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Mandatory Retirement and Incentives in Private Pension Plans[1]

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1 Introduction

On 12 December 2006, Bill 211 the Ending Mandatory Retirement Statute Law Amendment Act came into effect in Ontario. This act amended the Ontario Humans Right Code to prevent the discrimination of all persons over the age of 18, and effectively eliminated the use of mandatory retirement in the province of Ontario.[1] One might be inclined to think that this act would have no significant effects on labour markets. For decades after 1960, male labour force participation rates at older ages fell and female labour force participation rates at older ages have never been high. So, perhaps there might be a very few who, when given the option to work beyond 65, would choose to do so, but, with the continuing trend to retire earlier, the few would become an insignificant percentage of the older population.

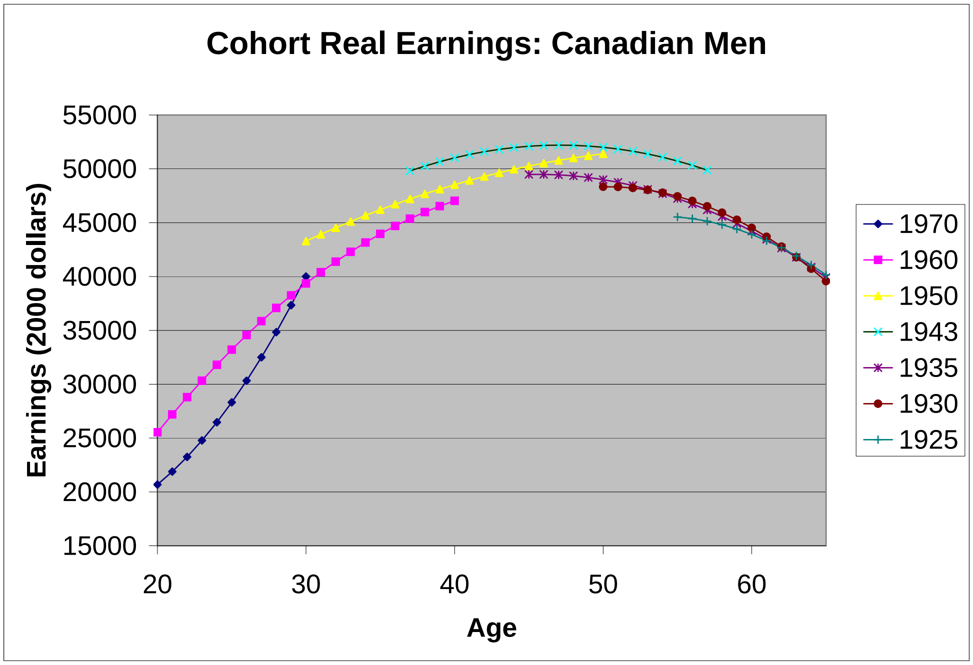
This paper questions this view. We use the last ten years of Labour Force Surveys (LFSs) to show that there are significant groups, particularly men with higher levels of education, who may decide to continue in their jobs beyond age 65. In addition, we argue that the trend to retire earlier may have reversed for all education groups, that, in the future, an increasing fraction of men and women may choose to stay in their jobs beyond 65. A comparison of Manitoba and Quebec, which abolished mandatory retirement in the early 1980s, with the rest of Canada shows that a much smaller proportion of the labour force retires in the neighbourhood of age 65 in Manitoba and Quebec.[2] If it is true that the abolition of mandatory retirement has changed the labour force behaviour of older workers in Manitoba and Quebec, and is likely to change labour force behaviour in Ontario and other provinces, then it is of some interest to know who will choose (or has chosen) to work beyond 65 and what inducements firms might have to offer these individuals to persuade them to retire at age 65. We begin the exploration of these questions by extending the consumption-retirement model in Burbidge and Robb (1980) and then using the model to simulate a standard defined-benefit pension plan.[3] Our analysis shows that, controlling for consumption-leisure preferences and outside options, it will be the less productive workers who wish to work beyond 65, and that it would require quite large increases in pension benefits at age 65 to persuade these workers to retire at age 65.

We also address the question of whether, after the abolition of mandatory retirement in Manitoba and Quebec, older workers may have migrated from other provinces into Manitoba and Quebec to be able to work beyond age 65. To this point, the data sets we have used do not offer a clear answer. Another issue we think worthy of some attention is the intergenerational equity of abolishing mandatory retirement. We begin with this and then turn to the LFS evidence on labour supply behaviour of older workers.

[1]Employers who can demonstrate that age is a bona fide occupational requirement may receive exemption from the act and thereby enforce mandatory retirement (Ontario Human Rights Commission, 2007).

[2]Changes in Quebec's employment standards legislation effectively banned mandatory retirement in 1983. The removal of mandatory retirement in Manitoba resulted from a series of court challenges to the Human Rights Act and was effective by 1982.

[3]About 40% of all paid workers are covered by a registered plan (Statistics Canada, 2007). The majority of active plan members are covered by a defined benefit plan. See Appendix for further information about registered pension plans in Canada.



Graph 1 shows median real earnings as a function of age for various cohorts of Canadian men. The data are based on data drawn from the five censuses between 1981 and 2001. The publicly released individual census files report, among many other things, earnings for the previous calendar year. We selected men, aged 20 to 65, who reported working 30 or more hours per week, 52 weeks a year (including holidays) and who were not self-employed. The details are in the Appendix. Briefly, one can estimate real earnings as a function of age for particular cohorts by tracking median earnings of the cohort through the five censuses. While different cohorts are observed at different ages it would appear from the graph that, of the cohorts shown, the 1943 cohort has the highest lifetime real earnings. A comparison of 1941, 1942,...,1946 (not shown) reveals that real earnings for the 1943 lie above the rest. The possible exception to this statement is that the 1970 cohort, most recent cohort shown in Graph 1, started out with low real earnings but it may overtake the rest eventually.

If it is true that the 1943 cohort of men has the highest real earnings in Canadian history, then one (intended or unintended) effect of the abolition of mandatory retirement in 2006 by the Ontario Government is to make the rich richer. The extended working lives of members of the 1943 cohort, or the extra inducements offered to the 1943 cohort to get them to retire, will constitute rents to this already fortunate cohort and delays in job openings for the poorer cohorts that follow them. Whatever else one can say about the abolition of mandatory retirement by the Ontario Government the policy change does not score well on intergenerational equity.

2 Evidence from LFSs: 1997-2006

During the 1990s, older workers were retiring earlier. Using data from the Labour Force Survey, Kieran (2001) shows that of those individuals retiring in the late 1980s, only 29% were under the age of 60 compared to 43% a decade later. Further, this *early retirement rate* in the late 1990s was substantially higher for individuals with a university degree (50%) than for individuals with less than high school (29%). As we observed above, if this trend towards early retirement were to continue through the 21st century, then the elimination of mandatory retirement would not have much bite. More recent data from the Labour Force Survey suggests, however, that this trend may be reversing.

The labour force participation rates for men aged 60-64 and aged 65-69 increased between 2000 and 2006 as shown in the Appendix.[4] The trend to earlier retirement, so evident for many years prior to 2000, appears to have reversed. Further, conditional on age, employment rises with education level; in 2006, for ages, 60-64, employment rates ranged from 42% for men with less than 9 years of education to 61% for men with at least a Master's degree; the corresponding numbers were 14% and 37%, for men aged 65 to 69, and 4% and 17%, for men 70 years of age or older. One would think that the abolition of mandatory retirement in Ontario would strengthen the trend to work longer.

To determine if the abolition of mandatory retirement does in fact influence the employment rates of older workers, we can compare these rates in Manitoba and Quebec with the rest of Canada. Manitoba and Quebec both eliminated the use of mandatory retirement in the early 80s. In 2006, employment rates in Manitoba and Quebec were lower than those in rest of Canada at ages 60-64 but were above those in rest of Canada at older ages, particularly for higher level of education. We speculate that the early abolition of mandatory retirement in Manitoba and Quebec contributed to this difference.

3 Theoretical Framework

Following Burbidge and Robb (1980), we employ a life-cycle model to analyse an individual's decision to retire where the retirement decision is assumed to be discrete and permanent.[5] At time zero, $t = 0$, the individual is assumed to be 50 years of age and acts as if he will live until time T. The individual has preferences over consumption at time t, denoted by $C(t)$, and amount of leisure at time t, denoted by $L(t)$. We also allow for the possibility that there is some minimum required amount of consumption needed to survive each period t, denoted by $\bar{C}_t \geq 0$. Preferences can then be represented by the following utility function $U(C(t) - \bar{C}_t, L(t))$ where U is increasing, at a decreasing rate, in net consumption. The minimal amount of consumption is assumed to be constant when the individual works and to be constant, possibly at a different level, when the individual is retired. Denote these

[4]Similar upward trends in the participation rates of both women and men aged 55 to 64 has been documented by Marshall and Ferrao (2007).

[5]We are ignoring the possibility that retired individuals immediately find different employment or re-entry the labour market at a later date.

minimal consumption amounts by $\bar{C}_w$ and $\bar{C}_r$, respectively. Leisure can only be varied by changing the age of retirement. Further, L is normalized to zero when the individual is working and to unity when the individual is retired. Let N be the number of years the individual spends working full-time. The individual is retired for $R = T - N$ years and the age at retirement is $50 + R$.

The individual chooses consumption in each period, $C(t)$, and the number of years to work N (or, equivalently the number of years of retirement) to maximize their discounted value of utility subject to their lifetime budget constraint. The individual's discounted value of utility is given by

$$\int_0^N U(C(t) - \bar{C}_w, 0)e^{-\delta t}dt + \int_N^T U(C(t) - \bar{C}_r, 1)e^{-\delta t}dt \tag{1}$$

where δ is the constant subjective discount rate. The individual's lifetime budget constraint is

$$\int_0^T C(t)e^{-rt}dt = W_0 + \int_0^N Y(t)e^{-rt}dt + \int_N^T P(t)e^{-rt}dt \tag{2}$$

where W_0 is the individual's initial wealth at time 0 and $Y(t)$ is the individual's earnings if they work in period t net of any taxes and pension contributions in that time period. When the individual retires, they receive a constant pension benefit P which depends positively on the number of years of full-time work, N. The interest rate r is also assumed to be constant and for simplicity assumed to be equal to the subjective discount rate, δ.

Let λ be the multiplier on the individual's lifetime budget constraint. Maximizing (1) subject to (2), yields the following optimality conditions:

$$U_c(C(t) - \bar{C}_w, 0) = \lambda, \qquad t \in [0, N] \tag{3}$$

$$U_c(C(t) - \bar{C}_r, 1) = \lambda, \qquad t \in (N, T] \tag{4}$$

From the above conditions, we have that $C(t) = C_w$ for $t \in [0, N]$ and $C(t) = C_r$ for $t \in (N, T]$. Consumption is constant while the individual works and constant, possibly at a different level, while the individual is retired. Given $U_{cc} < 0$, we have the following result:[6] if utility is separable in consumption and leisure, $U_{cL} = 0$, then

$$C_w - \bar{C}_w = C_r - \bar{C}_r \tag{5}$$

Under a separable utility function, $C_w > (<) C_r$ if $\bar{C}_w > (<) \bar{C}_r$.[7] We could interpret different levels of minimal consumption requirements as differences in home production. For example, while working individuals are likely to incur additional costs such as commuting or travel costs and higher food costs, so $\bar{C}_w > \bar{C}_r$ and consequently, $C_w > C_r$. This empirical implication matches the data quite nicely. Burbidge and Davies (1994) show that controlling for family size, consumption is roughly constant while individuals work and then drops

[6] If $U_{cL} > (<)0$, then $C_w - \bar{C}_w < (>) C_r - \bar{C}_r$.

[7] Burbidge and Robb (1980) consider separable utility when $\bar{C}_w = \bar{C}_r = 0$ so that consumption is constant over the individual's lifetime.

significantly when they retired but still remains relatively constant over this period. The more-standard hump-shaped consumption profile describes families with children.[8]

We can now look at the retirement decision. Given the above results, the individual's maximization problem becomes

$$\max_{C_w, C_r, N} \int_0^N U(C_w - \bar{C}_w, 0)e^{-rt}dt + \int_N^T U(C_r - \bar{C}_r, 1)e^{-rt}dt \tag{6}$$

subject to

$$\int_0^N C_w e^{-rt}dt + \int_N^T C_r e^{-rt}dt = W_0 + \int_0^N Y(t)e^{-rt}dt + \int_N^T P(t)e^{-rt}dt. \tag{7}$$

The optimality condition on N is given by

$$\frac{U(C_r - \bar{C}_r, 1) - U(C_w - \bar{C}_w, 0)}{\lambda} = Y(N) - C_w - (P(N) - C_r) - P'(N)\left(\frac{1 - e^{-r(T-N)}}{r}\right), \tag{8}$$

where λ is equal to the marginal utility of consumption as given in the above optimality condition. The left-hand side can be interpreted as marginal rate of substitution between working one more year and consumption. The right-hand is the additional net resources the individual obtains if they work one more year or, equivalently, postpone retirement for one year. Working one more year, increases the individuals wealth by their earnings that year less the resources need to purchased their consumption that year. The cost of working one more year, however, is the foregone pension benefit they could have obtained that year less the resources required to purchase consumption while retired. At the same time, working one more year increases the pension benefits in all future periods. This gain is discounted back and given by the last term.

Given the above analysis, we can think about an individual having preferences over consumption while working, consumption while retired and number of years of retirement. Denote these preferences by the following utility function

$$V(C_w - \bar{C}_w, C_r - \bar{C}_r, R - \bar{R}) \tag{9}$$

where $\bar{R} \geq 0$ is some minimum number of years of retirement. We can rewrite the individual's budget constraint as

$$\delta_w C_w + \delta_r C_r = W_0 + M(R) \tag{10}$$

where δ_w and δ_r discount the stream of annual consumption over the individual's lifetime, while working and while retired, respectively. These discount factors will depend on the years of retirement with δ_w decreasing in R and δ_r increasing in R.[9] The present value of the individual's life-time earnings is denoted by $M(R)$ and includes an exogenous stream of earnings, pension benefits and tax rates and will also depend on the interest rate. We

[8]Burbidge and Davies (1994) use adult-equivalence scales to control for family size.

[9]We have that $\delta_w = \int_0^N e^{-rt}dt$ and $\delta_r = \int_N^T e^{-rt}dt$.

assume that increases in years of retirement reduces $M(R)$ so $M'(R) < 0$. The shape of this function will depend on the pension rules.

The individual maximizes their utility subject to their budget constraint by choosing their annual consumption and the number of years of retirement. We solve this problem in two steps. First, taking R as given individual choose their consumption to maximize their lifetime utility subject to their budget constraint. Combining the first-order conditions on consumption, given R, yields[10]

$$\frac{\partial V/\partial C_w}{\partial V/\partial C_r} = \frac{\delta_w}{\delta_r}. \tag{11}$$

For any number of years of retirement, the optimal trade-off between consumption while working and consumption while retired is equal to the ratio of the discount factors. The above condition, together with the budget constraint, yield the optimal levels of consumption while working and while retired as a function of the number of years of retirement and the other parameters of the model, that is, $C_w(R; W_0, \bar{C}_w, \bar{C}_r)$ and $C_r(R; W_0, \bar{C}_w, \bar{C}_r)$. Explicit expressions for these optimal consumptions as a function of years of retirement can be determined under assumed functional forms. Suppose, for example, utility is given by:

$$(R - \bar{R})^{\alpha}(C_w - \bar{C}_w)^{\beta(1-\alpha)}(C_r - \bar{C}_r)^{(1-\beta)(1-\alpha)} \tag{12}$$

where $\alpha \in (0, 1)$ is the utility weight on years of retirement and $\beta \in (0, 1)$ is the utility weight on consumption while working. Under this specification, we have

$$C_w = \frac{\beta}{\delta_w}\left(W_0 + M(R) - \delta_r \bar{C}_r\right) + (1-\beta)\bar{C}_w, \tag{13}$$

$$C_r = \frac{1-\beta}{\delta_r}\left(W_0 + M(R) - \delta_w \bar{C}_w\right) + \beta \bar{C}_r. \tag{14}$$

How consumption changes with years of retirement is ambiguous.[11] To see this, note that

$$\frac{\partial C_w}{\partial R} = \frac{\beta}{\delta_w} M'(R) - \frac{\beta}{\delta_w^2}\frac{\partial \delta_w}{\partial R}\left(W_0 + M(R) - \delta_r \bar{C}_r\right) - \frac{\beta}{\delta_w}\frac{\partial \delta_r}{\partial R}\bar{C}_r \tag{15}$$

$$\frac{\partial C_r}{\partial R} = \frac{1-\beta}{\delta_r} M'(R) - \frac{1-\beta}{\delta_r^2}\frac{\partial \delta_r}{\partial R}\left(W_0 + M(R) - \delta_w \bar{C}_w\right) \tag{16}$$

$$- \frac{1-\beta}{\delta_r}\frac{\partial \delta_w}{\partial R}\bar{C}_w \tag{17}$$

The first term in both expressions is a wealth effect and is negative. Working one less year reduces the present value of lifetime earnings and pension benefits, and reduces consumption while working and while retired. The second term is a price effect. An increase in R reduces the discount rate applied to consumption while working and increases the discount rate

[10] The multiplier on the individual's budget constraint λ is equal to the marginal utility of consumption while working (retired) divided by the discount rate applied to consumption while working (retired).

[11] It is straightforward to determine how these consumption levels depend on the various parameters.

applied to consumption while retired. In other words, consumption today is relatively less expensive than consumption tomorrow. Therefore, the individual will substitute away from consumption while retired to consumption while working so the second term is positive in the first expression and negative in the second expression. The last term is an income effect arising from the change in relative prices. As mentioned the price of consumption while working (retired) has gone down (up). The resources required to purchase the minimum amount of consumption while working (retired) has gone down (up). This reduces (increases) the resources available for consumption while working (retired). The last term is negative in the first expression and positive in the second expression. Although we cannot determine how either consumption level changes with a change in R we can say that an increase in the years of retirement increases the difference between consumption levels.[12]

We could also consider the case in which preferences are represented by

$$(R - \bar{R})^{\alpha} \min\{\beta(C_w - \bar{C}_w), (C_r - \bar{C}_r)\}^{1-\alpha} \tag{18}$$

Under this specification, individuals are averse to consumption inequality over their lifetime and for a given R will optimally choose C_w and C_r such that

$$\beta(C_w - \bar{C}_w) = (C_r - \bar{C}_r) \tag{19}$$

Substituting this condition into the budget constraint, we can solve for the optimal consumption levels as a function of R.

$$C_w = \frac{W_0 + M(R) + \delta_r(\beta\bar{C}_w - \bar{C}_r)}{\delta_w + \beta\delta_r} \tag{20}$$

$$C_r = \frac{\beta(W_0 + M(R)) + \delta_w(\bar{C}_r - \beta\bar{C}_w)}{\delta_w + \beta\delta_r} \tag{21}$$

If $\bar{C}_w = \bar{C}_r = 0$ or if $\beta\bar{C}_w = \bar{C}_r$, then the ratio C_w/C_r will be constant and equal to β. Otherwise, the ratio will depend on the actual level of consumption as well as the minimal required levels of consumption. Again, how consumptions change with the number of years of retirement is ambiguous.

The second step is to use these optimal consumptions as a function of years of retirement to obtain utility as a function of R only. The individual then chooses the number of years of retirement to maximize their utility subject to their budget constraint. This yields the following optimality condition:

$$\frac{\partial V}{\partial R} = \lambda \left[\frac{\partial \delta_w}{\partial R} C_w + \frac{\partial \delta_r}{\partial R} C_r - M'(R) \right]. \tag{22}$$

The above expression has a similar interpretation as the one given earlier.

We use the above model as the basis for our simulation work. Although the model does not capture what are clearly some important determinants of the retirement decision, in

[12]This follows simply from subtracting the second expression from the first expression and using the fact that $\partial\delta_w/\partial R = -\partial\delta_r/\partial R$.

particular health shocks, we believe it does a reasonably good job of capturing important aspects of some of what we observe in the real-world, particularly the relative flat consumption streams controlling for family size. We use simulations to study the effects of changes in pension rules on the individual's decision to retire.

4 Simulations

We begin by outlining the assumptions we made regarding the institutional features of the private pension plan simulated and the individuals characteristics.

4.1 Assumptions

Private Pension Plan

We model a typical defined-benefit pension plan.[13] The rules of the plan are as follows: working members are required to contribute 4.25% of their annual salary up to the current Year's Maximum Pensionable Earnings (YPME) and 5.75% of their annual salary less the YMPE.[14] Once the individual reaches the normal retirement age of sixty-five, they can retire with a full pension. The pension benefit is equal to 1.4% of the worker's best average salary (BAS) up to the average YMPE, times the number of years of pensionable service plus 2% of the worker's BAS in excess of the average YMPE times pensionable service. Members might also retire early with full pension benefits if they reach the special retirement date which is a function of the member's age and their years of participation in the pension plan. For example, under a rule of 80 members whose age plus years of pensionable service equals or exceeds eighty can retire with full pension benefits. Members can also retire early with a reduced pension any month in the ten year period before reaching the normal retirement age of 65. Pension benefits are reduced by 0.5% for each month the actual retirement date precedes the normal retirement date. Finally, plan members who end their employment after two years of participation in the plan can receive a lump-sum amount equal to two times the member's required plan contributions plus the net interest earned on their contributions.

We are interesting in simulating the retirement decisions of relatively high income individuals. Thus, we ignore any public pension benefits since such benefits are likely to only be a small fraction of total pension income of such individuals and unlikely to have a large impact on their retirement decision.

Income Tax System

We use the 2006 Federal and Ontario tax schedules to calculate tax payable.

[13]Goss (2007) surveys the faculty pension plans at fifty-two Canadian universities. Close to half of the universities have defined benefit pension plans and the benefit formulas used in the plans are all very similar. When calculating the expected replacement ratio of the defined benefit plans, however, Goss shows that differences can arise across plans as a result of differences in the indexing of pension benefits for inflation and the length of the guarantee period of pension benefits. We return to these issues when we discuss our results.

[14]The YMPE is assumed to have grown at a real rate of 3% and is $40,000 in the current year.

Income

Individuals are assumed to have been working and covered by the private pension plan since the age of 30. They are currently 51 years of age. They have accumulated some wealth which reflects their personal savings. We assume that interest income is not taxed so that if individuals are saving while working than they are saving in income-taxed sheltered vehicles such as housing or registered education or savings plans. There is no lifetime uncertainty or at least individuals plan as if they will live until 80 years of age. To reflect the observation that earning profiles tend to be much steeper early in one's career, individual earnings are assumed to grow over time with the greatest growth occurring in the first 20 years of work, then slowing down for the next 10 years and then even slower growth thereafter.

Preferences

Following the theoretical model described above, we assume individuals have preferences over consumption while working, consumption while retired and years of retirement. We consider different specifications of utility functions, including requiring minimum levels of consumption and number of years of retirement. We also consider cases where annual consumption is constant throughout the individual's life-time as well as when consumption streams differ over the life-time. We do not, however, allow for preferences to change over time. As well, following the theoretical model, we assume individuals use exponential discounting and therefore ignore the possibility that individuals may use over forms of discounting which could give rise to regret over their retirement decision.[15]

4.2 Results

Using the simulation model, we were able to determine the impact on the individual's optimal retirement decision of various changes in both the private pension plan and the individual characteristics. Following is a summary of our results:

Who decides to retire early?

Under various preference specifications, we examined the effect on the retirement decision of changes in the earning streams and initial wealth of individuals. One could argue that higher earnings streams and higher wealth (at age 51) reflect greater productivity. Using one and a half times the median earnings stream and having an initial wealth of $500,000 generated optimal retirement ages in the neighbour of 61, depending on the actual utility specification. Whereas, considering earnings streams equal to one half of the median and low initial wealth (between 0 and $50,000), significantly increased the optimal retirement age to about age 70. It is also likely these high productive individuals would have greater outside opportunities but this is not modeled. An implication of this result is that, with the elimination of mandatory retirement, it may be the less productive individuals who choose to work beyond the normal retirement age of 65. Of course, this is assuming preferences are constant across individuals of differing productive ability.

[15]Diamond and Köszegi (2003) consider the retirement decision when individuals use quasi-hyperbolic discounting.

Buy-outs

Mandatory retirement may or may not be binding for individuals. For those for whom it is binding, the employer might want to provide an incentive for these individuals to retire. The simulation allows us to calculate how much one would have to increase the pension at age 65 to induce the person to retire at 65, when otherwise he would choose to retire at age 70. It turns out that these buy-out packages may be quite substantial, close to 40% of the individuals annual pension.

Inflation risk

Inflation gives individuals an incentive to delay retirement when pension benefits are linked to their final few years of earnings. Not surprisingly then, when we consider inflation persistence, the optimal retirement ages went up. With uncertainty over inflation it seems possible that individuals might want to re-optimize at every point in time or at least try to determine their option value of working one more year. We leave this line of research for future work.[16]

Special retirement provisions

We also consider various changes to the private pension plan. In particular, we considered different early retirement provision rules. Changes in these rules, for example, a move from a rule of 80 to a rule of 81, had no effect on the optimal retirement age. Given our assumptions individuals were generally not taking these early retirement provisions and consequently small changes in these provisions had no effect. If the rule was increased substantially, then individual's retirement decision would be affected. Anecdotal evidence suggests individuals do take early retirement and further they continue to work at other jobs. This suggests that individuals differ with respect to their outside employment opportunities and that this can affect their decision to retire early. Retiring so early as to only qualify for a reduced pension was never optimal. Again, without outside employment opportunities the individual's budget constraint set is always smaller under a reduced pension.

Contributions and Benefits

Changes in the contribution rates and pension benefits had the expected effects on the retirement decision. Increases in pension benefits reduced the optimal retirement age and increases in contribution rate increases the optimal retirement age.

5 Discussion

An individual's decision to retire depends on many factors. We have tried to highlight the role that both preferences and the provisions within a private pension plan can have on an individual's decision to retire. Our results are related to several different strands in the literature as follows:

[16] Goss (2007) shows the whether the pension benefits are indexed for inflation affect the replacement ratio of the pension plan. This suggests the financial incentives to retire will also depend on whether benefits are indexed, partially or fully, to inflation. Goss is not, however, looking at the retirement decision. In his simulations, he assumes that all individuals begin work at age 30 and retire at 65.

Pension Accruals

One approach in the literature to examine the impact of private and public pensions on the incentive to retire is to calculate the benefit accruals under different plan provisions. The benefit accrual is the change in the present value of benefit entitlement (possibly less taxes) if an individual works one more year. A positive accrual is thus a financial incentive for the individual to work another year. The ratio of a positive accrual to the individual's current year labour earnings yields the implicit subsidy rate on continued work. Gruber (1997) simulates the benefit accruals under the different Canadian public social security programs: Old Age Security System, the Canadian Public Pension/Quebec Public Pension including Disability Insurance, and the Guaranteed Income Supplement (GIS) and Spouses Allowance. He shows that the implicit tax/subsidy rate on work depends on the individual's circumstances.[17] In particular, the social security programs provide greater financial incentives to retire for married males than for either single workers or workers with other sources of income.[18]

Similar approaches have been used to uncover the financial incentives to retire in employer-sponsored private pension plans. Pesando and Gunderson (1988) calculate the pension benefits accrued by members of a defined-benefit private pension plan that contains representative provisions, including provisions for early retirement with a reduced pension and without a reduced pension (rule of 80). The pension accruals are shown to spike at the age in which these special retirement provisions kick in. The authors also demonstrate how different inflation rates when the pension benefits are, and are not, indexed for inflation can affect the benefit accruals. Following a similar methodology as in Gruber (1997), Gunderson (2001) calculates the expected pension wealth accruals for each year of employment for a representative employee under a typical defined benefit private pension plan and integrates these private financial incentives with those in the public plans. He also calculates the accrual rates when individuals can retire early with a reduced private pension, and when individuals can retire early with a full pension (rule of 80). He shows that as earnings go up the fraction of total pension wealth that comes from public pension gets smaller and thus the financial (dis)incentives created by the public pension programs are smaller for higher income individuals.

Effect of Eliminating Mandatory Retirement

Another approach in the literature has been to examine the effect of the elimination of mandatory retirement on labour force participation. Shannon and Grierson (2004) look at the impact of the elimination of mandatory retirement in Manitoba and Quebec on the employment of older workers in those provinces. Using provincial variation in mandatory retirement restrictions, Shannon and Grierson compare the employment rates of 65-69 year

[17] Baker, Gruber and Milligan (2003) estimate the effect of these social security programs on the retirement decision and suggest the impact is quite large.

[18] Other aspects of the public pension plans can also affect the retirement decision. For example, the age at which individuals become eligible for benefits and whether pension benefits are earnings-tested. See Baker and Benjamin (1999a, 1999b) for an examination of the effect of these provisions in the CPP/QPP on labour market participation.

olds in Manitoba and Quebec to the employment rates of two different control groups — 65-69 years olds in other provinces where there is mandatory retirement and 60-64 years olds in Manitoba and Quebec — before and after the policy changes. They do not, however, find any significant effects of the elimination of mandatory retirement on the employment rates of older workers. They suggest that the trend towards early retirement over this time period might be mitigating any possible positive employment effects from the elimination of mandatory retirement.

They might have been positive effects, however, for sub-groups of workers, in particular, faculty members at Canadian universities. Using annual survey data collected from Canadian universities, Worswick (2005) compares the age distribution of faculty employed at universities with mandatory retirement to those without. The percentage of faculty over the age of 65 is higher at universities without mandatory retirement. He also shows that the rate at which faculty aged 64-65 leave a university with mandatory retirement is 30 to 35 percentage points higher than the exit rate at a university without mandatory retirement. These findings are consistent with those using US data. At the beginning of 1994, mandatory retirement at the age of 70 for employees of post-secondary institutions was eliminated. Ashenfelter and Card (2002) show that the likelihood of university professors retiring at age 70 fell by two-third following this removal of mandatory retirement.

6 Migration as a Response to Mandatory Retirement

The above evidence suggests that the extent to which mandatory retirement is a binding constraint may depend on occupation. Worswick (2005) shows that there are higher exit rates of professors at universities with mandatory retirement but notes one caveat to his data; he is not able to track those faculty who left their university. Therefore, it is not clear whether these individuals have truly retired or simply pursued employment in a job without mandatory retirement, possibly in another province. This raises the following research question: do individuals move in response to changes in mandatory retirement?

We investigate this question by examining whether the migration patterns of older workers were affected by the elimination of mandatory retirement in the provinces of Manitoba and Quebec. We focus on individuals over the age of 51 who are likely to be thinking about and considering their retirement options. Using the public census data from 1981 and 1991, we compare the movement of individuals in the labour force between Quebec/Manitoba and the rest of Canada before and after the elimination of mandatory retirement in these two provinces as well as compare their movement to two control groups; those over the age of 51 and not in the labour force and those aged 37 to 45 and in the labour force. Overall, there was increased movement of all individuals in 1991 relative to 1981. The total number of individuals moving out of Quebec and Manitoba in both years, however, is extremely small. Consequently, it is difficult to infer any statistically significant effects on migration but it is instructive to describe what occurred. Larger samples of census 20% should be available over the next little while in the Statistics Canada Research Data Centres and with these larger datasets an extension of this empirical investigation might shed some light on this question.

7 Appendix

7.1 Graph 1: Cohort Real Earnings: Canadian Men

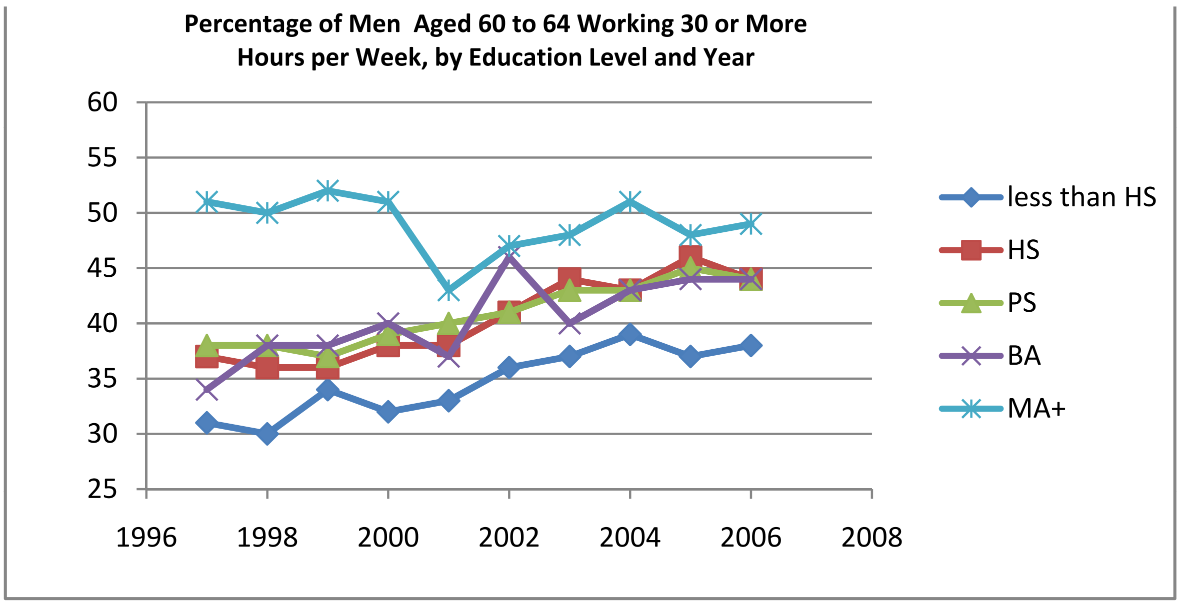
In earlier work, Lonnie Magee, Les Robb and John Burbidge developed an algorithm for estimating kernel-smoothed quantiles conditional on age (Magee et al., JASA, 1991). The nth quantile of say an earnings distribution is a value for earnings such that the fraction with lower earnings is n/100; the median is the 50th quantile. In a recent application to earnings data, Burbidge and Magee (2007) offer this description of the algorithm:

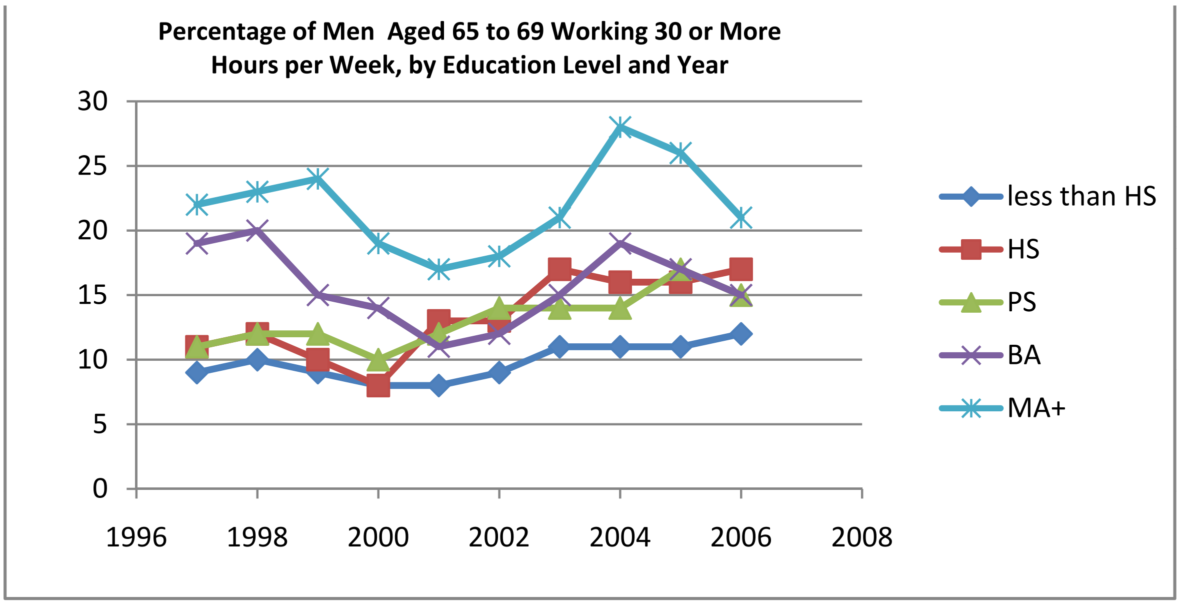
"Tables or graphs of raw quantiles conditional on age are typically noisy. For any given age, say 40, one can use data from neighbouring ages to smooth the estimate at 40. The bandwidth controls the size of this neighbourhood. A large bandwidth gives a smoother profile, at the cost of a larger bias. Our algorithm uses cross-validation to choose the bandwidth. "Delete-one" cross-validation deals with the bias-variance trade-off by minimizing a loss function based on deleting each observation one at a time. For each of these slightly smaller samples, the estimation is re-done, and its predictive performance for the deleted observation is assessed by an appropriate loss function. Our GAUSS program searches for an optimal bandwidth and then uses it to produce smoothed quantile estimates" (pp. 5-6).

Graph 1 is based on reported earnings in the public use releases (individual files) from the 1981, 1986, 1991, 1996 and 2001 Canadian censuses. Among other things, the detailed census questionnaires collect information on earnings in the previous calendar year. We selected men between the ages of 20 and 65 who were employed full-time (30 or more hours per week), full year (52 weeks worked, including holidays), and who were not self-employed. We used the algorithm to estimate a cross-validated bandwidth for the 50th quantile (median) and applied this bandwidth to produce smoothed median earnings for ages 20 to 65 inclusive, for each year earnings were observed – 1980, 1985, 1990, 1995 and 2000. Earnings for years prior to 2000 were converted to 2000 dollars using the annualized all-items CPI.

We then obtained cohort real earnings in the following way. Use the 1950 cohort as an example. Their median earnings are observed at age 30 in 1980, age 35 in 1985, age 40 in 1990, and so on. For each cohort with at least 3 years of observations, estimate earnings as a function of a constant, age and age squared using ordinary least squares, and then use the OLS coefficients to predict (within sample) earnings from ages 30 (year 1980) to 50 (year 2000).

7.2 Graphs 2 and 3: Male Labour Force Participation





LFS Coding	Our Coding	Frequency in 2006 LFS
0 to 8 years	less than high school	105739
Some secondary	less than high school	210321
Grade 11 to 13,grad	high school (HS)	244283
Some post secondary	post secondary (PS)	98778
Post secondary certificate or diploma	post secondary (PS)	372738
University: bachelors degree	BA	133467
University: graduate degree	MA+	57377

7.3 Private Pension Coverage in Canada

Registered pension plans established by employers or unions can be defined benefit plans, defined contribution plans, or some combination of the two. Such hybrid or combination plans cover only a small fraction of active members of registered pension plans. Members are active if contributions are being paid into the plan on their behalf by either the employee themselves or by their employer. Therefore, retired persons drawing benefits from a registered pension plan are not included as active members. A defined benefit plan pays out pension benefits to retired workers according to a set formula outlined in the pension plan. Benefits may be based on the final average earnings, average best earnings, or career average earnings over a given number of years or there may be a flat pension benefit. The cost (which can change) of providing these set pension benefits determines the pension contributions. A defined contribution plan, on the other hand, fixes the plan contributions made by both employees and employer, and pension benefits are paid out according to the accumulated contributions plus any returns on these contributions. From the annual Pension Plans in Canada Survey, the total number of paid workers who are active members of registered pension plans went up 8% from 2000 to 2006. Most of this increase (over 80%) came from an increase in the number of female members. Of those workers covered by a registered pension plan, the vast majority belong to a defined benefit plan. In 2006, 80.8% of active members belonged to a defined benefit pension plan down slightly from 84.6% in 2000. The Pension Plans in Canada Survey is available online from Statistics Canada (www.statcan.ca).

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