LAURIER
Business & Economics

DEPARTMENT OF ECONOMICS
WORKING PAPER SERIES

2007-02 EC:

"Health, Pensions, and the Retirement Decision: Evidence from Canada"

Tammy Schirle

Department of Economics
Wilfrid Laurier University,
Waterloo, Ontario, Canada
N2L 3C5

Tel: 519.884.1970
Fax: 519.888.1015
www.wlu.ca/sbe

Health, Pensions, and the Retirement Decision: Evidence from Canada

Tammy Schirle
Department of Economics
Wilfrid Laurier University

Working Paper
February 2007

Abstract

Using longitudinal data from the Canadian Survey of Labour and Income Dynamics, I use an option value framework to examine the effects of health and employer-provided pensions on retirement decisions. This study fills existing gaps in the literature by jointly modeling the impact of financial incentives and health on the retirement decisions of Canadians. The results indicate that both factors have substantial and significant effects on retirement, as having poor health increases the likelihood of entering retirement by up to 25 percentage points. Given the longitudinal aspect of the data, I am also able to address several identification issues discussed in the literature. The results corroborate previous evidence regarding the relative importance of attenuation and justification bias in self-reported health measures. The results also confirm U.S. and European evidence that employer-provided pensions and health are significant determinants of retirement.

JEL Classifications: J26, I10
Keywords: Retirement, Private Pensions, Health

I would like to thank Nicole Fortin, Thomas Lemieux, Kevin Milligan, participants of the Empirical lunch series at UBC and participants of the Second Annual PWFC Symposium for their comments and suggestions.

The statistical analysis in this study relies on Statistics Canada microdata, made available through the British Columbia Inter-University Research Data Centre and the South Western Ontario Research Data Centre. This study reflects the views of the author and does not reflect the opinions of Statistics Canada.

Correspondence: Tammy Schirle, Department of Economics, Wilfrid Laurier University, 75 University Ave W., Waterloo, Ontario, Canada N2L 3C5
E-mail: tschirle@wlu.ca
Website: www.wlu.ca/sbe/tschirle

1 Introduction

Concerns about the social, fiscal, and economic consequences of population ageing have sparked considerable interest in retirement behaviour and its determinants, resulting in an extensive international literature examining retirement decisions. While the international literature has provided substantial evidence of the importance of health, public pensions and employer-provided pensions as determinants of the retirement decision (including Coile and Gruber, 2000; Dwyer and Mitchell, 1999; Kerkhofs et al., 1999), very limited evidence is available for Canada.[1] In Canada, the retirement literature has focussed almost exclusively on the role played by public pension programs in retirement decisions (see for example Baker et al., 2003, 2004a). This study fills existing gaps in this literature by jointly modeling the impact of pension incentives and health on the retirement decisions of Canadians.

A few Canadian studies have examined the role of health in the labour market decisions of older Canadians. Magee (2002), for example, has found that poor health and work-related disability do not have a significant effect on the probability of job separation due to retirement. However the measurement of job separation in Magee's study limits the extent to which his analysis provides insight into retirement behaviour.[2] In contrast, Campolieti (2002) found that disability has a large negative effect on the likelihood of labour force participation among older men. His study, however, does not specifically address the relationship between general health and the retirement transition, nor does it control for public pension receipt or any other form of income in the models. More recently, Au et al. (2005) have found that changes in health are an important determinant of employment among older Canadians, using longitudinal data from the National Population Health Survey. This data source,

[1]The Canadian and international evidence is reviewed in Milligan and Schirle (2006). International evidence is also reviewed in Feldstein and Liebman (2002); Krueger and Meyer (2002); Lumsdaine and Mitchell (1999); Currie and Madrian (1999). Gruber and Wise (2004) present evidence on public pensions for several countries.

[2]Magee (2002) uses data from the Survey of Labour and Income Dynamics (SLID), primarily responses to the question of why the individual left their last job. Job separation due to illness or disability and retirement are mutually exclusive responses. Those who separate from a job due to illness and simultaneously retire may not be associated with retirement in this study.

however, does not allow the authors to examine jointly the impacts of financial incentives and health on the retirement decisions of older workers. As Au et al. (2005) point out, there may be important interactions between these two retirement determinants.[3]

The examination of employer-provided pensions in Canada has been limited, largely due to a lack of appropriate data. Several authors have identified employer-provided pension plan provisions that create incentives for individuals to enter retirement (see for example Pesando and Gunderson, 1988, 1991; Pescarus and Rivard, 2005) and there is some evidence suggesting that plan provisions will affect older individuals' labour supply decisions. Limited evidence provided by Pesando et al. (1992) suggests workers will respond to incentives to postpone retirement.[4] Also, Morissette et al. (2004) have found that many retirees would have changed their decision to retire if they had been able to reduce their work schedule without their employer-provided pensions being affected.[5] Again, however, these studies do not examine the financial incentives for retirement jointly with the effects of health.

In this paper, I fill this gap in the Canadian literature using data from the Survey of Labour and Income Dynamics (SLID) which provides measures of self-reported health status and the information necessary to develop measures of the financial incentives for retirement contained in employer-provided pension plans. I use an option value framework for the analysis of financial incentives and exploit the longitudinal aspect of SLID to address a variety of endogeneity issues involved in estimating the effects of health status and financial incentives on individuals' decisions to enter retirement.

In the next section, I provide some background to public and employer-provided pensions

[3]To note, although the evidence from U.S. studies may be informative for Canadians, several U.S. studies have also found that the availability of health insurance in retirement can act as an important constraint for the retirement decision. See for example Gruber and Madrian (1995) and Blau and Gilleskie (2001, 2003). Given Canada's universal health care system, these estimates may not represent the retirement response of Canadians to changes in health status.

[4] Based on monthly data from a major union pension plan in Ontario (1980-1987), workers who anticipate an enrichment to their pension benefit formula were likely to postpone retirement until the enrichment took effect.

[5]It is not immediately clear that employer-provided pensions will have a large behavioural effect, as Morissette and Zhang (2004) have recently shown that many individuals are not aware of whether a pension plan is provided by their employer.

in Canada. In the third section, I describe the theory underlying the analysis of retirement in this paper. In the fourth section I provide the details of the empirical analysis and present the key empirical results. The results indicate that health and the financial incentives in employer-provided pensions have substantial and significant effects on the retirement decision. The final section offers some conclusions.

2 A Brief Introduction to Retirement in Canada

Canada's retirement income system consists of several parts. First, Canada has a set of public pension (income security) programs that provide retirement income to the elderly. The largest component of this system involves the Canada Pension Plan and Quebec Pension Plan (CPP/QPP), which are earnings-related pensions funded by payroll taxes on employees and employers. CPP/QPP benefits are intended to replace approximately 25% of an individuals earnings upon retirement and can be collected as early as age 60 (with an actuarial adjustment made to benefits). In January 2007, the maximum retirement pension at age 65 was $863.75.

The Old Age Security (OAS) pension is a uniform demogrant available to all individuals over the age of 65 who meet residency requirements. In January 2007, the maximum OAS benefit was $491.93. There is a 15% clawback of OAS from individuals with net income exceeding $63511. The Guaranteed Income Supplement (GIS) is an income tested benefit available to Canadians from age 65 with benefit amounts depending on marital status and family income. Finally, the Allowance (SPA) is another income-tested benefit available to 60-64 year old spouses of OAS recipients and widows/widowers.

It has been clearly demonstrated by Milligan and Schirle (2006) that the structure of Canada's public pension system creates both incentives and disincentives for continued work among the elderly. They find the largest work disincentives are generated by the income test in the GIS as it interacts with the actuarial adjustment (and other provisions of) CPP/QPP and with earned income to reduce the financial return to working.

The second part of Canada's retirement system to consider here is its employer-provided pensions. The government provides tax assistance for savings through employer-provided pension plans (or Registered Pension Plans) in Canada, although less than half of paid workers are covered by a registered pension plan.[6] The proportion of female paid workers covered by pension plans remained fairly constant during the 1990s around 40%.[7] For men however, the proportion covered by pension plans dropped from 49% in 1991 to 41% in 2001. The vast majority of employer-provided pension plans in Canada take the form of defined benefit plans which provide a monthly benefit that typically depends on the years a person has spent with the employer, the wages they earn, and the individual's age of retirement. In 1996, 88% of pension plans in Canada were defined benefit plans while only 10% were defined contribution plans (for which pension benefits vary depending on the contributions accumulated for each individual and the return on investment). Over recent years a larger proportion of plans have taken the form of defined contribution plans. In 2001, 14% of pension plans were defined contribution plans.

It is also worth noting Canada's universal health care system here, as it may play an important role in the retirement decision. Administered by each province, the system provides universal coverage for medically necessary health care services. Private health insurance is often used by individuals to supplement this coverage, typically important for covering the costs of prescription medication.

3 Theoretical Considerations

There are several ways to model the retirement decision, viewed here as an individual's decision to permanently withdraw from labour market activities after participating in the

[6]Tax assistance is also available for savings through Registered Retirement Savings Plans (RRSPs). However, relatively few individuals currently at retirement ages have positive or substantial RRSP holding and this form of savings is not considered in this study.

[7]The pension coverage information in this section is from Statistics Canada (2002a).

labour force through most of his or her adult life.[8] In the simplest model, individuals choose a path of lifetime consumption and labour supply to maximize utility subject to the constraint that the discounted present value of lifetime income equals the discounted present value of lifetime consumption. Changes in total lifetime income are expected to have wealth effects that allow the individual to enjoy more leisure. Given hours constraints faced by many individuals, it is expected that such wealth effects will reduce the number of years that an individual works.[9]

Following the work of Stock and Wise (1990), most recent modeling of the retirement decision allows individuals to compare the expected present value of retiring immediately (in utility terms) to the expected present value of continuing to work and holding the option of retiring in the future. Each period, if the individual continues to work, this decision is re-evaluated. More formally, let the expected present value of lifetime (indirect) utility for retirement at age r be defined as

$$E_t V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} \pi(s|t) U_w(y_s, w_s, X_s) + \sum_{s=r}^{T} \beta^{s-t} \pi(s|t) U_r(y_s, B_s(r), X_s) \qquad (1)$$

where U_w and U_r represent the indirect utility of future income while working and while retired respectively, w_s is the wage earned at age s, $B_s(r)$ are retirement benefits at age s that depend on the age of retirement, y_s is non-labour income at age s, and X_s represents individual characteristics. Future utility is discounted for the probability of survival to age s given survival to age t ($\pi(s|t)$) and discounted for preferences at $\beta = 1/(1+\delta)$. Each period, an individual will compare the utility of entering retirement immediately ($E_t V_t(t)$) to the utility of entering retirement at a future optimal date ($E_t V_t(r^*)$). Placing few assumptions on the indirect utility function, we can say an individual will choose to postpone retirement

[8]Several models are described in Lumsdaine and Mitchell (1999).

[9]Gustman and Steinmeier (1983, 1984) show that the majority of workers face hours constraints that would prevent them from gradually phasing out of full time jobs into retirement.

if

$$
\begin{aligned}
0 \;\leq\; & \delta_{ACC}\Bigg[\Bigg(\sum_{s=t}^{r^*-1}\beta^{s-t}\pi(s|t)(y_s+w_s)+\sum_{s=r^*}^{T}\beta^{s-t}\pi(s|t)(y_s+B_s(r^*))\Bigg) \\
& -\sum_{s=t}^{T}\beta^{s-t}\pi(s|t)(y_s+B_s(t))\Bigg] \\
& +\sum_{s=t}^{r^*-1}\pi(s|t)(\beta\rho_H)^{s-t}\gamma_H H_t]+\sum_{s=t}^{r^*-1}\pi(s|t)(\beta\rho)^{s-t}\lambda\eta_t \qquad (2)
\end{aligned}
$$

where the first term in square brackets represents the accrual of wealth possible when retirement is delayed, having good health (larger H_t) implies a person is more likely to delay retirement, and η_t represents other characteristics important for the retirement decision.[10] This simple structural model underlies the econometric model used to estimate the effects of health and pensions on the retirement decision.

4 Empirical Analysis

The objective is to estimate a simple probit model for the decision to enter retirement as it relates to the individuals' health, wealth, and the accrual of wealth associated with employer-provided pensions. That is, I want to estimate the reduced form model

$$
R^*_{it} \;=\; \beta_0+\beta_1 H_{it}+\beta_2 W_{it}+\beta_3 ACC_{it}+\beta_4 X_{it}+\epsilon_{it} \qquad (3)
$$

where individual i enters retirement at time t ($R_{it}=1$) if the latent variable $R^*_{it}>0$, indicating that the expected present value of entering retirement (in utility terms) is greater than the expected present value of continuing to work. $R_{it}=0$ if the individual continues to work. This retirement decision depends on the individual's health status (H_{it}), pension wealth (W_{it}) and the accrual in pension wealth (ACC_{it}) that could be achieved if retirement

[10]Here, I am assuming individual characteristics such as health (H_s) act as preference shifters in the utility function (which are additively separable from utility gained from income sources) that follow a first order autoregressive process, and I place a linear utility function over income. δ_{ACC}, γ_H, and λ represent the weights placed on wealth, health and other characteristics in the utility function.

were delayed, as well as other characteristics (X_{it}) we might consider important in the retirement decision.

4.1 Data, Measurement and Identification Issues

To estimate the model I am using data from the Survey of Labour and Income Dynamics (SLID). SLID is a longitudinal survey following individuals over the course of 6 years. In this study, samples are drawn from three of the existing panels. Specifically, from each year 1996-2001, I take a sample of individuals who spent at least part of that year in the labour force, are age 50-68 and are flagged as paid workers during the year.[11] I exclude individuals whose labour force status or health information is missing. At a minimum, I need to observe an individual's labour force status for two consecutive years in order to judge their retirement status. Since the questions regarding health status are not asked until 1996, earlier years of the survey cannot be used here.[12] The panel aspect of this survey is heavily relied on to define and identify the effects of the key covariates, further discussed below.

The definition of retirement used in this study is meant to capture individuals who depart from and remain out of the labour force. Using the data available in SLID, a person is defined as entering retirement during the observation year if they were in the labour force for at least part of the observation year and then not at all in the labour force in the following year. A person is defined as not entering retirement if they continued in the labour force the following year.[13] This definition of retirement results in an expected retirement hazard, presented in Figure 1.

The retirement hazard presented here represents the probability of entering retirement at each age, given that the individual was in the labour force at that age. Small spikes in the

[11] To note, a self-employed worker will still be included in the sample if they also held a paid worker job during the year. The exclusion made here allows me to keep individuals for whom self-employment is a secondary activity. The results are robust to further exclusion of all self-employed individuals.

[12] The first panel of SLID began in 1993, the second began in 1996. Thus, the 1996 sample will include people in both panels.

[13] For a recent discussion of how we can define the concept of retirement see Bowlby (2007). The definition of retirement used here is fairly robust. For example, I have tried using and absence of earned income to define retirement and the results do not change substantially.

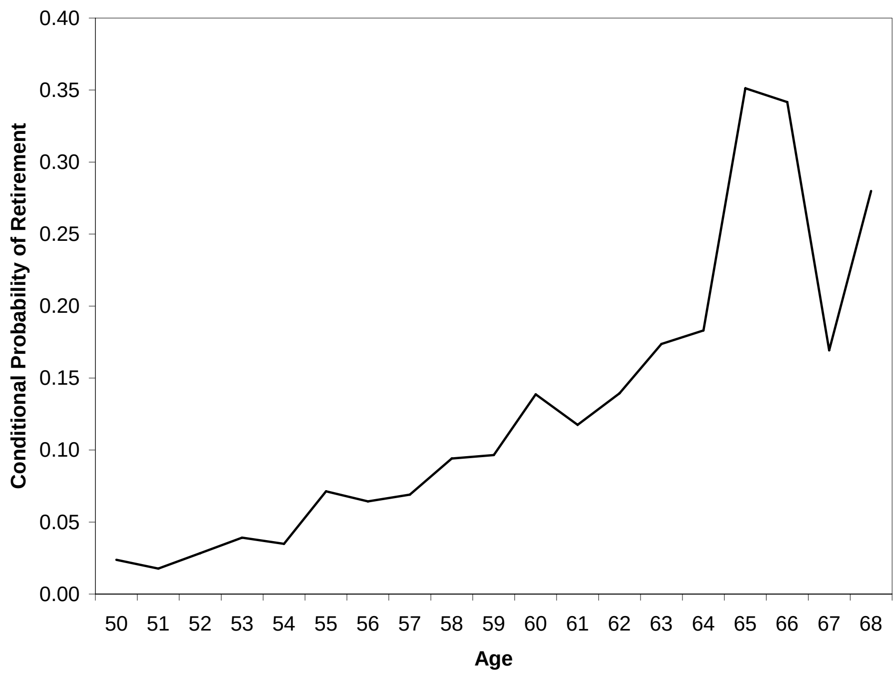

Figure 1: Conditional Probability of Retirement at Different Ages
Note: This is the probability of entering retirement at each age given participation in the labour force at that age. The sample is described in the text.

hazard occur at age 55 (when many employer-provided pension plans allow early retirement) and at age 60 (when individuals are first eligible for CPP/QPP). A large spike occurs at age 65 when individuals become eligible for several public pension benefits and may be subject to mandatory retirement. Very few individuals who retire (according to this definition) are likely to return to the labour force (ie. exit retirement). Using the full panel aspect of SLID to investigate this, I found that only 5% of retirees age 60-64 exit retirement within 2 years and less than 10% of individuals aged 60-64 exit within four years. Re-entry to the labour force, however, is a more likely event for those under 55.[14]

The measurement of health relies on individuals' self-reported health status. In estimating the reduced form model above, I explore a variety of health measures in order to address several of the problems associated with measuring and identifying the effects of health on retirement. As a baseline, I begin by using an indicator for poor health, based on individuals'

[14]45% of retired individuals age 50-54 spent at least some time in the labour force (employed or unemployed) in the following 4 years.

Table 1: Self-reported health status and disability

Age	50-54	55-59	60-64	65-68
Current Health				
Poor	0.01	0.02	0.03	0.02
Fair	0.07	0.10	0.10	0.11
Good	0.26	0.29	0.26	0.27
Very Good	0.40	0.35	0.39	0.38
Excellent	0.25	0.24	0.23	0.22
Past Health				
Poor	0.01	0.02	0.02	0.02
Fair	0.07	0.10	0.09	0.10
Good	0.24	0.28	0.24	0.25
Very Good	0.41	0.37	0.40	0.37
Excellent	0.28	0.24	0.25	0.26
Changes in Health				
New Disability	0.09	0.10	0.12	0.14
Small Shock	0.28	0.28	0.29	0.29
Large Shock	0.05	0.07	0.07	0.09

Note: Proportions reporting each category of health reported. Sample is described in text, includes 25810 observations. For past health information, only 17618 observations are available. See text for definitions of variables.

self-reported current health status (summarized in Table 1). The first identification problem lies in the fact that measurement error is likely and will place a downward (attenuation) bias on any estimated effect of poor health. On one hand, this problem arises because this is not an objective measure of health. Baker et al. (2004b), however, have found evidence of measurement error in self-reported objective measures of health, including reports of cancer. Another problem, therefore, is simply that the measure of health is self-reported. I am unable to correct for this type of error given the limited health information in this survey.

The second identification problem is referred to as justification bias - a situation where people will rationalize their retirement by reporting poor health. This is expected to place an upward bias on the estimated effect of poor health. Whether this bias will be significant is not clear. Au et al. (2005) present evidence suggesting that self-assessed health measures suffer from attenuation bias rather than justification bias. Other studies, such as that by Dwyer and Mitchell (1999), find no evidence of justification bias. Finally, a third source of bias works in the opposite direction. There exists some evidence that health improves after retirement, particularly among blue collar workers (Marshall and Clarke, 1998).

I have tackled these last two endogeneity problems by taking advantage of the longitudinal aspect of SLID. The key problem with the health measure is that respondents are interviewed in January following the survey year about their current (and potentially post-retirement) health. To address this, I use several specifications that rely on past reports of health, effectively representing the individual's health at the beginning of the observation year in which the retirement decision is made.

Making use of past health reports, however, will miss events that happen during the year to worsen a person's health and push them into retirement. With this in mind, I also provide specifications that use health measures reflecting a change in health status. As summarized in Table 1, I create a measure reflecting whether a person reports not having a disability at the beginning of the year, but reports having a disability at the end of the year (new disability) and measures for small shocks and large shocks to an individual's health.[15]

The measurement of the financial incentives variables - wealth and the accrual of wealth associated with pensions - is quite involved. Essentially, I use information available in SLID to obtain estimates of the financial components of equation (2). Here, I allow individuals to live up to age 102 (T) and retire up to age 69 (r). A discount rate of 3% is used ($\beta = 0.97$) and the survival probabilities (π) are based on Statistics Canada's sex-specific lifetables (Statistics Canada, 2002b). The wealth measure then represents the expected present discounted value of lifetime income if a person retired immediately (ie. $\sum_{s=t}^{T} \beta^{s-t}\pi(s|t)[y_s + B_s(t)]$). There are two components to the pension benefits (B_s) included here - public pensions and employer-provided pensions - neither of which are directly observable. For public pensions, I determine the initial benefit an individual would be eligible for from CPP/QPP, OAS, GIS and SPA given a specific retirement age and the policy rules in place in the observation year.

[15] A small shock measures any worsening of reported health status and large shock measures a worsening of health from excellent, very good, or good to fair or poor.

The initial benefit is then indexed to expected inflation.[16]

For employer-provided pensions, I have effectively developed an average potential pension formula to estimate the future pensions of individuals who report having access to employer-provided pension benefits. Here, I estimate the pension amount a person would initially receive upon retirement based on the individuals age, job tenure, union status, public or private sector status, occupation, wage and size of employer. The estimates are obtained using a standard Heckman selection model, accounting for the fact that I am unable to observe the potential pension amounts for individuals who choose not to retire.[17] As with the public pension amount, the initial pension amount is then assumed to increase with expected rates of inflation. As reflected in Table 2, the projections of future incomes that I construct here approximate the actual distributions of each source of income fairly well. The distributions of resulting wealth and peak accrual measures are provided in the appendix.

Problems arise in estimating the effects of pension incentives on the decision to retire because the variation in pensions is partly based on individual variation in work histories. The variation we see in work histories may capture individual heterogeneity in preferences for leisure and work. For example, we would expect that individuals with a higher preference for work will also have longer and more complete work histories, and potentially higher wealth and accrual measures. If this heterogeneity is not controlled for, the estimated effects of wealth and accruals may be biased downward.

I take two approaches to controlling for this type of heterogeneity. First, I provide

[16] An example program for constructing public pension wealth is available from the author upon request. Expected inflation rates used here follow the expected inflation rates used in the CPP/QPP Actuarial Reports. Public pensions require the construction of a wage history for each individual. This is is constructed by using the Survey of Consumer Finances and SLID to obtain sex-specific annual wage regression estimates and imputing a wage history from 1973 to the observation year. Covariates include experience, education, province, and marital status. Simple projections are used for previous years. The reported years of full time full year experience is used to determine the appropriate length of the wage history. Income testing for GIS and SPA amounts account for investment income, which is imputed by matching individuals in my sample to individuals in the Census files and assigning investment income as the cell-specific expected median investment income, $(PRob(I > 0)^*_c(Median|I > 0)_c)$. Cells were based on labour force status, region, age group, marital status, sex, and occupation.

[17] The selection equation is a retirement probit, with instruments including indicators for health status, marital status, whether a spouse is in the labour force, the number of children in the census family, and non-linear functions of tenure and wages.

Table 2: The Distribution of Imputed and Actual Incomes

	Mean	Median	1st Dec.	9th Dec.	Std. Dev
$\widehat{Wage}_t, \ (R_t = 0)$	32284	25313	8890	65431	24292
$Wage_t, \ (R_t = 0)$	37331	32215	7000	68350	39121
$\widehat{CPP}_{t+1}, \ (R_t = 1, Age_{t+1} \geq 60)$	5568	6060	1443	8876	2693
$CPP_{t+1}, \ (R_t = 1, Age_{t+1} \geq 60)$	4809	5238	0	8637	3234
$\widehat{OAS}_{t+1}, \ (R_t = 1, Age_{t+1} \geq 65)$	4776	5049	3660	5232	839
$OAS_{t+1}, \ (R_t = 1, Age_{t+1} \geq 65)$	4209	4901	1286	5232	1588
$\widehat{GIS}_{t+1}, \ (R_t = 1, Age_{t+1} \geq 65)$	451	0	0	0	1138
$GIS_{t+1}, \ (R_t = 1, Age_{t+1} \geq 65)$	878	0	0	3504	1618
$\widehat{Pension}_{t+1}, \ (R_t = 1)^a$	9533	6870	0	24898	10189
$Pension_{t+1}, \ (R_t = 1)$	9982	0	0	33956	14551
$\widehat{Pension}_{t+1}, \ (R_t = 1, Age_{t+1} \geq 60)$	8880	6870	0	22501	9318
$Pension_{t+1}, \ (R_t = 1, Age_{t+1} \geq 60)$	9266	2374	0	31212	12956
$\widehat{Investment}_t, \ (R_t = 1)$	909	920	467	1370	338
$Investment_t, \ (R_t = 1)$	1494	8	0	3848	7064

Note: Sample is described in text. Imputed incomes are denoted with $\widehat{\ }$. $R_t = 1$ indicates the individual entered retirement during the year t.
[a] Imputed pensions are zero below the 40th percentile among those who retired.

specifications of the retirement probit that include control variables for lifetime earnings, experience, and current wages, as these variables should proxy for the heterogeneity in leisure preferences.[18] Second, I use a fixed effects probit estimator to deal directly with the individual unobserved heterogeneity.

In all the specifications presented in the next section I include a set of indicators for age, province, sex, marital status, whether a spouse continues to work or enters retirement, whether a spouse has poor health, and the number of children in the census family under the age of 18 as basic set of covariates.[19]

[18] Baker et al. (2003) use similar earnings controls to address this identification problem. Estimates of lifetime earnings are based on the same information used in individuals work histories constructed for CPP/QPP estimates. Experience is measured as the number of years of full time full year experience, reported in SLID. A cubic in lifetime earnings and wages and a cubic in spouse's earnings and wages is used.

[19] Obviously, time invariant covariates are dropped from the individual fixed effects specifications.

Table 3: Retirement Probit Results I (Marginal Effects[a])

	Probit	Probit	F.E.
Poor Health	0.239 ***	0.250 ***	0.154 *
	(.040)	(.040)	(.101)
Pension Wealth	0.018 ***	0.019 ***	0.083 ***
($10000 increase)	(.003)	(.003)	(.019)
Peak accrual	-0.015 **	-0.018 **	-0.096 *
($10000 increase)	(.007)	(.008)	(.056)
Lifetime earnings	yes	no	no
Experience	no	yes	no
Wages	yes	yes	no

Notes: ***, **, and * indicate coefficients are statistically significant at teh 1%, 5%, and 10% level, respectively. Sample is described in the text. The retirement probits use 25810 observations. For the fixed effects estimator, only 3195 observations (representing 1131 individuals) are available. See text for definitions of variables. Specifications include the basic set of covariates.

[a] Marginal effects are representing a 60 year old single male in Ontario. Standard errors are in parentheses.

4.2 Results

The results of the various retirement probits discussed above are presented in Tables 3 and 4. As expected, pension wealth has a positive and significant effect on an individual's likelihood of entering retirement. The results in the first column of Table 3 indicate that a $10,000 increase in pension wealth increases the likelihood of entering retirement by 1.8 percentage points. Given the sample retirement rate is 7%, this implies a very substantial increase in the retirement rate by 25%. When the individual fixed effects estimator is used to control any bias associated with individual preferences for leisure, the estimated marginal effect of pension wealth is actually the same. Although the marginal effect appears much larger, the data restrictions required here to use the fixed effects estimator result in a sample retirement rate of 33% so that a $10000 increase in pension wealth implies an increase in the retirement rate of 25%. This would suggest that the use of lifetime earnings and experience measures are adequate to control for this type of bias.

The accrual of wealth also has a significant and substantial impact on the likelihood of retirement, with estimates indicating that the retirement rate would decrease by 25% if individuals were given an additional $10000 to delay retirement for at least one year. This estimate is fairly consistent across specifications. It is interesting to note that the results presented here are driven by the variation in employer-provided pensions rather than public pensions. Specifications using only public pensions in the measures of wealth and accrual often result in insignificant estimates.[20] Specifications using only employer-provided pensions result in very similar estimates to those presented here.[21]

Table 4: Retirement Probit Results II (Marginal Effects[a])

	1	2	3	4	5	6
Past health status	no	yes	yes	–	–	–
Poor	0.273 ***	0.245 ***	0.266 ***	–	–	–
	(.041)	(.056)	(.057)			
Fair	0.091 ***	–	0.057 ***	–	–	–
	(.018)		(.019)			
Good	0.023 ***	–	0.045 ***	–	–	–
	(.009)		(.013)			
Very Good	0.011	–	0.008	–	–	–
	(.008)		(.010)			
Change in Health						
New Disability	–	–	–	0.094 ***	–	–
				(.016)		
Small Shock	–	–	–	–	0.021 **	–
					(.010)	
Large Shock	–	–	–	–	–	0.082 ***
						(.023)
Pension Wealth	0.017 ***	0.022 ***	0.020 ***	0.018 ***	0.022 ***	0.022 ***
	(.003)	(.004)	(.004)	(.003)	(.004)	(.004)
Peak Accrual	-0.015 **	-0.018 *	-0.016	-0.020 ***	-0.019 *	-0.019 *
	(.007)	(.011)	(.010)	(.008)	(.011)	(.011)

Notes: ***, **, and * indicate coefficients are statistically significant at teh 1%, 5%, and 10% level, respectively. Sample is described in the text. The probit in column 1 uses 25810 observations, and the retirement probits in columns 2-6 use 17618 observations. See text for definitions of variables. Specifications include the basic set of covariates and controls for experience and wages.

[a] Marginal effects are representing a 60 year old single male in Ontario. Standard errors are in parentheses.

The results in Tables 3 and 4 also consistently demonstrate that health status has a significant effect on the likelihood of retirement. The effect is substantial, as estimates in

[20] Note there are only minor changes to public pensions over the period studied here, resulting in limited exogenous variation in this variable. See the results reported in the appendix.

[21] When public pension amounts are left out of the wealth measure the marginal effect of wealth is 0.018 and accrual is -0.013 (which should be compared to the estimate in the first column of Table 3). Also, including an indicator variable for access to an employer-provided pension as a covariate does not change these results. Furthermore, including other forms of income such as projected investment or wage income and tax payable does not substantially change the results.

the first column of Table 3 imply that having poor health raises the likelihood of entering retirement by 24 percentage points. The results presented in Table 4 make use of the various measures of health to check the robustness of this result in light of the various identification issues involved in estimating the effect of health.[22] The specification presented in the first column makes use of all categories of current health. Not surprisingly, having fair (relative to excellent) health also has a substantial effect on the likelihood of retirement, although not nearly as large as having poor health.

The next two columns address the concern that justification bias creates an upward bias in the estimated effect of health. The resulting estimated effect of health is only slightly smaller when using the individuals' report of health at the beginning of year (past health), lending support to the conclusions of Au et al. (2005) that justification bias is fairly small. The smaller estimates may reflect the importance of changes in health that may occur throughout the year, as evidenced by the estimates presented in remaining columns. Here, the onset of a new disability raises the likelihood of entering retirement by more than nine percentage points and a large health shock has a comparable effect.

The models presented here are unable to address any measurement error in self-assessed health. The results, however, further support the conclusions of Au et al. (2005) as they suggest that attenuation bias is a large problem. As they point out in their paper, measurement error problems can be exacerbated by allowing for fixed effects, as I have in Table 3. The fixed effects estimate of the effect of poor health is obviously much smaller than the probit estimates. The effect remains positive and significant, however, attesting to the robustness of this result.

Although not presented here, it is interesting to note that specifications of the probit model that included indicators for access to health, life, and disability insurance through an employer, as well as interaction terms for poor health and access to insurance were also estimated to check whether these factors might act as a constraint on retirement as it

[22]The results in this table are are most comparable to those in the second column of Table 3.

appears to in the United States. Not surprisingly, the effects of insurance on the likelihood of retirement appear insignificant in the Canadian context. Furthermore, the effects of poor health did not differ between individuals with and without health or disability insurance.

Finally, the results presented in Tables 3 and 4 suggest that there are not important interactions between health and pension incentives that would lead to omitted variables bias. Here, the estimated effects of pension wealth and accrual are not particularly sensitive to the choice of health measure used. Furthermore, several specifications of the retirement probit that included interaction terms for poor health and pension wealth were estimated and these coefficients were not at all significant.

5 Conclusions

Faced with an ageing population, governments in several developed countries have expressed a desire to alter the structure of retirement and encourage the participation of older individuals in the labour force.[23] A necessary first step in any policy development is to acquire a solid understanding of the determinants of the retirement decision.

This paper fills an existing gap in the Canadian literature (noted by Au et al., 2005) by jointly modeling and estimating the role played by health and employer-provided pensions in the retirement decision. The results demonstrate that health is a substantial and significant determinant of the retirement decision, as having poor health will increase the likelihood of entering retirement by roughly 25 percentage points. This is likely an underestimate of the effect of poor health, given the lack of evidence for justification bias and evidence supporting attenuation bias. The results also indicate that the financial incentives built into most employer-provided pension plans play an important role in the timing of retirement.

The analysis makes a more general contribution to the international retirement literature in two ways. First, the findings add to the evidence provided in papers such as Au et al.

[23]See for example, recent on-line documents from the Canadian government at http://www.fin.gc.ca/ec2006/plan/plc3e.html.

(2005), Dwyer and Mitchell (1999), and Coile and Gruber (2000) that the identification of health effects in retirement models can be problematic. Second, the analysis supports the results of several US and European studies such as Kerkhofs et al. (1999) that demonstrate the importance of health and pensions in retirement decisions.

Finally, these results potentially have important implications for the reform of public pension and employer-provided pension policies in Canada. Primarily, changes to the structure of benefit formulas or tax policies that affect accruals in pension wealth may influence the timing of retirement. Further, it important to consider that the importance of health may trump the effects of financial incentives found in any pension scheme.

References

Au, Doreen Wing Han, Thomas F Crossley, and Martin Schellhorn (2005) 'The effect of health changes and long-term health on the work activity of older Canadians.' *Health Economics* 14, 999–1018

Baker, Michael, Jonathan Gruber, and Kevin Milligan (2003) 'The retirement incentive effects of Canada's income security programs.' *Canadian Journal of Economics* 36(2), 261–290

— (2004a) 'Income security programs and retirement in Canada.' In *Social Security Programs and Retirement Around the World: Micro Estimation,* ed. Jonathan Gruber and David Wise (Chicago: University of Chicago Press)

Baker, Michael, Mark Stabile, and Catherine Deri (2004b) 'What do self-reported, objective, measures of health measure?' *Journal of Human Resources* 39(4), 1067–1093

Blau, David M., and Donna B. Gilleskie (2001) 'Retiree health insurance and the labor force behavior of older men in the 1990s.' *Review of Economics and Statistics* 83(1), 64–80

— (2003) 'The role of retiree health insurance in the employment behavior of older men.' *NBER Working Paper No. w10100*

Bowlby, Geoff (2007) 'Defining retirement.' *Perspectives on Labour and Income* (Statistics Canada Catalogue no. 75-001-XIE) 8(2), 15–19

Campolieti, Michele (2002) 'Disability and the labor force participation of older men in Canada.' *Labour Economics* 9, 405–432

Coile, Courtney, and Jonathan Gruber (2000) 'Social security and retirement.' *NBER Working Paper No. w7830*

Currie, J., and B.C. Madrian (1999) 'Health, health insurance and the labor market.' In *Handbook of Labor Economics,* ed. O. Ashenfelter and D. Card, vol. 3c (New York: Elsevier) pp. 3309–3416

Dwyer, Debra Sabatini, and Olivia S. Mitchell (1999) 'Health problems as determinants of retirement: Are self-rated measures endogenous?' *Journal of Health Economics* 18, 173–193

Feldstein, Martin, and Jeffrey B. Liebman (2002) 'Social security.' In *Handbook of Public Economics,* ed. A.J. Auerbach and M. Feldstein, vol. 4 (New York: Elsevier) pp. 2245–2324

Gruber, Jonathan, and Brigette C Madrian (1995) 'Health insurance availability and the retirement decision.' *American Economic Review* 85(4), 938–948

Gruber, Jonathan, and David A. Wise (2004) *Social Security and Retirement Around the World: Micro-Estimation* (Chicago: University of Chicago Press)

Gustman, Alan L., and Thomas L. Steinmeier (1983) 'Minimum hours constraints and retirement behavior.' *Economic Inquiry* 3, 77–91

_ (1984) 'Partial retirement and the analysis of retirement behavior.' *Industrial and Labor Relations Review* 37, 403–15

Kerkhofs, Marcel, Maarten Lindeboom, and Jules Theeuwes (1999) 'Retirement, financial incentives and health.' *Labour Economics* 6, 203–227

Krueger, Alan B., and Bruce D. Meyer (2002) 'Labor supply effects of social insurance.' In *Handbook of Public Economics,* ed. A.J. Auerbach and M. Feldstein, vol. 4 (New York: Elsevier) pp. 2327–2392

Lumsdaine, Robin L., and Olivia S. Mitchell (1999) 'New developments in the economic analysis of retirement.' In *Handbook of Labor Economics,* ed. A.J. Auerbach and M. Feldstein, vol. 3C (New York: Elsevier) pp. 3261–3307

Magee, William (2002) 'Effects of self-rated disability and subjective health on job separation.' *Income Statistics Division, Statistics Canada*

Marshall, Victor .W., and Phillipa .J. Clarke (1998) 'Facilitating the transition from employment to retirement.' In 'Canada Health Action: Building the Legacy. Papers Commissioned by the National Forum on Health,' vol. 2 (Sainte-Foy, Quebec: Editions MultiMondes) pp. 171–207

Milligan, Kevin, and Tammy Schirle (2006) 'Public pensions and retirement: International evidence in the Canadian context.' *HRSDC-IC-SSHRC Skills Research Initiative Working Paper 2006-A-13*

Morissette, René, and Xuelin Zhang (2004) 'Retirement plan awareness.' *Perspectives on Labour and Income* (Statistics Canada 75-001-XIE) 5(1), 11–18

Morissette, René, Grant Schellenberg, and Cynthia Silver (2004) 'Retaining older workers.' *Perspectives on Labour and Income* (Statistics Canada, Catalogue no. 75-001-XIE) 5(10), 15–20

Pesando, James, and Morley Gunderson (1988) 'Retirement incentives contained in occupational pension plans and their implications for the mandatory retirement debate.' *Canadian Journal of Economics* 21, 244–64

_ (1991) 'Does pension wealth peak at the age of early retirement?' *Industrial Relations* 30, 79–95

Pesando, James, Morley Gunderson, and Pauline Shum (1992) 'Incentive and redistributive effects of private sector union pension plans in Canada.' *Industrial Relations* 31(1), 179–194

Pescarus, Cristiana, and Maud Rivard (2005) 'Régimes de retraite d'employeur et incitations à la retraite anticipée au Canada.' Department of Finance Working Paper 2005-02

Statistics Canada, . (2002a) 'Canada's retirement income programs (1991-2001).' CD-ROM. Catalogue No. 74-507-XCB

_ (2002b) 'Life tables, Canada, provinces and territories 1995-1997.' Catalogue No. 84-537XIE

Stock, James H., and David A. Wise (1990) 'Pensions, the option value of work, and retirement.' *Econometrica* 58, 1151–80

6 Appendix

Table 5: Retirement Probit Results III (Marginal Effects[a])
(Using only Public Pensions)

	Probit	Probit	F.E.
Poor Health	0.247 ***	0.249 ***	0.160 **
	(.039)	(.039)	(.096)
Pension Wealth	0.024	0.020	0.343 *
($10000 increase)	(.022)	(.020)	(.181)
Peak accrual	-0.155 **	-0.186 ***	-0.282
($10000 increase)	(.076)	(.069)	(.367)
Lifetime earnings	yes	no	no
Experience	no	yes	no
Wages	yes	yes	no

Notes: ***, **, and * indicate coefficients are statistically significant at the 1%, 5%, and 10% level, respectively. Sample is described in the text. The retirement probits use 25810 observations. For the fixed effects estimator, only 3195 observations (representing 1131 individuals) are available. See text for definitions of variables. Specifications include the basic set of covariates.
[a] Marginal effects are representing a 60 year old single male in Ontario. Standard errors are in parentheses.

Table 6: The Distribution of Wealth and Accrual Measures within Age Groups

		Pension Wealth				Peak Accrual			
Age	N	Median	1st Declile	9th Decile	Std.Dev.	Median	1st Declile	9th Decile	Std.Dev.
50	3,131	204072	96346	448996	147318	107896	5506	149898	59563
51	2,870	174181	100609	405799	129435	155502	5075	205586	86032
52	2,667	266419	108314	507459	166529	59395	3890	89134	34098
53	2,483	225413	111290	472029	154192	112735	3118	136583	57288
54	2,288	273574	118562	518201	164770	68328	2603	83652	34314
55	1,986	344029	124555	590725	184606	-18907	-32707	12558	19159
56	1,726	305070	126361	546680	169383	439	-23696	17257	17615
57	1,525	284707	131189	536750	163862	3114	-2011	25486	14816
58	1,333	274819	137719	543600	163252	137	-37957	15834	22819
59	1,184	254931	144166	506597	151043	4708	79	48252	20946
60	1,045	257537	147919	504418	149748	-857	-20787	36154	21088
61	866	255119	153223	479915	139655	-551	-13865	50751	24665
62	726	255196	155808	439787	120979	17351	-3325	77402	33570
63	597	261815	156082	474867	137022	1314	-4511	51211	25007
64	461	244065	154429	404648	100542	57558	-4198	99085	42637
65	394	233722	166686	402048	104203	91029	-4692	128191	56882
66	231	233819	166382	413200	101780	110729	-5073	141875	61721
67	167	279393	162572	547821	147559	-111457	-164307	-3297	74199
68	130	242735	163157	387834	85649	-7041	-20889	-2354	6963

Notes: Sample is described in the text. See text for definitions of variables.