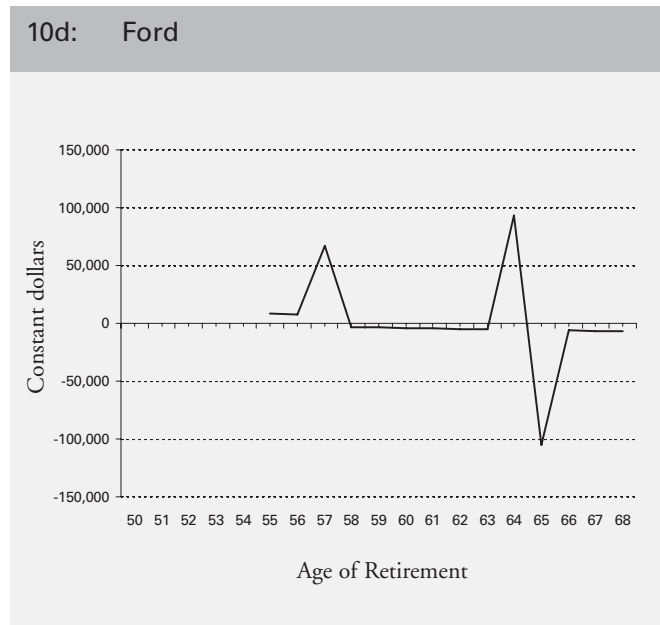
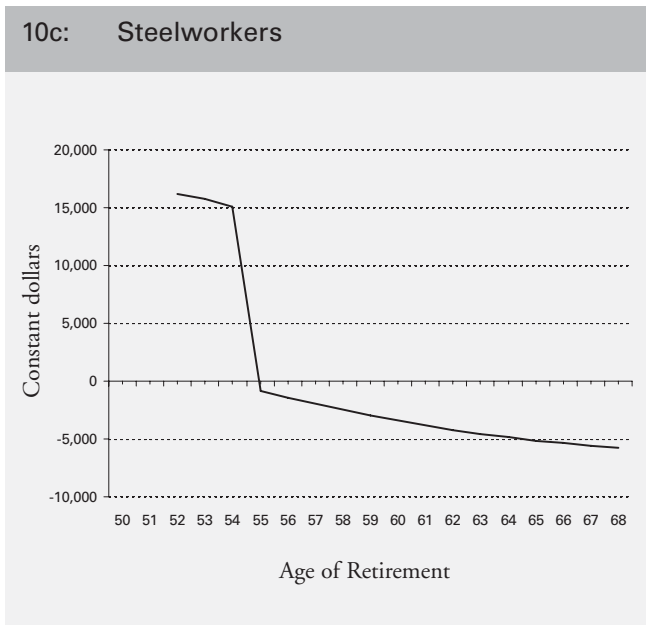
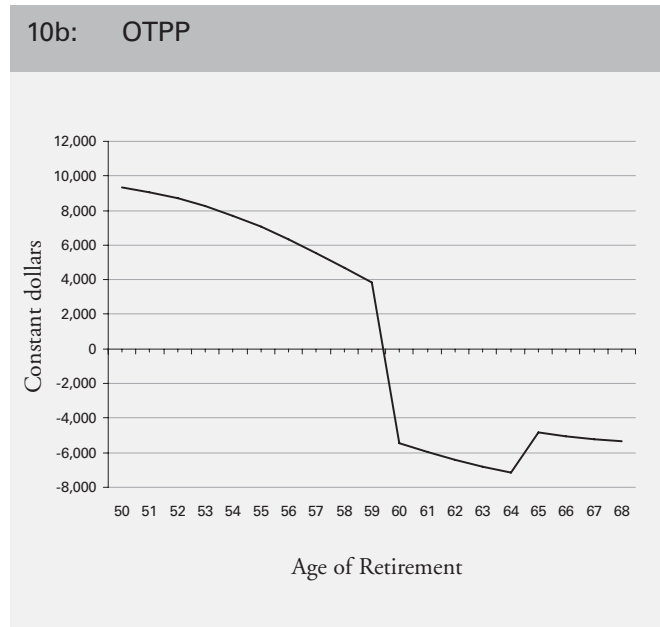
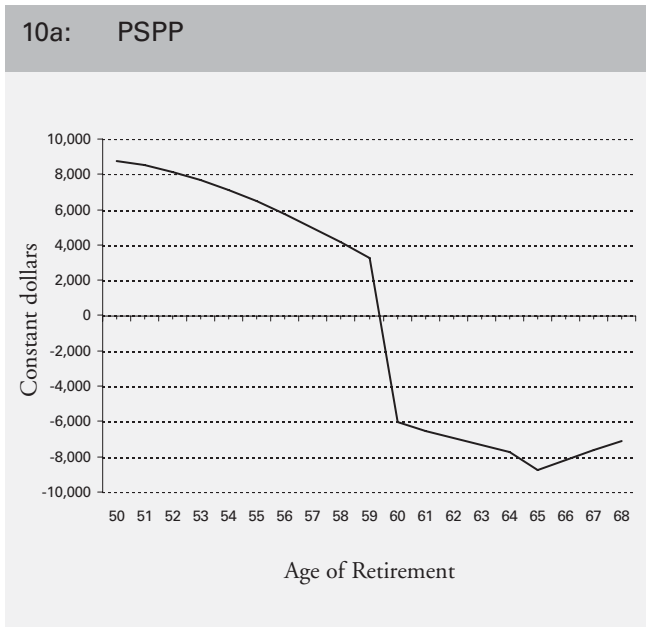
Note: These profiles represent the accrual of retirement wealth achieved by delaying retirement by one year, for each potential age of retirement. This is derived from the Figure 7 results and represents a 50-year-old worker with 25 years of seniority.

Figure 9: Discounted Present Value of Retirement Benefits, by Age of Retirement



Note: These profiles represent the discounted present value of lifetime retirement benefits for a 50-year-old worker with 15 years seniority, earning \$40,000 annually, at each future age of retirement.

Figure 10: One-Year Accrual of Retirement Benefits, by Age of Retirement



Note: These profiles represent the accrual of retirement wealth achieved by delaying retirement by one year, for each potential age of retirement. This is derived from the Figure 9 results and represents a 50-year-old worker with 15 years of seniority.

under OTPP also would reach the first age of unreduced benefits at 60 as this is when they have achieved enough points for the 85 factor (60 years of age plus 25 years service). For the Steelworkers, who require a 75 factor for unreduced benefits, the individual has an incentive to retire at 55 with 20 years of service.

The Ford plan is similar as this individual sees a large jump in retirement benefits at 58 — the first year of unreduced benefits with an 80 factor. The present value of lifetime benefits falls thereafter, except in the year the Ford worker turns 65. This is the only year he/she would be eligible for the top-up benefit under the 30-n-out plan.

It is worth emphasizing the factors at work in creating these early-retirement incentives. The greatest benefit that can be achieved by delaying retirement under these plans is the smaller actuarial reduction applied to the initial benefit amounts. Once a worker reaches the retirement age with unreduced benefits, the additional benefits from extra years of service are not adequate to financially compensate for the years of forgone retirement benefits, without an incremental benefit. Note this incremental benefit could be achieved with an actuarial increase in benefits for delayed retirement.

Plans such as the PSPP create further disincentives for delayed retirement by placing a maximum on years of service that will raise pension benefits. Plans such as the Ford pension plan create some incentives to continue work by giving a bonus for retirement at an age after that of unreduced benefits. Such provisions, of course, provide incentives to retire as soon as the bonus is available and disincentives to enter retirement thereafter.

The Effects of Pensions Incentives on Retirement Behavior

It remains to ask a critical question: How do individuals respond to the financial incentives for retirement discussed here? If they do respond by

taking early retirement, what is the relative importance of these incentives among the various factors that influence retirement decisions?

The literature examining the incentives contained in public pensions is quite extensive (see Milligan 2005 and Milligan and Schirle 2006), and generally suggests individuals will take advantage of the types of retirement incentives discussed in the previous section. In an influential paper, Baker, Gruber and Milligan (2004) examine the effect of Canada's income security programs on retirement behaviour, using the retirement wealth and accrual measures described in this study. They find that retirement wealth has a positive and significant effect on early retirement decisions and that, specifically, the accrual of wealth for delayed retirement has the expected negative effect on the likelihood of entering retirement. Some of their estimates suggest a \$1,000 accrual increase is associated with a two-percentage-point decline in retirement rates.¹⁴

It is unclear whether one can expect employer-provided pension plans to have an impact similar to public pensions. Evidence of the effects of employer-provided pension plans has been limited, especially in Canada, largely due to a lack of adequate data sets. Pesando and Gunderson (1988 and 1991) map out pension wealth profiles for common employer-provided pensions in Canada, with the goal of identifying the incentives to continue working created by the structure of the pension plans. They suggest the absence of actuarial increases or accrual in benefits for additional years of service would create early retirement incentives — potentially serving as a substitute for mandatory retirement.

In a later work, Pesando and Gunderson (1991) found that pension wealth is likely to decline after the age at which unreduced pension benefits are available. Pesando, Gunderson and Shum (1992) also document the work and retirement incentives contained in defined-benefit pension plans and provide evidence that unionized workers who anticipate positive changes in the defined-benefit

14 Their study refers to a US\$1,000 increase, in 1998 constant dollars.

formulas are likely to postpone retirement until a new contract is negotiated. In these studies, however, the authors did not actually estimate the effects of such provisions on retirement behaviour.

In a US study, Stock and Wise (1990) use data from a large Fortune 500 firm to examine the retirement incentive effects of defined-benefit pension plan provisions.¹⁵ This firm's pension benefit formula is a simple function of years of service and final wages. There are early retirement actuarially reduced benefits for retirements from 50 to 54; there are less than actuarially reduced benefits available for retirements from 55 to 65; and the person is entitled to unreduced benefits at 60 if he/she has 30 years of service. All beneficiaries have benefits reduced after age 65, depending on their Social Security entitlement.

Under this plan, the discounted present value of retirement benefits peaks at 55 when benefits are no longer subject to the full actuarial reduction, similar to the plans discussed in the previous section. The results of the study suggest that a substantial portion of individuals would delay retirement if the early retirement provisions were applied at older ages.

Interestingly, switching from a defined-benefit plan to a defined-contribution plan is expected to increase retirement rates at younger ages. Results from Stock and Wise (1990) suggest that as there is no need to stay to receive "retirement bonuses," individuals will retire earlier. They point out that these results are consistent with the view that the defined-benefit plan keeps employees in the firm until certain ages and then provides an incentive to leave.

In another US study, Coile and Gruber (2000) use a simpler model to estimate the effect of pension plan and social security incentives on retirement decisions. While difficult to separately identify the effects of public and private pensions, they found that incentives from Social Security

had important effects on retirement decisions. Their results, however, suggest that individuals are less responsive to changes in pension incentives than to changes in Social Security incentives.

Canadian evidence of the effects of pension incentives is more limited. Gunderson, Hyatt and Pesando (1992) have provided evidence suggesting early retirement provisions influence retirement decisions. Schirle (2006) provides more recent Canadian evidence suggesting individuals respond to both public pension and private pension early retirement incentives.

Overall, the literature examining pension incentives suggests individuals will respond to financial incentives when making retirement decisions. However, it remains to be determined what is the relative importance of these incentives in the retirement decision? While 25 percent of retirees aged 55 to 59 in one study stated that they retired because their employer offered an early retirement incentive, retirees are more likely to report they retired because of health reasons or because they simply wanted to stop working (Milligan and Schirle 2007).¹⁶

There is also a large body of literature examining these other factors that influence retirement decisions. For example, Canadian evidence from Campolieti (2002) demonstrates that disability has a large negative effect on labour force participation. Evidence from Schirle (2006) suggests poor health increases the likelihood of entering retirement by 20 percentage points. US literature provides similar conclusions and suggests that the availability of retiree health insurance is an important consideration for early retirement. As health deteriorates with age, some workers may experience falling wages or increased disutility of work, providing them with additional incentives to retire.

The incentives contained in defined-benefit pension plans are thus only one factor to consider

15 Stock and Wise are often credited with developing the measures used in this paper. They use an "option value" measurement of continued work to represent the amount an individual can gain in terms of the discounted present value of utility from income when retirement is postponed until some optimal age. Our simple use of income rather than utility to describe these decisions effectively assumes individuals are risk-neutral.

16 In this survey, these reasons for retirement were not mutually exclusive categories.

in the retirement decision. One expects individuals to respond to the inducements discussed in this study. Specifically, one can expect many early retirements when the present value of retirement benefits reaches a maximum at the first age of unreduced benefits. Other special retirement provisions, such as Ford's "30-n-out" provisions, can be constructed to keep employees with the firm past this first age of unreduced benefits. Defined-contribution plans, on the other hand, would not provide employers with the tools, useful in their employment contracts, to keep high seniority employees with the firm at older ages.

Conclusion

The central goal of this study is to illustrate how the structure of defined-benefit pension plans may create incentives for workers to take early retirement or continue working with an employer. The examples used here — Ford Canada, Steelworkers, the Ontario Teachers' Pension Plan and the Federal Public Service Pension Plan — have significant provisions that provide motivation for early retirement. In each of these plans, individuals have inducements to retire at the age when unreduced benefits are first available. Without actuarial increases for delayed retirement, any accrual in retirement benefits associated with more years of service is unlikely to adequately compensate the individual for the years of forgone retirement benefits.

The Ford Canada plan best exemplifies how a defined-benefit pension plan can be designed to encourage workers to remain with the firm until a particular age. A high-seniority worker that qualifies for Ford's "30-n-out" program has large incentives to retire at 60 and not work beyond that age. The use of penalties for early retirement, such as those found in the Steelworkers' plan for workers under the 75 factor, can be used to retain

older workers while allowing some flexibility in the choice of retirement age among its workers.

This study provides some additional insight into the nature of retirement incentives for all parties involved in pension plans, whether they be employers, workers or policymakers. Ultimately, the provisions of a defined-benefit pension plan are the result of negotiations between an employer and employees and should be thought of as one part of an optimal contract between these parties. This contract should reflect the human resource needs of the employer and the retirement preferences of employees. From the firm's perspective, the use of such contracts as part of the compensation package can facilitate worker-retention objectives. Employers should regularly perform comprehensive analyses of their plans to ensure they fit their long-term goals.

From the worker's perspective, a defined-benefit pension plan provides a secure form of retirement income and offers protection from the longevity risk that is more easily absorbed by a large employer. Difficulties may arise, however, when there exist considerable differences in retirement preferences among workers at different stages of their career. It is difficult to negotiate a range of pension options within a workplace to suit various types of employees. It would be even more difficult to alter pension plan provisions to reflect changing employee preferences or employer needs.

Finally, while policymakers at the provincial and federal levels may be very interested in the retirement incentive effects of pension plan provisions, interfering in any substantial way in these contracts can only lead to inefficiencies in the labour market. While it is the responsibility of pension legislators to monitor pension funds and ensure that pension obligations are met, the only other role suggested here would be ensuring that flexibility in pension arrangements, as it reflects the preferences of workers and employers, is protected.

Appendix — The Simulation of Pension Plans

The models used here do not truly represent all provisions of individuals' pension plans and should not be relied upon in determining individual benefits. Rather, the models are designed to exemplify how key provisions of various plans matter in determining an individual's retirement wealth. The simulation model, designed for use in Microsoft Excel, is publicly available at http://www.tammyschirle.org/research/db_plans.html.

Assumptions and Measurement.

All benefits are viewed from the perspective of an individual deciding whether to retire in 2007. The individual assumes the benefit structure of his/her pension plan will not change and that the amounts that define a basic-benefit amount will increase with inflation. The initial benefit amount, if the individual retired immediately, is stated in 2007 dollars.

Throughout, it is assumed that the individual will not consider retiring unless he/she can simultaneously begin receiving pension benefits.

The survival probabilities used are those for men. It is assumed individuals have zero probability of surviving past age 102. The survival probabilities used in the model reflect the probability of surviving to each age given that the individual survived to the age of retirement under consideration.

The use of survival probabilities for women, for the most part, would result in a higher discounted present value of retirement benefits at each age, given a longer life expectancy.

The various pension plan provisions are described below (closely following Pescarus and Rivard 2005):

1. *Ford Canada — Canadian Auto Workers pension plan.*

- This is a flat-benefit plan, with a fixed retirement benefit linked to the individual's category of employment. The model here assumes the benefit for an assembler, set at \$57.80 per month per year of service (2002 amounts).
- Individuals may receive benefits without actuarial reduction as early as 55 with an 80 factor, or from 60 with an 85 factor.
- At the time this model was developed, the actuarial reduction and earliest possible pension take-up age was not clear to the author. I have assumed the earliest age for pension take-up to be 55 years and an actuarial reduction of 5 percent per year. When retiring between 55 and 60, this reduction applies to each year the individual is under the 80 factor. When retiring at 60 or older, this reduction applies to each year the individual is under the 85 factor.
- Employees who retire between 60 and 65 with at least 30 years of pensionable service can receive a top-up benefit under a 30-n-out program, set at \$1,236 per month above the basic benefit (2002 amount).
- The model assumes pension benefits are indexed to inflation.
- The model implicitly assumes there are no future collective agreements that will change retirement benefits.

2. *The Steelworkers and Stelco Canada, now U.S. Steel, pension plan*

- This is a flat-benefit plan, with a fixed retirement benefit independent of earnings. In 2002, the basic benefit was \$50.33 per month per year of service and was topped up by a bonus of \$22 per month per year of service. This bonus is not included in our calculation of the initial benefit, but is incorporated into the present value calculations.

- Individuals may receive benefits without actuarial reduction at 52 with a 75 factor.
- Conditions under which reduced benefits are available was not clear at the time this model was developed. It is assumed that reduced benefits may be collected at age 52, reduced by 5 percent for every year the individual is below the 75 factor.
- The model assumes pension benefits are indexed to inflation.

3. Ontario Teachers' Pension Plan (OTPP)

- Modeled here is a simplified version of the plan.
- Individuals may draw benefits as early as age 50.
- They are eligible for a full pension (no actuarial reduction) if they reach an 85 factor (age plus years of service), reach 35 years of service, or reach age 65.
- The formula for the basic benefit is two percent x years service x highest paid salary (noting actual pensions depend on five years of highest earnings).
- The actuarial reduction is 2.5 percent for each point missing from the 85 factor, or 5 percent per year until age 65, whichever is less.
- OTPP is partially integrated with the Canada/Quebec Pension Plan. Regardless of age of take-up or retirement, benefits are reduced by the amount of 0.45 percent x years

of service x lesser of the five-year average YMPE and earnings.

4. Federal Public Service Pension Plan (PSPP)

- The minimum age for pension take-up is 50.
- Non-reduced pensions are available from 55 with at least 30 years of pensionable service or from 60 (regardless of seniority).
- This is a defined-benefit plan. The basic unreduced benefit is 2 percent x number of years of pensionable service (maximum 35 years) x highest earnings (average of 5 highest years is used in practice, but not in this model).
- If the individual is between 50 and 54 with less than 25 years of seniority, his/her pension is reduced by 5 percent per year under age 60.
- If the individual retires between 50 and 54 with 25 years of seniority, his/her pension is reduced by 5 percent per year under 30 years of service.
- If the individual is between 55 and 59 with less than 25 years of seniority, the pension is reduced by 5 percent per year under age 60.
- If the individual is between 55 and 59 with 25 to 29 years of seniority, the pension is reduced by 5 percent per year under 30 years of service.
- PSPP is integrated with CPP/QPP. Regardless of age of take-up, benefits are reduced at age 65, the reduction amounts to 0.007 x number of years service x lesser of average YMPE or earnings.

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