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

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RÉSUMÉ

En utilisant des données longitudinales de l'Enquête sur la dynamique du travail et du revenu, j'examine les effets de la santé et des régimes de pension offerts par les employeurs sur les décisions de retraite ce qui n'a pas été étudiés simultanément dans le contexte canadien. Les résultats indiquent que les régimes de pension offerts par les employeurs ont des effets incitatifs importants et significatifs sur le comportement de la retraite. Etre en mauvaise santé augmente considérablement la probabilité de prendre sa retraite, jusqu'à 25 points de pourcentage. Les résultats corroborent les résultats antérieures concernant l'importance relative de l'atténuation et le biais de la justification de l'auto-déclaration des mesures de santé. En outre les résultats confirment aussi les conclusions des recherches américains et européens, que l'état de santé et les régimes de pension offerts par les employeurs sont des déterminants importants de la retraite.

ABSTRACT

This article examines, on the basis of longitudinal data from the Canadian Survey of Labour and Income Dynamics, the effects of health and employer-provided pensions on retirement decisions, which have not been studied simultaneously in the Canadian context. The results indicate that employer-provided pensions have substantial and significant incentive effects on retirement behaviour. Having poor health substantially increases the likelihood of entering retirement, by up to 25 percentage points. The results corroborate previous evidence regarding the relative importance of attenuation and justification bias in self-reported health measures. Further, the results confirm U.S. and European evidence that employer-provided pensions and health are significant determinants of retirement.

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Introduction

Despite an extensive international literature providing evidence of the importance of health, public pensions, and employer-provided pensions as determinants of the retirement decision (including Coile & Gruber, 2000; Dwyer & Mitchell, 1999; Kerkhofs, Lindeboom, & Theeuwes, 1999; and Gruber & Wise, 2004), limited evidence has been provided for Canada.[1] In Canada, the retirement literature has focused almost exclusively on the role played by public pension programs in retirement

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decisions (e.g., see Baker, Gruber, & Milligan, 2003, 2004), and conflicting evidence exists for the role played by health (see Au, Crossley, & Schellhorn, 2005; Campolieti, 2002; Magee, 2002).[2] A few Canadian studies (such as Pesando & Gunderson, 1988, 1991; Pescarus & Rivard, 2005) identify employer-provided pension plan provisions that potentially create incentives for older individuals to enter retirement. However, because appropriate data is lacking, only limited evidence is available to suggest that these incentives have behavioural effects (Pesando, Gunderson, & Shum, 1992).

This study fills existing gaps in this literature by estimating the impact of pension incentives and health on the retirement decisions of Canadians. With data from the Canadian Survey of Labour and Income Dynamics (SLID), I have used an option value framework to construct measures of financial incentives. Further, I have exploited the longitudinal aspect of SLID to address a variety of endogeneity issues that arise when estimating the effects of health status and financial incentives on an individual's decision to enter retirement.

Econometric Model and Data

The objective of the study was to estimate a simple probit model for the decision to enter retirement as it relates to individuals' health, wealth, and the accrual of wealth associated with employer-provided pensions. The model is most comparable to those estimated by Coile and Gruber (2000) and Baker et al. (2003). Specifically, I wanted to estimate the reduced form model

$$R_{it}^* = \beta_0 + \beta_1 H_{it} + \beta_2 W_{it} + \beta_3 ACC_{it} + \beta_4 X_{it} + \varepsilon_{it} \quad (1)$$

where individual i enters retirement at time t ($R_{\mathrm{it}} = 1$) if the latent variable $R_{\mathrm{it}}^* > 0$, indicating that the expected present value of entering retirement (in utility terms) is greater than the expected present value of continuing to work. $R_{\mathrm{it}} = 0$ 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 were delayed, as well as other characteristics (X_{it}) we might consider important in the retirement decision.

Data, Measurement, and Identification Issues

To estimate the model, I used data from the SLID, a longitudinal survey following individuals for six years. From each year for the period 1996–2001, I took a sample of individuals who spent at least part of that year in the labour force, were aged 50 to 68, and flagged as paid workers during the year.[3] I excluded individuals whose labour force status or health information was missing. Further, I needed to observe an individual's labour force status for two consecutive years in order to observe their transition into retirement. The panel aspect of this survey was heavily relied on to define and identify the effects of the key covariates.

Limitations of the survey data often guide the definition and measurement of variables. In this study, 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 in the labour force at all the following year. The resulting probabilities of entering retirement at each age exhibit the expected spikes at age 55 (when many employer-provided pension plans allow early retirement), at age 60 (when individuals are first eligible for some public pension benefits), and at age 65 (when other public pension benefits are available and many individuals are subject to mandatory retirement). Few individuals who retired at the ages indicated in the samples are likely to exit retirement. We can see that only 5 per cent of individuals aged 60 to 64 exit retirement within two years (see Table 1), and 9 per cent exit retirement within four years of retirement. The rate of exit is shown to be much higher among younger individuals in my sample. Among those aged 50 to 54, 45 per cent will spend at least some time in the labour force (employed or unemployed) in the following four years.[4]

The measurement of health relies on individuals' self-reported health status, categorized as poor, fair, good, very good, or excellent, as well as individual reports of disability. When estimating the model, I explored a variety of health measures in order to address several problems associated with measuring and identifying the effects of health on retirement. As a baseline, I began by using an indicator for poor health. The first identification problem is that measurement error is likely when health is self-reported, placing a downward (attenuation) bias on any estimated effect of poor health.[5] Measurement error also arises because this is not an objective measure of health (see Baker,

Table 1: Rate of exit from retirement

Retire Within:	1 Year	2 Years	3 Years	4 Years
Ages 50–64	0	0.15	0.23	0.26
Ages 50–54	0	0.21	0.40	0.45
Ages 55–59	0	0.22	0.29	0.31
Ages 60–64	0	0.05	0.07	0.09

Notes: **An individual enters retirement if they leave the labour force and do not participate in it at all the following year. Exit then refers to any re-entry to the labour force. This sample from the Canadian Survey of Labour and Income Dynamics (SLID) represents individuals who entered retirement in 1994 and 1997.**

Stabile, & Deri, 2004). I was unable to correct for this type of error given the limited health information in the SLID.

The second identification problem can be referred to as justification bias – a situation where people rationalize their retirement by reporting poor health. This can be expected to place an upward bias on the estimated effect of poor health. Whether this bias is significant is not clear. Au et al. (2005) presented 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), found no evidence of justification bias. Finally, there exists some evidence that health improves after retirement, particularly among blue collar workers (Marshall & Clarke, 1998), giving rise to a third source of bias working in the opposite direction.

I have tackled these last two endogeneity problems by taking advantage of the longitudinal aspect of the SLID. A key problem with this 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 have included 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 was made.

Making use of past health reports, however, misses events that happen during the year to worsen a person's health and push them into retirement. With this in mind, I also have provided specifications in this article that use health measures reflecting a change in health status. I have created 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.[6]

The measurement of the financial incentives variables, wealth, and the accrual of wealth associated with pensions, has been done in several steps. I used information available in the SLID to obtain estimates of the components of the accrual equation

$$\begin{aligned} ACC_t = & \sum_{S=t}^{r^*-1} \beta^{S-t} \pi(S\,|\,t)(y_S + w_S) \\ & + \sum_{S=r^*}^{T} \beta^{S-t} \pi(S\,|\,t)(y_S + B_S(r^*)) \\ & - \sum_{S=t}^{T} \beta^{S-t} \pi(s\,|\,t)(y_S + B_S(t)) \end{aligned} \tag{2}$$

and the wealth equation

$$W_t = \sum_{S=t}^{T} \beta^{S-t} \pi(s\,|\,t)(y_S + B_S(t)) \tag{3}$$

where y represents non-labour income, w represents wages, $B(r)$ represents pension benefits that depend on the timing of retirement, and r^* is the age of retirement at which pension wealth is maximized. The wealth measure (W) represents the expected present discounted value of lifetime income if a person retired. The measurement of accrual then represents the amount to be gained by delaying retirement to an optimal future age. This is similar in spirit to that measured by Stock and Wise (1990) in their option value framework, except that I have effectively placed a linear utility function over income. Here, I have allowed individuals to live up to age 102 (T) and retire up to age 69 (r). A discount rate of 3 per cent is used ($\beta = 0.97$) and the survival probabilities (π) have been based on Statistics Canada's sex-specific life tables (Statistics Canada, 2002).[7]

There are two components to the future pension benefits included in Equations (2) and (3), public pensions and employer-provided pensions, neither of which is directly observable. For public pensions, I have determined the initial benefit an individual would be eligible for from three sources: (a) Canada Pension Plan/ Quebec Pension Plan (CPP/QPP) (an earnings-related public pension available to individuals over aged 60), (b) Old Age Security (OAS) (a universal transfer payment available after over aged 65), and (c) Guaranteed Income Supplement (GIS) and Spouses Allowance (SPA) (income-tested benefits generally available after age 65) given a specific retirement age, observable individual characteristics and earnings, and the policy rules in place in the observation year. For CPP/QPP benefit eligibility, a wage history has been imputed for each individual based on sex-specific annual wage regression estimates from the Survey of Consumer Finances and the SLID, with covariates including experience, education, province, and marital status. The reported years of full-time full-year experience in the SLID was used to define the length of the wage history.[8] The initial public pension benefit was then indexed to expected inflation.[9]

For employer-provided pensions, I developed an average potential pension formula to impute the future pensions of individuals who reported having access to employer-provided pension benefits. Here, I estimated the pension amount a person would initially receive upon retirement based on the individual's age, job tenure, union status, public- or private-sector status, occupation, wage, and size of employer. The estimates were obtained using a standard Heckman selection model, accounting for the fact that I could not observe the

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potential pension amounts for individuals who chose not to retire. The selection equation is a retirement probit, with explanatory variables including indicators for health status, marital status, whether a spouse was in the labour force, the number of children in the census family, and non-linear functions of tenure and wages.[10] As with the public pension amount, the initial imputed pension amount was then assumed to increase with expected rates of inflation.[11] The projections of future incomes that I describe here approximate the actual distributions of each source of income fairly well.

The resulting distribution of pension wealth (by age) is presented in Table 2.[12] In Table 2, the estimates of wealth based only on the public pension amounts are also presented, demonstrating the importance of employer-provided pensions. Among the individuals with the least pension wealth (at the 10th percentile), pension wealth was heavily dominated by public pensions. For the typical individual, represented by the median, pension wealth was generally split between public pension wealth and employer-provided pension wealth. As we might expect, those with the highest levels of pension wealth (the 90th percentile) received much larger employer-provided pensions so that employer-provided pensions made up the majority of their pension wealth.

Problems arose in estimating the effects of pension incentives on the decision to retire because the variation in pensions was 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 would also have longer and more complete work histories, and potentially higher wealth and accrual measures. If this heterogeneity were not controlled for, the estimated effects of wealth and accruals might be biased downward.

I took two approaches to controlling for this type of heterogeneity. First, I provided specifications of the retirement probit that included control variables for lifetime earnings, experience, and current wages, as these variables should proxy for the heterogeneity in leisure preferences.[13] Second, I used a fixed-effects probit estimator to deal directly with the individual unobserved heterogeneity. The individual-specific fixed-effects model presented here allowed each individual in the sample to have a different intercept in Equation (1) representing their greater or lesser probability of entering retirement relative to other individuals in the sample. This individual-specific intercept will capture the heterogeneity in leisure preferences as well as heterogeneity in any individual characteristics that do not change over time.

In all the specifications presented next, I have included a set of indicators for age, province, sex, marital status, whether a spouse continued to work or entered

Table 2: Distribution of pension wealth, by age

Age	Public Pensions			Public + Employer Pension		
	10th P.	Median	90th P.	10th P.	Median	90th P.
50	82,371	111,740	156,046	98,493	204,245	454,761
51	86,911	117,014	164,570	101,374	177,227	409,870
52	87,393	121,468	167,590	109,694	268,544	515,133
53	96,066	126,097	176,129	112,733	227,631	475,387
54	97,958	131,177	181,022	120,479	277,638	527,877
55	100,218	137,406	187,842	126,487	348,430	592,154
56	103,166	139,838	193,690	127,326	302,482	553,035
57	108,853	143,699	200,997	132,454	281,129	535,394
58	115,333	149,019	208,164	138,310	277,108	544,984
59	122,388	153,372	218,758	144,793	256,831	509,204
60	124,353	158,372	222,779	148,778	259,701	498,930
61	128,536	165,732	232,022	154,713	251,911	479,846
62	131,299	170,524	241,861	156,957	251,858	432,458
63	127,563	172,967	238,957	155,643	260,886	471,105
64	132,610	177,490	246,758	156,587	246,515	407,699
65	140,633	185,533	254,912	165,007	232,792	404,605
66	147,062	185,358	245,805	165,215	237,076	416,135
67	126,553	184,717	242,631	165,801	272,818	549,415
68	151,518	191,418	246,271	165,646	237,615	384,673

Notes: **Amounts represent the 10th, 50th, and 90th percentiles of wealth within each one-year age group. See text for a description of the wealth measures and the sample used.**

retirement, whether a spouse had poor health, and the number of children in the census family under the age of 18 as a basic set of covariates.[14]

Discussion of Results

The results of the various retirement probits are presented in Tables 3 and 4. In each table, the marginal effects of each variable (representing the effect of a one-unit increase in that variable on the probability of entering retirement) are presented rather than the probit coefficients.

As expected, pension wealth has a positive and significant effect on an individual's probability of entering retirement. The results in the first column of Table 3 indicate that a $10,000 increase in pension wealth increases the probability of entering retirement by 1.8 percentage points. Given that the sample retirement rate is 7 per cent, this implies a substantial increase in the retirement rate by 25 per cent. 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 per cent so that a $10,000 increase in pension wealth implies an increase in the retirement rate of 25 per cent. 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 probability of retirement, with estimates indicating that the retirement rate would decrease by 25 per cent if individuals were given an additional $10,000 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 have been largely driven by the variation in employer-provided pensions rather than public pensions. As presented in Table 5, specifications using only public pensions in the measures of wealth and accrual result in insignificant estimates of the effect of wealth while the specifications using only employer-provided pensions result in estimates similar to those presented in Table 3.[15]

The results in Tables 3 and 4 also consistently demonstrate that health status has a significant effect on the probability of retirement. The effect is substantial, as estimates in the first column of Table 3 imply that having poor health raises the probability of entering retirement by 24 percentage points relative to an individual who is not in poor health. 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.[16] The specification presented in the first column makes use of all categories of current health. The results suggest that a person with poor health will be 27.3 percentage points more likely to enter retirement than a person with excellent health. Not surprisingly, having fair (relative to excellent) health also has a substantial effect on the probability of retirement, raising the probability by 9.1 percentage points. A person in good health is only 2.3 percentage points more likely than a person in excellent health to enter retirement.

The next two columns of Table 4 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 individual's report of health at the beginning of the year (past health), lending support to the conclusions of Au et al. (2005) that justification bias is fairly small. The smaller estimates, however, may reflect the importance of changes in health that may occur throughout the year.

Table 3: Retirement probit results I (marginal effects)

	Probit	Probit	Fixed Effects
Poor Health	0.239 *** (.040)	0.250 *** (.040)	0.154 * (.101)
Pension Wealth ($10,000 increase)	0.018 *** (.003)	0.019 *** (.003)	0.083 *** (.019)
Peak Accrual ($10,000 increase)	–0.015 ** (.007)	–0.018 ** (.008)	–0.096 * (.056)
Lifetime Earnings	Yes	No	No
Experience	No	Yes	No
Wages	Yes	Yes	No

Notes: *****, **, and * indicate the marginal effects are significantly different from zero at the 1%, 5%, and 10% levels of significance, respectively. Sample is described in the text. The retirement probits used 25,810 observations. For the fixed-effects estimator, only 3,195 observations (representing 1,131 individuals) are available. See text for definitions of variables. Specifications include the basic set of covariates. Marginal effects were evaluated for a 60-year-old single male in Ontario. Standard errors are in parentheses.**

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Table 4: Retirement probit results II (marginal effects)

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

Notes: *****, **, and * indicate the marginal effects are significantly different from zero at the 1%, 5%, and 10% levels of significance, respectively. Sample is described in the text. The probit in column 1 uses 25,810 observations, and the retirement probits in columns 2–6 use 17,618 observations. See text for definitions of variables. Specifications include the basic set of covariates and controls for experience and wages. Marginal effects were evaluated for a 60-year-old single male in Ontario. Standard errors are in parentheses.**

The estimates in the remaining columns represent the effect of changes in health on the probability of retirement. The onset of a new disability raises the probability of entering retirement by more than nine percentage points. A large health shock has a comparable effect, raising the probability of entering retirement by eight percentage points. A small health shock also has a significant effect, raising the probability of entering retirement by two percentage points.

The models presented here do not enable us 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 Au et al. pointed out in their work, 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.

The results presented in Tables 3, 4, and 5 suggest that there are not important interactions between health and pension incentives that would lead to omitted variables bias. In the first column of Table 5, I have provided estimates of the effect of pension wealth and accrual resulting from a retirement probit specification with only these two variables as covariates. Adding the poor-health variable, as in the second column of Table 5, does not change the estimated effect of pension wealth or accrual. Also, the estimated effects of pension wealth and accrual are not particularly sensitive to the choice of health measure used, as in Table 4. 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.

The effects of other variables on the retirement decision (presented in Table 5) are worth noting. As expected, there is a clear increase in the probability of entering retirement as individuals age. At age 55, individuals are nearly five percentage points less likely to enter retirement than they are at age 60. At age 65, the average individual is 20 percentage points more likely than they are at age 60 to enter retirement. As expected, having a spouse that is employed will reduce the probability of entering retirement, although being married will itself increase the probability of entering retirement. Interestingly, being male, having more children under the age of 18, and having a spouse with poor health do not appear to be important components of the retirement decision.

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

Table 5: Additional retirement probit results (marginal effects)

	(1)	(2)	(3)	(4)	(5)
Poor Health	–	0.195 ***	0.239 ***	0.242 ***	0.247 ***
Pension Wealth ($10,000 increase)	0.008 ***	0.008 ***	0.018 ***	0.017 ***	0.024
Peak Accrual ($10,000 increase)	–0.031 ***	–0.029 ***	–0.015 **	–0.014 *	–0.015 **
Spouse – employed	–	–	–0.047 ***	–0.048 ***	–0.050 ***
Spouse – poor health	–	–	–0.014	–0.015	–0.019
Number of children under 18	–	–	–0.012	–0.013 *	–0.014*
Married	–	–	0.053 ***	0.054 ***	0.048 ***
Male	–	–	–0.001	–0.007	0.002
Age (60 omitted)					
50	–	–	–0.064 ***	–0.070 ***	–0.078 ***
51	–	–	–0.069 ***	–0.074 ***	–0.087 ***
52	–	–	–0.067 ***	–0.071 ***	–0.077 ***
53	–	–	–0.055 ***	–0.060 ***	–0.071 ***
54	–	–	–0.063 ***	–0.067 ***	–0.074 ***
55	–	–	–0.048 ***	–0.051 ***	–0.042 ***
56	–	–	–0.051 ***	–0.055 ***	–0.052 ***
57	–	–	–0.044 ***	–0.047 ***	–0.047 ***
58	–	–	–0.029 **	–0.031 **	–0.026*
59	–	–	–0.027 **	–0.029 **	–0.030 **
61	–	–	–0.010	–0.010	–0.015
62	–	–	0.008	0.009	–0.003
63	–	–	0.034	0.038 *	0.032
64	–	–	0.044 **	0.047 **	0.027
65	–	–	0.204 ***	0.211 ***	0.175 ***
66	–	–	0.202 ***	0.208 ***	0.167 ***
67	–	–	0.011	0.017	0.031
68	–	–	0.112	0.120 ***	0.105 ***
Pension Sources Included	Public + Private	Public + Private	Public + Private	Private Only	Public Only
Province Dummies	No	No	Yes	Yes	Yes
Lifetime Earnings	No	No	Yes	Yes	Yes
Wages	No	No	Yes	Yes	Yes

Notes: *****, **, and * indicate the marginal effects are significantly different from zero at the 1%, 5%, and 10% levels of significance, respectively. Marginal effects were evaluated for a 60-year-old single male in Ontario. The results in column (3) represent the full specification of the results presented in column (1) of Table 3.**

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

Conclusions

This study fills an existing gap in the Canadian literature by estimating the role played by health and employer-provided pensions in the retirement decision. The results demonstrate that health and 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 by adding to the evidence – provided in work by, for example, Au et al. (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 U.S. and European studies such as Kerkhofs et al. (1999) that demonstrate the importance of health and pensions in retirement decisions.

Notes

1 The Canadian and international evidence was reviewed in Milligan and Schirle (2006).

2 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.

3 The results were robust to full exclusion of all self-employed individuals.
4 For a recent discussion of how to define the concept of retirement, see Bowlby (2007). The definition of retirement used here is fairly robust. For example, I have also tried using an absence of earned income to define retirement and the results did not change substantially.
5 The downward bias associated with measurement error in the explanatory variables is commonly known as attenuation bias. It can be shown that the estimated OLS effect will be biased toward zero as a result of the presence of classical errors in variables (see, for example, Wooldridge, 2002, p. 75). In this case, although the measurement error may be uncorrelated with true (unobserved) health, the measurement error (by construction) was correlated with the observed measure of health, leading to a bias in OLS estimates. This should be considered separately from the measurement error due to systematic reporting errors.
6 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.
7 Increasing the discount rate will reduce the level of wealth and the age at which wealth reaches its maximum. Changing the discount rate, however, will not qualitatively affect the estimated effect of wealth and accrual on the retirement decision as this will not affect the variation in wealth and accrual across individuals. A discount rate of 3 per cent appears common in the literature, reflecting an average real rate of interest.
8 An example program for constructing public pension wealth is available from the author upon request. Income testing for GIS and SPA amounts accounted for investment income, which was 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, ($Prob(I_c > 0) * (Median \mid I_c > 0)$). Cells were based on labour force status, region, age group, marital status, sex, and occupation.
9 I used the expected inflation rates used in the CPP/QPP Actuarial Reports.
10 It might be argued that a spouse's labour force status and the number of children are inadequate exclusion restrictions, given that lifetime choices for labour supply and family formation are made simultaneously and thus will also affect pension benefits later in life. In light of these arguments, non-linearities in tenure and wages were added as exclusion restrictions, though not ideal as an identification strategy. It is important to state clearly that we were not attempting to define a causal relationship between these variables; rather, the goal was to form reasonable predicted values of pension benefits.
11 This is a simplifying assumption. Based on estimates from Statistics Canada (2004), in 2001, 52 per cent of public-sector pension plans (covering 79% of public-sector pension plan members) included provisions for automatic adjustment, while 32 per cent of private-sector plans (covering 17% of private-sector plan members) included provisions for automatic adjustment. Of those plans with automatic adjustment mechanisms, 24 per cent of public-sector and 26 per cent of private-sector plans were fully indexed to increases in the CPI. The vast majority with automatic adjustment were partially indexed to increases in the CPI.
12 The complete distributions of resulting incomes, wealth, and peak accrual measures are available from the author upon request.
13 Baker et al. (2003) used similar earnings controls to address this identification problem. Estimates of lifetime earnings were based on the same information used in individuals' work histories constructed for CPP/QPP estimates. Experience was measured as the number of years of full-time full-year experience, reported in the SLID. A cubic in lifetime earnings and wages and a cubic in spouse's earnings and wages were used.
14 Obviously, time-invariant covariates were dropped from the individual fixed-effects specifications.
15 Note there were only minor changes to public pensions over the period studied here, resulting in limited exogenous variation in this variable. Also, including an indicator variable for access to an employer-provided pension as a covariate did not change the results. Furthermore, including other forms of income such as projected investment or wage income and tax payable did not substantially change the results.
16 The results in this table are most comparable to those in the second column of Table 3.

References

Au, D.W.H., Crossley, T.F., & Schellhorn, M. (2005). The effect of health changes and long-term health on the work activity of older Canadians. *Health Economics*, *14*, 999–1018.

Baker, M., Gruber, J., & Milligan, K. (2003). The retirement incentive effects of Canada's income security programs. *Canadian Journal of Economics*, *36*(2), 261–290.

Baker, M., Gruber, J., & Milligan, K. (2004). Income security programs and retirement in Canada. In G. Jonathan & W. David (Eds.), *Social security programs and retirement around the world: Micro-estimation* (pp. 99–152). Chicago: University of Chicago Press.

Baker, M., Stabile, M., & Deri, C. (2004). What do self-reported, objective, measures of health measure? *Journal of Human Resources*, *39*(4), 1067–1093.

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

Blau, D.M., & Gilleskie, D.B. (2003). The role of retiree health insurance in the employment behavior of older men. NBER Working Paper No. 10100. Cambridge, MA: National Bureau of Economic Research.

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

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

Coile, C., & Gruber, J. (2000). Social security and retirement. NBER Working Paper No. 7830. Cambridge, MA.: National Bureau of Economic Research.

Dwyer, D.S., & Mitchell, O.S. (1999). Health problems as determinants of retirement: Are self-rated measures endogenous? *Journal of Health Economics*, *18*, 173–193.

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

Gruber, J., & Wise, D.A. (2004). *Social security and retirement around the world: Micro-estimation*. Chicago: University of Chicago Press.

Kerkhofs, M., Lindeboom, M., & Theeuwes, J. (1999). Retirement, financial incentives and health. *Labour Economics*, *6*, 203–227.

Magee, W. (2002). Effects of self-rated disability and subjective health on job separation. Income Research Paper Series No. 001. Ottawa, ON: Income Statistics Division, Statistics Canada. (Statistics Canada Catalogue no. 75F0002MIE2002001).

Marshall, V.W., & Clarke, P.J. (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*, pp. 171–207). Sainte-Foy, Quebec, Canada: Editions Multi-Mondes.

Milligan, K., & Schirle, T. (2006). *Public pensions and retirement: International evidence in the Canadian context*. HRSDC-IC-SSHRC Skills Research Initiative Working Paper 2006-A-13. Ottawa, ON: Industry Canada.

Pesando, J., & Gunderson, M. (1988). Retirement incentives contained in occupational pension plans and their implications for the mandatory retirement debate. *Canadian Journal of Economics*, *21*, 244–264.

Pesando, J., & Gunderson, M. (1991). Does pension wealth peak at the age of early retirement? *Industrial Relations*, *30*, 79–95.

Pesando, J., Gunderson, M., & Shum, P. (1992). Incentive and redistributive effects of private sector union pension plans in Canada. *Industrial Relations*, *31*(1), 179–194.

Pescarus, C., & Rivard, M. (2005). *Régimes de retraite d'employeur et incitations a la retraite anticipée au Canada*. Government of Canada, Department of Finance Working Paper 2005-02. Ottawa, ON: Pescarus and Rivard.

Statistics Canada. (2002). *Life tables, Canada, provinces and territories 1995–1997*. Catalogue No. 84-537XIE. Ottawa, ON: Statistics Canada.

Statistics Canada. (2004). *Canada's retirement income programs*. Catalogue no. 74-507-XCB. Ottawa, ON: Statistics Canada.

Stock, J.H., & Wise, D.A. (1990). Pensions, the option value of work, and retirement. *Econometrica*, *58*, 1151–1180.

Wooldridge, J.M. (2002). *Econometric analysis of cross section and panel data*. Cambridge, MA: The MIT Press.