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3

Option Value of Disability Insurance in Canada

Kevin Milligan and Tammy Schirle

3.1 Introduction

As Canadians approach retirement, there are two principal paths to be taken. First, a person may choose to work until entering retirement, at which time they will rely on public pension income and other private savings. For most Canadians, public pension income becomes available as early as age sixty and the normal retirement age is sixty-five. Second, depending on eligibility, a person may work, take up disability benefits available through the public pension system, and then make the transition to regular public pension benefits when they reach age sixty-five.

We are interested in understanding the importance of the financial incentives for work and retirement that are embedded in Canada's public retirement and disability benefit systems. We are also interested in accounting for the relative importance of financial incentives as it depends on individuals' health and socioeconomic status. To this end we extend the research presented in Baker, Gruber, and Milligan (2004), which focused on the financial incentives for retirement in the structure of the Canada and Quebec Pension Plans' (C/QPP) regular retirement benefits. In this study, we have introduced the possibility of receiving Canada and Quebec Pension Plan Disability

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Benefits as a potential path into retirement. In doing so, we also look more closely at the impact of self-assessed health status on the responsiveness of the retirement decision.

Unlike several other Organisation for Economic Co-operation and Development (OECD) countries, the Canadian system for disability benefits is quite limited. To qualify for C/QPP disability, a person must have a "severe and prolonged" medical condition. In determining eligibility, a person's age, employment opportunities, or socioeconomic status is not taken into account. Furthermore, disability benefits are not permanent—an eligible person must convert their disability benefits to a retirement benefit at age sixty-five. While the person's C/QPP retirement pension benefits will account for time taken away from the labor force with a disability, it is not typically the case that taking the disability path will substantially alter future retirement benefit amounts (after age sixty-five). Rather, the financial incentives along the two paths to retirement are quite similar.

In this context, we find that the financial incentives embedded in the C/QPP system have a significant and even substantial effect on the likelihood of entering retirement. The incentives are not driven by the provisions specific to the C/QPP disability benefits. Rather, the financial incentive effects largely reflect incentives contained in the C/QPP retirement benefit calculations. Furthermore, we find that the impact is driven by those with lower self-assessed health.

The chapter proceeds as follows. First, we provide background information on the Canadian retirement income and disability system, including both the institutions and some descriptive graphs to investigate the important trends in the data. Next we lay out our empirical approach, including descriptions of our data and estimation strategy. We then explain our results and go through some simulations to explore the implications of our estimates. Finally, we conclude by placing our results in the context of other evidence and the policy environment.

3.2 Background

We provide in this section the relevant background on the institutions of the Canadian retirement and disability policy environment.[1] We also provide graphical illustration of some important trends to help place our work in context.

In Canada, seniors can receive public pension income from two programs—the Old Age Security (OAS) program and the Canada and Quebec Pension Plans (C/QPP). The OAS provides a modest pension to all individuals over age sixty-five that meet residency requirements. The OAS

1. For more details on Canada's public pensions, see Baker, Gruber, and Milligan (2004) and Milligan and Schirle (2006, 2013).

pension is supplemented with the Guaranteed Income Supplement (GIS), which is an income-tested benefit for those receiving the OAS pension. The OAS program also provides a supplement (known as the Allowance) to spouses of OAS pensioners and widows age sixty to sixty-four. About one-third of Canadian seniors receive either GIS or Allowance benefits. The OAS program had not changed significantly for three decades. However, gradual increases in the ages of eligibility by two years will begin in April 2023. Also, in July 2013 the option to defer the OAS pension was introduced, with an actuarial adjustment applied for each month (up to sixty months) that the OAS pension is deferred.

The Canada and Quebec Pension Plans offer three types of benefits—retirement, survivor, and disability. The C/QPP is funded with a payroll tax applied to earnings above a "Year's Basic Exemption" and below a "Year's Maximum Pensionable Earnings" (YMPE). The C/QPP retirement pension offers a defined benefit pension, with a monthly benefit based on an individual's earnings history from age eighteen (or 1966) up to the time benefits are claimed (from age sixty to age seventy). Some allowances are made for low-earnings years, years with a disability, and years spent caring for young children. The normal retirement age is sixty-five, and an actuarial adjustment is applied for early or late benefit take-up. The C/QPP benefit is designed to replace up to 25 percent of lifetime average earnings (below the YMPE). In 2013, the maximum benefit for an individual claiming benefits at age sixty-five was CAD $1,021.50.

Core components of the C/QPP have not changed significantly since the 1980s. In 1998–1999, the formula that defined the maximum C/QPP benefit changed slightly, effectively lowering the maximum monthly benefit.[2] Recently, a few important changes were made to the C/QPP retirement benefit. First, a schedule of gradual increases in the actuarial adjustments began in 2011 and will be fully phased in by 2017 (see Laurin, Milligan, and Schirle 2012). Second, beginning in 2012 individuals can continue contributing to the C/QPP after taking up the retirement benefit, as contributions toward a separate postretirement benefit. Third, a work interruption (at least one month of no earnings) is no longer required to initiate C/QPP benefits after 2011.

The C/QPP also provides a survivor benefit to the surviving spouse of C/QPP contributors. The benefit amount has two components—a flat-rate portion, and an earnings-related portion that depends on the deceased spouse's earnings history from age eighteen until the time C/QPP benefits are claimed. Both components of the benefit depend on the claimant's age. The maximum benefit depends on whether the recipient is also receiving a C/QPP

2. Until 1997 the benefit formula had used an average of the past three years' YMPE to update lifetime earnings to current levels. In 1998 the past four years' YMPE was used, and from 1999 on the past five years' YMPE was used.

retirement or disability pension, with a maximum combined retirement and survivor pension equal to CAD $1,021.50 (the maximum retirement pension).

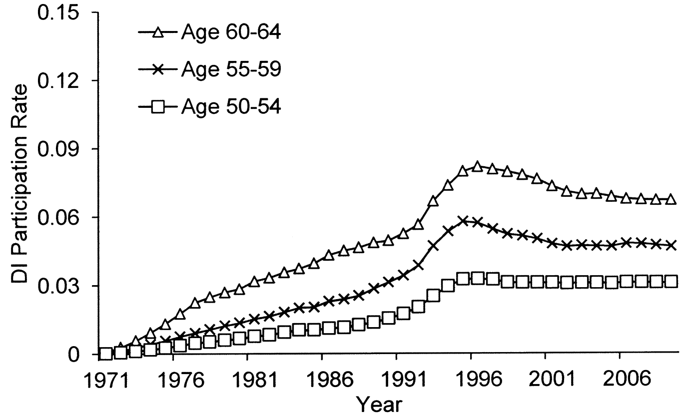
The C/QPP also administers a disability benefit available to C/QPP contributors under age sixty-five. The disability benefit also has two components—a flat-rate portion and an earnings-related portion based on the individual's earnings history from age eighteen and the year in which a disability occurs. Before 1997, a person was eligible if they contributed for at least two of the three years or five of the ten years preceding the onset of the disability. After 1997, the minimum contribution requirement is four of the previous six years. The maximum monthly disability benefit is higher than the maximum retirement benefit, set at CAD $1,212.90 in 2013. The maximum combined survivor and disability benefit is equal to the maximum disability benefit. At age sixty-five, the C/QPP benefits are converted to a retirement benefit. In the retirement benefit calculation, years in which the individual received C/QPP disability benefits are not counted as part of the earnings history.

The administration of disability benefits was significantly altered in September 1995, with more stringent eligibility requirements put in place. After the reforms, an individual must have a medical condition that is "severe and prolonged" to qualify for benefits. A medical report from a physician is required. A major change in 1995 was that socioeconomic factors were no longer considered in adjudicating applications and no special consideration would be given to applicants age fifty-five and over.[3] (For more detail on the historic development of the DI part of the C/QPP, see Baker and Milligan [2012].)

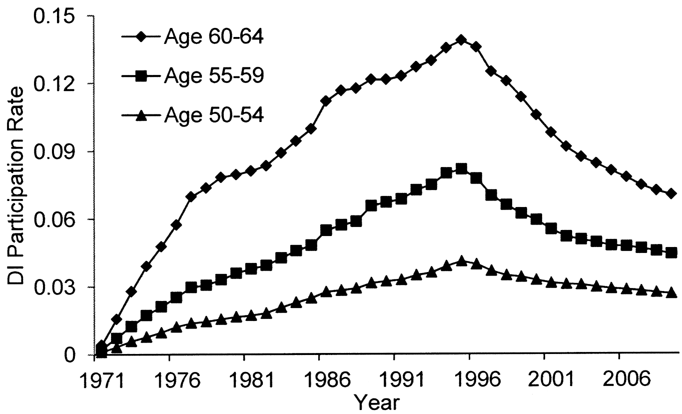
It is apparent that these changes significantly affected disability benefit eligibility. In figure 3.1, we can see that disability benefit receipt by individuals age fifty to sixty-four rose steadily until 1995, when 14 percent of men and 8 percent of women age sixty to sixty-four received CPP disability benefits. For men, disability benefit receipt declines sharply after the reforms, so that in 2009 only 7 percent of men age sixty to sixty-four are receiving benefits. For women disability receipt also declines after the reforms, however, the effect of the reforms on the rate of receipt is offset by the general upward trend in women's employment rates (figure 3.2). With greater attachment to the labor force, more women meet the minimum contribution requirements for disability benefits than before.

There were important changes in the employment rates of both men and women over time. In figure 3.2, we see that for women there is a general increase in the employment rate among those age fifty to sixty-four since

3. See http://www.oag-bvg.gc.ca/internet/English/parl_oag_199609_17_e_5048.html, paragraph 17.66.



A. Female



B. Male

Fig. 3.1 CPP disability benefit receipt by sex and age, 1971–2009
Source: CPP Statistical Bulletin for DI counts; CANSIM database population counts.

the 1970s, with larger increases after the mid-1990s. Men's employment rates, on the other hand, fell steadily until the early 1990s after which their employment rates rose steadily. By 2009, the gender gap in employment rates among seniors had narrowed substantially—with 62 percent of women and 70 percent of men age fifty to sixty-four employed.

The recent increases in older individuals' employment rates in Canada have many explanations. One important factor is education. In figure 3.3, we see that more educated men and women are more likely employed. Although the likelihood of being employed among university-educated men does not

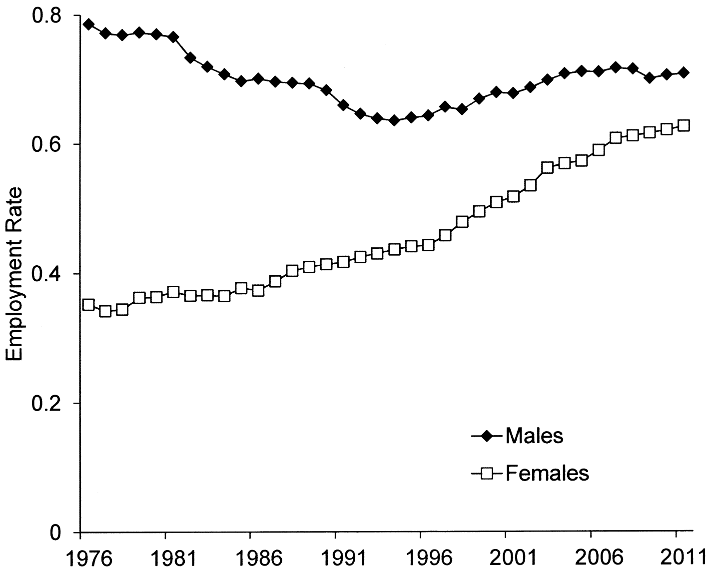


Fig. 3.2 Employment rates of individuals age fifty to sixty-four, 1976–2011
Source: Labour Force Survey public use microdata files.

show a clear upward trend after the mid-1990s, the portion of men and women that are university educated has increased substantially.[4] The likelihood of employment among university-educated women increased steadily since the 1970s, but only increased since the mid-1990s for less educated groups of women. These broader trends for women are generally ascribed to cohort effects—the women entering the older age groups since the mid-1990s are the same women driving large increases in younger women's participation after the 1960s (see Schirle 2008).

Interesting to consider is the inverse relationship that appears between the employment rates of older men, particularly those with a high school education, and the rates of disability benefit receipt among men. Unfortunately the Canadian administrative data on disability insurance (DI) use does not allow us to examine the education levels of individuals receiving CPP disability benefits, so we are not able to report tabulations describing potential relationships between education, health, and disability benefit receipt. We expect, however, that more stringent eligibility requirements (that no longer account for socioeconomic circumstances in determining disability status)

4. From tabulations based on Statistics Canada Cansim Table 282–0004 (Labour Force Survey), in 1995 13 percent of men and 7 percent of women age fifty-five to sixty-four had a university degree. In 2009, 23 percent of men and 19 percent of women age fifty-five to sixty-four had a university degree.

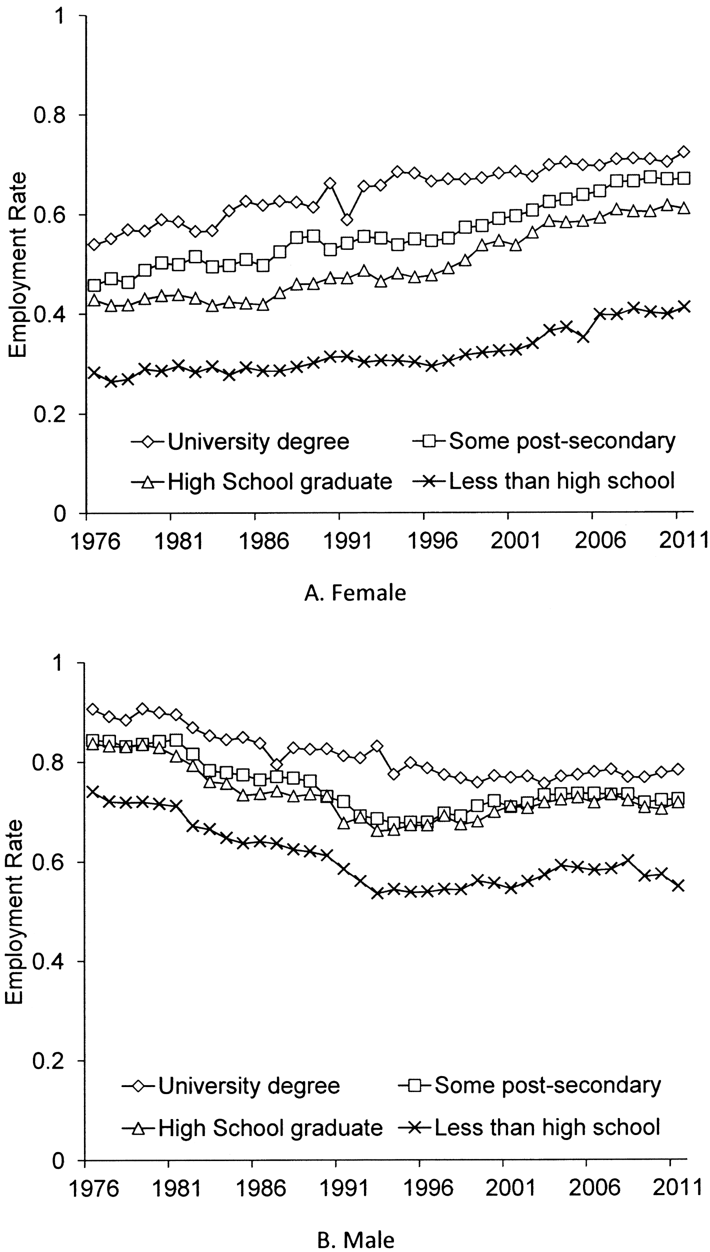


Fig. 3.3 Employment rates of men and women age fifty to sixty-four, by education (1976–2011)

Source: Labour Force Survey public use microdata files.

would affect those in lower-education groups more so than individuals with university degrees.

To summarize, the Canadian experience with disability insurance was one of increasing growth until 1995, and retrenchment since then. For females, across-cohort differences in lifetime labor market participation tend to dominate movements in DI use. Overall, DI use in Canada is lower than that of other countries in the International Social Security (ISS) project.

3.3 Empirical Approach

Our goal is to describe the extent to which the provisions of the Canada and Quebec Pension Plan's disability benefit program affect individuals' retirement decisions. To do this, we need to consider various routes to retirement that individuals will consider and the other forms of income they may receive. We account for two paths here: (a) a disability path whereby a person works, enters retirement, and immediately initiates disability and other public pension benefits as soon as they are eligible; and (b) a regular retirement path whereby a person works until entering retirement and then initiates C/QPP retirement benefits as soon as they are eligible. We then consider the retirement incentives that individuals will account for, derived from each program's provisions, by calculating the option value (OV) associated with delayed retirement on each path to retirement.

3.3.1 Data

Unfortunately, Canada lacks the data necessary to accurately calculate individuals' incentives to retire and/or participate in the disability insurance program. The best data source we have available for this study is the Survey of Labour and Income Dynamics (SLID), which is a panel data set conducted as an annual survey. The SLID panel surveys started in 1993. Individuals belonging to the households sampled in the first year of the panel are interviewed each year for six years. A new panel is started every three years, so that two panels are underway each year after 1995. Approximately 50,000 individuals are interviewed each year, covering the entire population. Around one-third of this sample is in the fifty to sixty-nine age range. The SLID survey provides us with fairly deep information on the labor market activities and earnings of an individual, as well as a few health questions.

The focus of our analysis is the period 1996–2009. Separate samples of males and females age fifty to sixty-nine are drawn from each year. The sample is selected conditional on positive employment earnings, so that incentives for retirement conditional on being employed are examined. Work is defined as having positive earnings in two consecutive years. If an individual has positive earnings in one year and zero earnings in the next, the year of positive earnings is defined as the retirement year. Given this structure, we are only able to use retirements that take place in the first five years of each panel and the last year a retirement observation is formed is 2008.

3.3.2 Pathways to Retirement

In Canada, there are only two pathways to retirement to consider. First, we consider individuals who work, retire, and begin collecting CPP/QPP retirement benefits at their first age of eligibility after retirement. We refer to this as the retirement path. Second, we consider individuals who work, are disabled and collect CPP/QPP disability benefits, and then begin collecting CPP/QPP retirement benefits at age sixty-five. We refer to this as the disability path. In both cases, an individual who was eligible for an employer-provided pension will begin collecting that pension as soon as they retire.

Other pathways are feasible for Canadians, but would not likely be taken. For example, individuals could work, use employment insurance (EI) benefits, and then retire, collecting CPP/QPP retirement benefits at their first opportunity. The EI system, however, has fairly strict job search requirements for those not temporarily laid off and will not pay benefits to those who quit their jobs or were justifiably fired. Those fired are paid benefits only in special cases (including those for whom short-term disability was the reason for quitting). It must be the case, however, that individuals intend to return to work and benefits are paid for a limited time. Sickness benefits are only available for fifteen weeks. Regular EI benefits are available for fourteen to forty-five weeks, depending on the individual's work history and local unemployment rates.

Also, individuals may access provincial social assistance programs if they do not meet the age/marital status requirements of GIS and Allowance programs. Most provinces, however, require social assistance recipients without young children to engage in a job search. Moreover, the programs do not provide generous benefits.

3.3.3 Weighting the Pathways

The pathway probabilities applied in option value calculation (described in more detail below) are based on the Canada Pension Plan Statistical Bulletin and census population counts. We have information to calculate the number of individuals receiving disability benefits per population by five-year age group and sex. This age- and sex-specific disability rate in each year is used in weighting the two pathways. The resulting weights for the disability path are presented in figure 3.4. Note that take-up of C/QPP disability benefits is not an option after age sixty-five, so that the weight placed on the disability path for the sixty-five to sixty-nine age group is set to zero. The weight placed on the retirement path is then (1 – disability rate).

3.3.4 Health Quintiles

The information in SLID is not detailed enough for the creation of a meaningful health index. Instead, we rely on individuals' reported self-assessed health. For all years 1996 and later, individuals are asked to describe their current state of health as excellent, very good, good, fair, or poor. Note

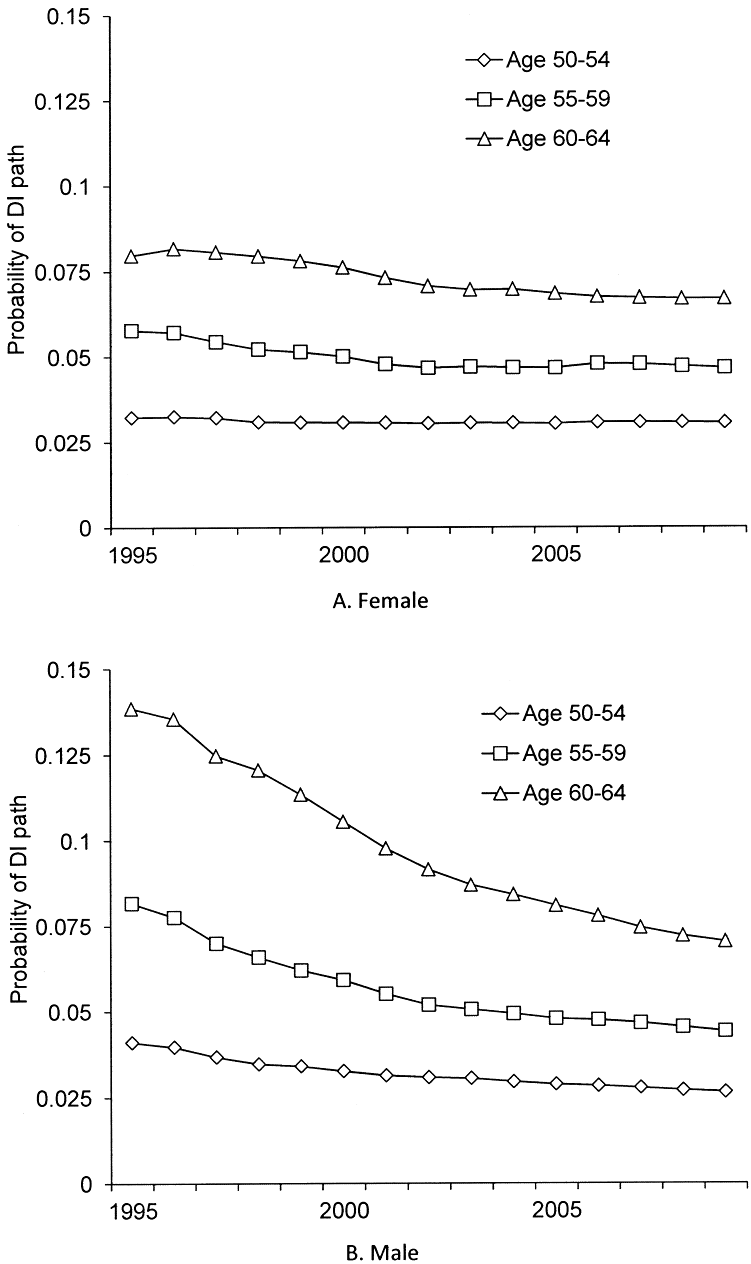


Fig. 3.4 Pathway probabilities

Source: CPP Statistical Bulletin for DI counts; CANSIM database population counts.

that individuals are asked to report on their health in the month of January following the income year.

There are a few questions in SLID that capture an individual's self-reported disability status, however, the nature of the question varies over time. Prior to 1999, the questions were designed to capture whether a person was permanently unable to work. Starting in 1999, questions were designed to more generally reflect activity limitations. As such, we do not attempt to make use of this health information here.

Figure 3.5 graphs the labor market exit rate by self-assessed health category, separately for females and for males. This variable is of particular importance since it will define our dependent variable for the regression analysis, which comes later. While there are five categories available in the SLID (poor, fair, good, very good, excellent), we combined poor and fair for the purposes of this graph because of low sample sizes in some age cells. The result is four lines, representing poor-fair, good, very good, and excellent self-assessed health. For both females and males, the poor-fair category stands noticeably apart from the other three lines. Exit rates are higher for those with weaker health. In contrast, those with good, very good, or excellent health are clustered quite close together.

3.3.5 Option Value Calculations

For each pathway (P = retirement or disability) and each potential retirement age (R), we calculate the present discounted value at age t of the flow of indirect utility derived from all income sources as

$$(1) \qquad PDV_t(R,P) = \sum_{s=t}^{R-1} \frac{1}{(1+\delta)^{s-t}} \pi_{s|t}(Y_s)^{\gamma} + \sum_{s=R}^{T} \frac{1}{(1+\delta)^{s-t}} \pi_{s|t}(kB_s(R))^{\gamma},$$

where p is the probability of surviving to age s, Y_s represents labor income, B_s represents nonlabor income, and all income sources are in real terms. The discount rate (d) is set at 0.03, the risk aversion parameter (g) is 0.75, and the parameter $k = 1.5$ accounts for the disutility of labor. We assume the last age a person is alive is 102. The earliest retirement age considered is age fifty and the last retirement age is sixty-nine. Note that for married couples, the probability of joint survival is used and the income received by surviving spouses (e.g., survivor benefits) is accounted for.[5]

The value of delaying retirement until age $R > t$ rather than retiring immediately at age t is

$$(2) \qquad \begin{aligned} OV_t(R,P) = {} & \sum_{s=t}^{R-1} \frac{1}{(1+\delta)^{s-t}} \pi_{s|t}(Y_s)^{\gamma} + \sum_{s=R}^{T} \frac{1}{(1+\delta)^{s-t}} \pi_{s|t}(kB_s(R))^{\gamma} \\ & - \sum_{s=t}^{T} \frac{1}{(1+\delta)^{s-t}} \pi_{s|t}(kB_s(t))^{\gamma}. \end{aligned}$$

5. Survival probabilities are based on the 2000–2002 life tables from Statistics Canada.

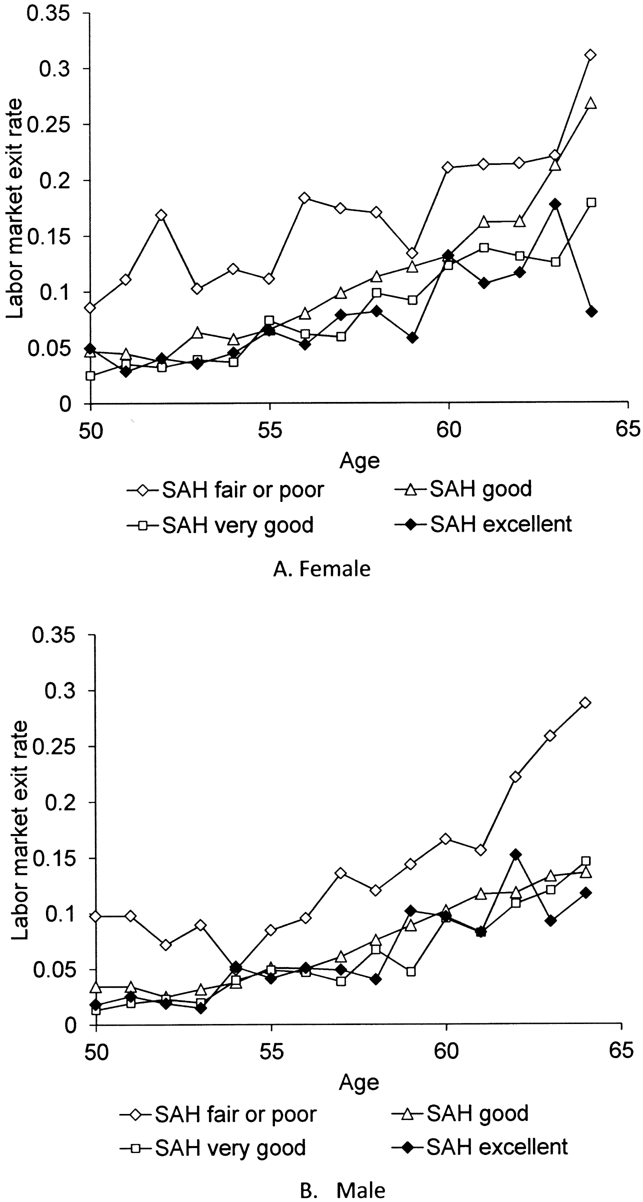


Fig. 3.5 Exit rates by self-assessed health status

Source: Authors' calculations using the SLID.

The option value of each pathway then represents the utility that can be gained by delaying retirement. Let $R^* > t$ represent the retirement age that would maximize the utility that can be gained by delaying retirement. Then the maximum option value for a given pathway P is simply

$$\text{(3)} \qquad \text{OV}_t(P) = \text{OV}_t(R^*, P) - \text{OV}_t(t, P).$$

An *inclusive* option value is then derived as a weighted average of the pathways' maximum option values, using the weights described in the previous section. That is,

$$\text{(4)} \qquad \text{OV}_t(\text{inclusive}) = \omega_d \text{OV}_t(\text{Disability}) - (1 - \omega_d)\text{OV}_t(\text{Retirement}).$$

We estimate the option value for all individuals in our SLID sample (ages fifty to sixty-nine, 1996–2009) separately for women and men. We have 78,350 person-year observations.

Although SLID provides us with fairly deep information on the labor market activities and earnings of an individual, it does not provide the information required to accurately calculate the indirect utility flows (equation [1]) for each individual. Annual income is reported, and is often drawn directly from individuals' tax records (though individuals have the option of self-reporting income).[6] We do not have access to individuals' full earnings histories. The SLID income data also lacks detail. For instance, SLID does not differentiate between CPP/QPP retirement, disability, or survivor benefits. There is also no distinction between (employer-provided) registered pension plan (RPP) benefits and registered retirement income fund (RRIF) payments. The RRIF payments could reflect payments from a defined contribution RPP or withdrawals from individual Registered Retirement Savings Plans (RRSPs) that must eventually be converted to RRIFs.

Given our data limitations, we impute income derived from many sources—including past earnings, investment income, and employer-sponsored pension income—based on the information we have available and calculate the benefits that individuals may receive based on policy rules existing at the time that expectations are formed. Details of these calculations are as follows.

Earnings—Histories and Forecasts

Earnings forecasts are required for the option value calculation, as individuals delaying retirement will receive earnings and those earnings will in part determine later retirement benefit entitlements. To forecast earnings, we assume the observed wages (at time t) will increase with inflation. That

6. The distribution of income among those opting to share income tax information is clearly different from those who self-report, but the implications of this for research are not entirely clear. See Brochu, Morin, and Billette (2014).

is, we assume zero real wage growth. Inflation projections are taken from the Canadian Pension Plan (CPP) Actuarial Reports.

Earnings histories are required for the calculation of C/QPP benefit entitlements. To construct the earnings history, we take the observed earnings from SLID and backcast earnings based on age and sex specific median-earnings growth rates. Our growth estimates are based on the age- and sex-specific median earnings observed from the Survey of Consumer Finances ([SCF]; 1973–1997) and SLID (1998–2009). The SCF was only conducted every second year until 1981, so we interpolate the missing year values by taking an average of previous and subsequent year's median earnings. For years prior to 1973, we backcast median earnings based on the growth in the industrial composite of average weekly wages.[7]

Benefit Entitlement and Tax Payable

We estimate the after-tax expected value of C/QPP retirement, disability, and survivor benefits, OAS pensions, and GIS/Allowance entitlement for each individual and their spouse based on the policy rules in place in the year considered (t).

The C/QPP benefit entitlements are based on the earnings histories described above. While we account for C/QPP provisions that allow low-earnings years to be dropped from the earnings history when determining average earnings, we have not accounted for time spent caring for young children since we have little information on this in SLID. After initiating benefits, C/QPP benefits rise with inflation and are held constant in real terms. Interactions between the three C/QPP programs are accounted for. For the disability path calculations, we require C/QPP disability benefit recipients to convert their disability benefit to the C/QPP retirement benefit at age sixty-five, accounting for years of disability in the earnings history. For survivor benefits, the cap on total C/QPP benefits is applied.

For the calculation of C/QPP survivor benefits that an individual would receive upon the death of their spouse, simplifying assumptions were required to make the calculations tractable. The difficulty lies in the fact that for each year into the future the spouse survives, another year is added to their earnings history for the survivor benefit calculation. To keep this simple, we assume an individual forms the expectation for potential survivor benefits in the future based on the survivor benefits they would receive if their spouse died the next year.

In the calculation of C/QPP disability benefits, we do not account for benefits available to dependent children under age eighteen and children that are students age eighteen to twenty-four.

7. Based on 11-516-XIE Series E49-59 ("Average Weekly Wages and Salaries, Industrial Composite, by Province, 1939 to 1975"), accessed at http://www.statcan.gc.ca/pub/11-516-x/sectione/E49_59-eng.csv, May 3, 2012.

Individuals are assumed to meet OAS and GIS residency requirements. To be entitled to full OAS benefits, a person must have resided in Canada for forty years, otherwise the OAS benefit is prorated and special provisions apply (offering additional benefits) in the calculation of GIS. The OAS clawbacks on individual income (at a rate of 15 percent for income over CAD $70,954 in 2013) and GIS/Allowance clawbacks on a couple's income (50 percent for GIS benefits and 75 percent for Allowance benefits) accounts for all forecasts of income discussed in this section, including spouse's income. We have not assigned Allowance benefits to widows and widowers ages sixty to sixty-four; rather, they are treated the same as other single individuals. We account for GIS and Allowance earnings exemptions.

To obtain an after-tax income, we calculate the amount a person can expect to pay in federal and provincial income taxes each year, using the Canadian Tax and Credit Simulator (CTaCS) calculator (Milligan 2012) and the policy rules in place in the year considered (t). To make the calculations more tractable we have calculated the tax payable on individual income until at least age seventy.[8] When calculating future taxes, we assume federal and Quebec income tax brackets, and amounts for major tax credits, increase with inflation. We then set further projections of tax payable to increase with inflation. This aligns with the assumption that individuals are retired by age seventy and all income sources are increasing only with inflation thereafter. This imposes the assumption that all tax parameters set in dollar amounts will also increase with inflation.

Spouses

We also create a full earnings history and projections for a spouse, which is used to determine their C/QPP and other benefit entitlements. As we are not modeling a joint retirement decision, we impose the behavioral assumption that a spouse will retire at age sixty, or immediately if the spouse is already over age sixty. This assumption is made to keep the benefit calculations tractable. We also assume the spouse cannot take the disability path and only takes the retirement path. Otherwise, forecasted spousal income is calculated using almost the same methods as for the individual.

Other Income Sources

We also require projections of individual (and their spouse's) future nonlabor income. We project future nonlabor income based on conditional means estimated from the 2001 census. First, we impute other income (representing investment and other money income) based on 2001 mean other income conditional on sex (male/female) and age (fifty to fifty-four, fifty-five

8. More precisely, we have calculated taxes up to year 2019, at which point all individuals in our sample have reached at least age seventy. When calculating spouse's tax payable, we will have some error for younger spouses in the most recent years of our data.

to fifty-nine, sixty to sixty-four, sixty-five to sixty-nine, and seventy and older). We assigned the same amount whether in or out of the labor force in order to focus attention on the public pension benefits. Without this assumption, the imputed income would be pivotal to the determination of option value since the other income would “turn on” only once someone retires. Once a spouse has died, we assume the surviving spouse will begin receiving 75 percent of the deceased spouse’s other income.

We also impute an employer-provided pension to those in SLID who appear to contribute to an employer-provided plan, based on the 2001 census mean retirement pension income conditional on age and sex. Note the census pension income variable does not differentiate between RPP, RRSP, and RRIF income. The age- and sex-specific means are then applied to all individuals who indicated in SLID that they either contribute to an RPP or they had a pension plan with their job once they turn age sixty. Once a spouse has died, we assume the surviving spouse will begin receiving 75 percent of the deceased spouse’s pension.

The resulting mean option value, by age, for Canadian women and men is presented in figure 3.6. Note the mean is based on a cross section of people in our SLID sample at each age. While there is clearly a substantial gap in option values at each age between the retirement and disability paths, the low probability of entering the disability path implies a negligible gap between the retirement path option values and the inclusive option value (which averages across the paths using the probabilities as weights). For women, we see that the utility to be gained from working until an optimal retirement age tends to decline with age. For men, the option value increases slightly from ages fifty to fifty-five and declines thereafter.

To get a more complete picture of the shape of the incentives, we present in figure 3.6 the total discounted present value of lifetime benefits by age of retirement. This is different from option value because it does not account for future earnings at all, and it is measured in dollars rather than in utility terms. Also, we are showing here the lifetime total value of benefits rather than the difference between current and future benefits, as is done for option value. The results here indicate that the present value of benefits for both women and men peak at around age fifty-seven, and that the benefits from retiring through DI are on an average lifetime basis much higher at most ages than through the standard retirement path. The DI and non-DI paths converge at age sixty-five because DI benefits are transformed to regular CPP/QPP benefits at that age, so there is no longer any difference.

A contrast between figure 3.6 and figure 3.7 is that for option value in figure 3.6 very few reach the point of optimal retirement (when option value is at zero) until late in their sixties, while in figure 3.7 many see declines in their discounted present value of pension wealth decline from their late fifties. The difference comes from the utility basis of option value. Even though the discounted pension wealth may be falling, the value of future earnings

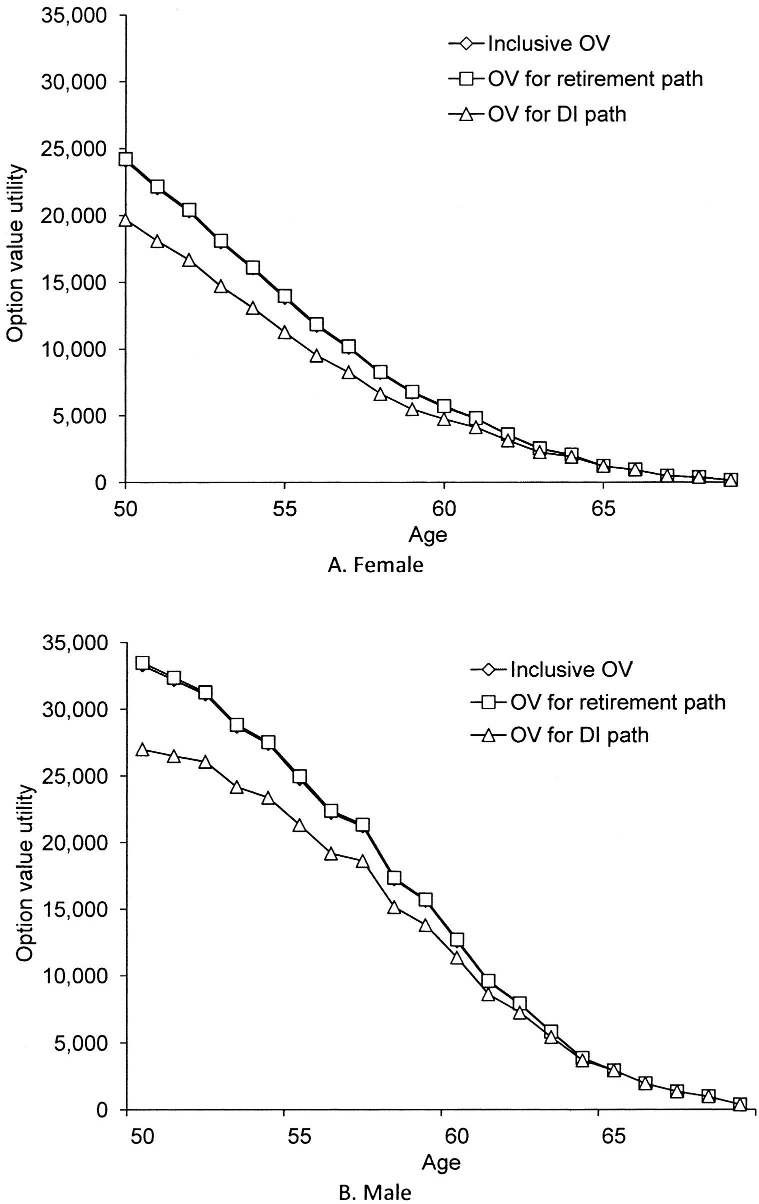


Fig. 3.6 Option value (mean) by age

Source: Authors' calculations using the SLID.

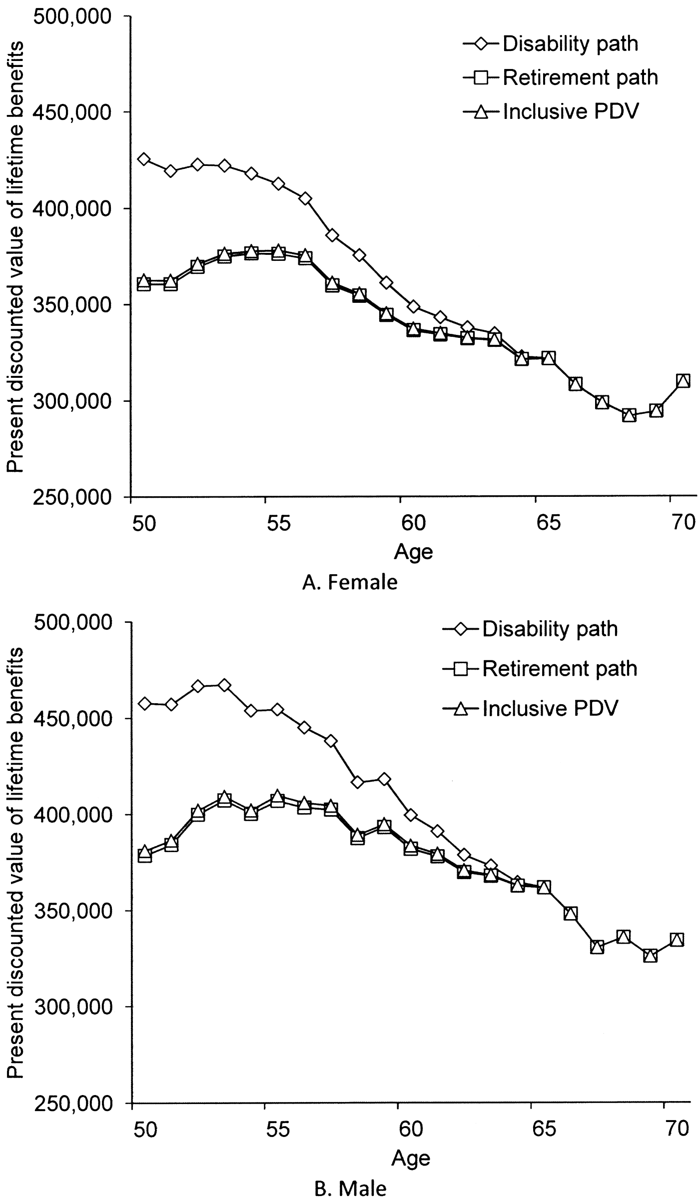
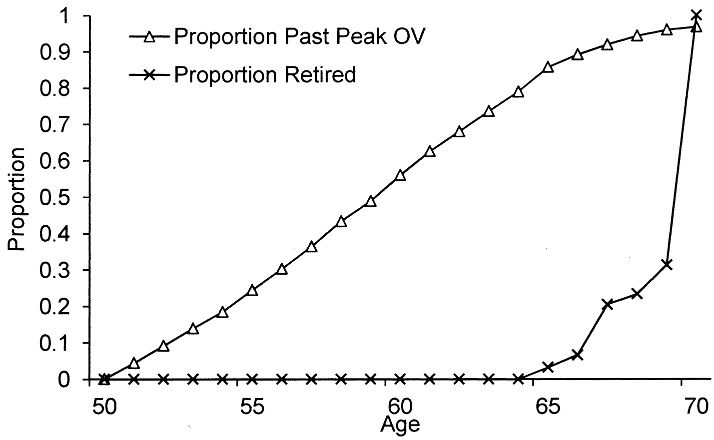


Fig. 3.7 Present discounted value by age

Source: Authors' calculations using the SLID.



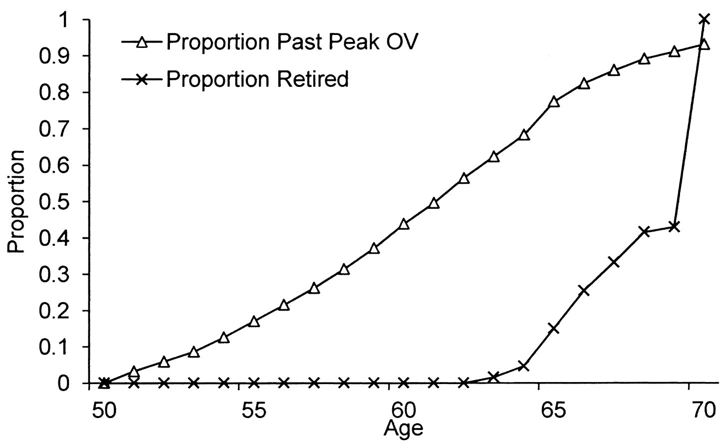


Fig. 3.8 Share having reached the maximum OV and retirement, by age
Source: Authors' calculations using the SLID.

(which is taken into account through the utility calculations of option value) makes it optimal to continue work. How these different factors are weighed depends on the preference parameters (discount rate, preference for leisure, risk aversion) that are chosen for the optional value calculations. We use the parameters that are common to all countries in the project in order to have our calculations on the same basis. We experimented with alternative sets of parameters, finding our regression coefficients were not particularly sensitive to other reasonably similar sets of parameters.

Figure 3.8 shows the proportion having retired at each age and compares that to the proportion having reached their optimal retirement date as calculated by option value. The proportion retired comes from applying observed hazard rates to a fictional cohort starting at age fifty to see how many have retired by each age. The results in figure 3.8 indicate that retirements by option value do not match the observed retirement distribution particularly well. However, in order to maintain comparability to other countries in the project, we maintain this calculation of option value based on the set of parameters common to all papers in the project.

3.4 Results

The equations estimated take the form

$$R_{it} = \beta_0 + \beta_1 \mathrm{OV}_{it} + \beta_2 \mathrm{AGE}_{it} + \beta_3 \mathrm{RPP}_{it} + \beta_4 X_{it} + \upsilon_{it}, \quad (5)$$

where entry to retirement (R_{it}) is set equal to 1 if we see the individual retire (a year of no earnings following a year of positive earnings); OV_{it} is the inclusive option value described above. We also use a "percent change" formulation of this variable by dividing the option value by the present level of utility. Here AGE represents either a set of age dummies or a linear variable for the individual's age, and also includes the age difference between spouses; RPP represents variables that indicate whether the person and their spouse appear eligible for employer-sponsored pension benefits. Finally, we include as a set of controls (X_{it}) the individual's marital status, immigrant status, education, occupation, industry, and the spouse's employment status.

The main results are presented in tables 3.1A and 3.1B for the female and male samples, respectively, using the inclusive option value incentive measure. The inclusive option value has a statistically significant, negative effect on the probability of entering retirement. An increase of 10,000 units in the option value decreases the probability of retirement by 2–3 percentage points for women and 1 to 1.5 percentage points for men. The results are fairly robust to the choice of specification. The effect of the option value does not depend on the specification of age. The effect of the option value falls by about one-third when the broader set of controls is included in the estimating equation in columns (3) and (4).

Other coefficients have the expected effects. Those with better health are substantially less likely to leave the labor force. For example, in column (1) of table 3.1A, the coefficient on having excellent self-assessed health is –0.071, which suggests a 7.1 percentage point decrease in the probability of exiting compared to those with poor health (the excluded category). The effect of better health is slightly larger for women than for men. The other notable significant results are for the presence of a firm pension plan for oneself and for the spouse. Those with their own pension are less likely to exit. This simple dummy variable combines any dynamic incentive with any wealth effect of a pension, so this negative coefficient likely reflects strong incentives

Table 3.1A **Effect of inclusive OV on retirement, female sample**

	(1)	(2)	(3)	(4)
Number of obs.	35,409	35,409	35,409	35,409
Retirement rate	0.094	0.094	0.094	0.094
Mean of OV	13,303	13,303	13,303	13,303
Inclusive OV	–0.0316***	–0.0321***	–0.0245***	–0.0250***
	[0.0027]	[0.0027]	[0.0028]	[0.0028]
Impact of one SD change	–0.0568	–0.0574	–0.046	–0.0469
Health fair	–0.0391***	–0.0386***	–0.0306***	–0.0300***
	[0.0063]	[0.0063]	[0.0051]	[0.0051]
Health good	–0.0661***	–0.0656***	–0.0489***	–0.0484***
	[0.0069]	[0.0069]	[0.0064]	[0.0063]
Health very good	–0.0849***	–0.0843***	–0.0627***	–0.0619***
	[0.0078]	[0.0077]	[0.0077]	[0.0075]
Health excellent	–0.0710***	–0.0709***	–0.0511***	–0.0506***
	[0.0058]	[0.0058]	[0.0054]	[0.0053]
Age	0.0059***		0.0031***	
	[0.0005]		[0.0005]	
Age dummies		Included		Included
Married/common law			0.0167***	0.0169***
			[0.0046]	[0.0046]
Immigrant			0.0041	0.0041
			[0.0048]	[0.0047]
Spouse age difference			0.0025***	0.0025***
			[0.0005]	[0.0006]
Finished high school			0.0111*	0.0100*
			[0.0058]	[0.0057]
Some postsecondary			0.0045	0.0041
			[0.0046]	[0.0046]
University degree			0.0147*	0.0146*
			[0.0077]	[0.0076]
Has firm pension plan			–0.0167***	–0.0160***
			[0.0038]	[0.0038]
Spouse has firm pension			0.0175***	0.0171***
			[0.0057]	[0.0057]
Spouse employed			–0.0054	–0.005
			[0.0046]	[0.0046]
Occupation dummies			Included	Included
Industry dummies			Included	Included

Notes: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. For inclusive OV, beneath the standard errors we report the impact of a one standard deviation change in inclusive OV in retirement, calculated by the difference in predicted probability perturbing inclusive OV by plus and minus one-half of a standard deviation.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.1B — Effect of inclusive OV on retirement, male sample

	(1)	(2)	(3)	(4)
Number of obs.	42,941	42,941	42,941	42,941
Retirement rate	0.077	0.077	0.077	0.077
Mean of OV	16,469	16,469	16,469	16,469
Inclusive OV	–0.0166***	–0.0163***	–0.0129***	–0.0128***
	[0.0022]	[0.0022]	[0.0024]	[0.0024]
Impact of one SD change	–0.0465	–0.0454	–0.0376	–0.0374
Health fair	–0.0305***	–0.0313***	–0.0247***	–0.0253***
	[0.0049]	[0.0048]	[0.0041]	[0.0040]
Health good	–0.0495***	–0.0503***	–0.0398***	–0.0406***
	[0.0054]	[0.0055]	[0.0050]	[0.0049]
Health very good	–0.0631***	–0.0641***	–0.0500***	–0.0510***
	[0.0063]	[0.0063]	[0.0062]	[0.0062]
Health excellent	–0.0527***	–0.0533***	–0.0411***	–0.0417***
	[0.0050]	[0.0050]	[0.0045]	[0.0044]
Age	0.0053***		0.0028***	
	[0.0005]		[0.0006]	
Age dummies		Included		Included
Married/common law			0.0028	0.0024
			[0.0039]	[0.0039]
Immigrant			–0.0004	–0.0002
			[0.0036]	[0.0036]
Spouse age difference			0.0013***	0.0013***
			[0.0004]	[0.0004]
Finished high school			–0.0043	–0.0042
			[0.0041]	[0.0041]
Some postsecondary			0.0039	0.0042
			[0.0034]	[0.0034]
University degree			0.0069	0.0073
			[0.0055]	[0.0055]
Has firm pension plan			–0.0163***	–0.0162***
			[0.0034]	[0.0034]
Spouse has firm pension			0.0153***	0.0155***
			[0.0047]	[0.0047]
Spouse employed			–0.004	–0.0031
			[0.0037]	[0.0036]
Occupation dummies			Included	Included
Industry dummies			Included	Included

Note: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. For inclusive OV, beneath the standard errors we report the impact of a one standard deviation change in inclusive OV in retirement, calculated by the difference in predicted probability perturbing inclusive OV by plus and minus one-half of a standard deviation.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.1C **Effect of percent change in OV on retirement, female sample**

	(1)	(2)	(3)	(4)
Number of obs.	34,674	34,674	34,674	34,674
Mean retirement rate	0.094	0.094	0.094	0.094
Mean % gain in OV	0.328	0.328	0.328	0.328
Percent gain in OV	–0.1229***	–0.1255***	–0.0887***	–0.0906***
	[0.0121]	[0.0122]	[0.0115]	[0.0116]
Linear age	X		X	
Age dummies		X		X
SAH controls	X	X	X	X
Other Xs			X	X

Note: Coefficients are the marginal effects of a 100 percent change in the ratio of OV to peak value. Standard errors clustered on individuals are in brackets. The four models presented are the same as in table 3.1A.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.1D **Effect of percent change in OV on retirement, male sample**

	(1)	(2)	(3)	(4)
Number of obs.	42,127	42,127	42,127	42,127
Mean retirement	0.077	0.077	0.077	0.077
Mean % gain in OV	0.514	0.514	0.514	0.514
Percent gain in OV	–0.0398***	–0.0387***	–0.0299***	–0.0298***
	[0.0095]	[0.0093]	[0.0095]	[0.0094]
Linear age	X		X	
Age dummies		X		X
SAH controls	X	X	X	X
Other Xs			X	X

Note: Coefficients are the marginal effects of a 100 percent change in the ratio of OV to peak value. Standard errors clustered on individuals are in brackets. The four models presented are the same as in table 3.1B.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

to stay in the labor force to continue accruing future firm pension income. For the spouse's pension, there is only a wealth effect as one's own continued work would not increase the future pension income from the spouse's pension. So, the positive coefficient here suggests that the wealth effect goes in the expected direction—higher wealth through the presence of a spousal pension means earlier retirement, all else equal.

Tables 3.1C and 3.1D present the results for the percent-change version of option value. The specifications here are the same as in tables 3.1A and 3.1B. To be concise, we present only the coefficient on the percent gain in OV. Because these percent change measures are scale independent, they should be more comparable to the other countries in the project. The reported coefficients for males and females are of the expected negative sign. The first column in table 3.1C reports a coefficient of –0.12, which suggests that an increase in the percent option value of 10 percent would lead to a 1.2 percentage point drop in the likelihood of retirement. The relative magnitudes of the estimates across tables 3.1C and 3.1D are similar to the relative magnitudes seen in tables 3.1A and 3.1B.

The next set of tables breaks down the sample into subsamples defined by self-assessed health status. Tables 3.2A, 3.2B, 3.2C, and 3.2D look at females and males using the option value and percent gain in option value formulations. One way to think about the impact of health on the response to incentives is to consider that poor health may make the decisions of individuals less elastic with respect to economic incentives, as health imperatives become more important than economic calculations. On the other hand, the incentives may be much more salient for individuals in poorer health because they are actively confronting a choice of when to retire, while those in good health just continue to work. The results presented in tables 3.2A through table 3.2D support the second of these hypotheses, as the responsiveness to the incentives is much higher for those in poor health than those in strong health. For example, in table 3.2B, specification (1), the impact of a 10,000-unit increase in the option value would be to lower retirement probability by 6.38 percentage points for those in poor health, but only 1.28 percentage points for those in excellent health. This pattern of results holds across specifications, sexes, and for both the option value and percentage gain in option value formulations.

To look further into this phenomenon, we pool the sample together again across all health categories and try interacting the option value incentive measure with the level of self-assessed health. These results are presented in tables 3.3A, 3.3B, 3.3C, and 3.3D using the same progression of specifications, sexes, and option value versus percent gain in option value results. Here, the results show little difference across health groups. For example, in table 3.3A, the coefficient on the interaction of OV and "Health Fair" has a coefficient of –0.0174, which is not statistically significant. This means that those with fair health do not have a statistically significantly larger response to a unit change in OV than do those in the excluded health category (poor health). The base effects of OV at –0.0252 and of health (–0.0320 for fair health) are still strongly statistically significant and not much changed from the corresponding estimates in the first column of table 3.1A.

At first glance, the results from tables 3.2A–D do not appear to be in accord with tables 3.3A–D. Tables 3.2A–D show evidence that samples selected on being in low health have much stronger responses to OV than

Table 3.2A **Effect of inclusive OV on retirement by health status, female sample**

					Specification			
	Observations	Mean retirement rate	Mean of OV	Std. dev. OV	(1)	(2)	(3)	(4)
Health poor	828	0.244	8,955	14,527	–0.0726***	–0.0715***	–0.0553**	–0.0530***
					[0.0237]	[0.0230]	[0.0221]	[0.0189]
Health fair	2,985	0.152	9,952	13,314	–0.0689***	–0.0724***	–0.0602***	–0.0581***
					[0.0139]	[0.0136]	[0.0110]	[0.0103]
Health good	10,287	0.101	12,245	14,482	–0.0503***	–0.0503***	–0.0334***	–0.0335***
					[0.0047]	[0.0046]	[0.0046]	[0.0046]
Health very good	13,665	0.077	13,951	15,879	–0.0185***	–0.0185***	–0.0157***	–0.0159***
					[0.0038]	[0.0039]	[0.0038]	[0.0039]
Health excellent	7,644	0.074	15,429	17,066	–0.0215***	–0.0222***	–0.0208***	–0.0211***
					[0.0036]	[0.0035]	[0.0035]	[0.0034]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1A.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.2B Effect of inclusive OV on retirement by health status, male sample

	Observations	Mean retirement rate	Mean of OV	Std. dev. OV	Specification (1)	(2)	(3)	(4)
Health poor	11,31	0.203	13,470	17,063	–0.0638***	–0.0598***	–0.0449**	–0.0431**
					[0.0179]	[0.0172]	[0.0204]	[0.0194]
Health fair	4,046	0.126	14,686	17,078	–0.0426***	–0.0396***	–0.0288***	–0.0252***
					[0.0082]	[0.0079]	[0.0068]	[0.0061]
Health good	12,596	0.080	19,071	22,666	–0.0163***	–0.0161***	–0.0093***	–0.0098***
					[0.0032]	[0.0031]	[0.0029]	[0.0029]
Health very good	16,068	0.063	21,831	23,098	–0.0119***	–0.0115***	–0.0131***	–0.0127***
					[0.0032]	[0.0032]	[0.0020]	[0.0019]
Health excellent	9,100	0.061	24,649	27,054	–0.0128***	–0.0123***	–0.0084**	–0.0081**
					[0.0039]	[0.0037]	[0.0039]	[0.0037]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1B.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.2C Effect of inclusive OV on retirement by health status, female sample

	Observations	Mean retirement rate	Mean of % OV	Std. dev. % OV	Specification (1)	(2)	(3)	(4)
Health poor	805	0.256	0.256	0.502	–0.1779**	–0.1785**	–0.1814**	–0.1466**
					[0.0901]	[0.0898]	[0.0762]	[0.0661]
Health fair	2,914	0.153	0.260	0.380	–0.2636***	–0.2820***	–0.2267***	–0.2194***
					[0.0524]	[0.0520]	[0.0408]	[0.0387]
Health good	10,052	0.101	0.309	0.399	–0.2103***	–0.2105***	–0.1284***	–0.1287***
					[0.0203]	[0.0201]	[0.0184]	[0.0183]
Health very good	13,391	0.078	0.335	0.398	–0.2103***	–0.2105***	–0.1284***	–0.1287***
					[0.0203]	[0.0201]	[0.0184]	[0.0183]
Health excellent	7,512	0.074	0.375	0.440	–0.0786***	–0.0824***	–0.0753***	–0.0760***
					[0.0157]	[0.0155]	[0.0149]	[0.0144]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1A.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.2D **Effect of inclusive OV on retirement by health status, male sample**

					Specification			
	Observations	Mean retirement rate	Mean of % OV	Std. dev. % OV	(1)	(2)	(3)	(4)
Health poor	1,116	0.204	0.382	0.502	–0.1853***	–0.1724***	–0.1426**	–0.1395**
					[0.0564]	[0.0536]	[0.0718]	[0.0682]
Health fair	3,949	0.127	0.388	0.488	–0.1082***	–0.1013***	–0.0592**	–0.0518**
					[0.0332]	[0.0305]	[0.0239]	[0.0213]
Health good	12,317	0.081	0.470	0.582	–0.0375***	–0.0376***	–0.0199**	–0.0214**
					[0.0130]	[0.0126]	[0.0093]	[0.0092]
Health very good	15,790	0.062	0.527	0.603	–0.0266***	–0.0252***	–0.0328***	–0.0311***
					[0.0097]	[0.0097]	[0.0074]	[0.0071]
Health excellent	8,955	0.061	0.611	0.778	–0.0290*	–0.0272*	–0.0175	–0.0167
					[0.0159]	[0.0151]	[0.0120]	[0.0115]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1B.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.3A Effect of inclusive option value on retirement with health interactions, female sample

	Specification			
	(1)	(2)	(3)	(4)
OV	–0.0252***	–0.0264***	–0.0217**	–0.0224***
	[0.0093]	[0.0091]	[0.0087]	[0.0084]
OV*health fair	–0.0174	–0.0166	–0.0150	–0.0148
	[0.0129]	[0.0127]	[0.0119]	[0.0117]
OV*health good	–0.0234**	–0.0226**	–0.0155	–0.0154*
	[0.0105]	[0.0103]	[0.0095]	[0.0092]
OV*health very good	0.0004	0.001	0.0014	0.0016
	[0.0101]	[0.0100]	[0.0092]	[0.0089]
OV*health excellent	0.0015	0.0020	0.0037	0.0037
	[0.0103]	[0.0102]	[0.0092]	[0.0089]
Health fair	–0.0320***	–0.0318***	–0.0239***	–0.0233***
	[0.0090]	[0.0091]	[0.0081]	[0.0079]
Health good	–0.0548***	–0.0546***	–0.0398***	–0.0393***
	[0.0092]	[0.0091]	[0.0088]	[0.0085]
Health very good	–0.0851***	–0.0850***	–0.0634***	–0.0629***
	[0.0101]	[0.0101]	[0.0102]	[0.0099]
Health excellent	–0.0720***	–0.0720***	–0.0529***	–0.0525***
	[0.0073]	[0.0073]	[0.0068]	[0.0066]
Age control	Linear	Dummies	Linear	Dummies
Extended controls			Yes	Yes
Number of observations	35,409	35,409	35,409	35,409
Mean retirement rate	0.094	0.094	0.094	0.094
Mean of OV	13,303	13,303	13,303	13,303
Std. deviation of OV	15,616	15,616	15,616	15,616

Note: Models are the same as those in table 3.1A, with the addition of interaction terms for the inclusive option value and health status. Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

do individuals in better health. Tables 3.3A–D, on the other hand, show little difference in responsiveness across health groups. To reconcile these results, it must be understood that the samples in tables 3.2A–D are selected on health, but the other characteristics of the individuals in the different health categories are not random. That is, people in low health typically have lower education and have lower lifetime earnings, among other factors. The results in tables 3.3A–D suggest that it is not health itself that was driving the differing responses to OV in tables 3.2A–D. Instead, it was some other difference that is correlated with health. In tables 3.3A–D, when these factors are controlled, we see only the extra responsiveness by health to OV. To

Table 3.3B Effect of inclusive option value on retirement with health interactions, male sample

	Specification			
	(1)	(2)	(3)	(4)
OV	–0.0164***	–0.0164***	–0.0174**	–0.0176**
	[0.0057]	[0.0057]	[0.0071]	[0.0070]
OV*health fair	–0.0082	–0.0076	–0.0046	–0.0039
	[0.0075]	[0.0074]	[0.0085]	[0.0084]
OV*health good	0.0007	0.0011	0.0078	0.0080
	[0.0063]	[0.0062]	[0.0073]	[0.0072]
OV*health very good	0.0005	0.0008	0.0029	0.0031
	[0.0066]	[0.0065]	[0.0072]	[0.0071]
OV*health excellent	–0.0002	0.0000	0.0058	0.0059
	[0.0074]	[0.0073]	[0.0080]	[0.0079]
Health fair	–0.0258***	–0.0271***	–0.0221***	–0.0232***
	[0.0071]	[0.0070]	[0.0070]	[0.0067]
Health good	–0.0502***	–0.0513***	–0.0464***	–0.0474***
	[0.0072]	[0.0072]	[0.0075]	[0.0074]
Health very good	–0.0637***	–0.0649***	–0.0523***	–0.0536***
	[0.0089]	[0.0089]	[0.0096]	[0.0096]
Health excellent	–0.0527***	–0.0534***	–0.0451***	–0.0457***
	[0.0076]	[0.0075]	[0.0075]	[0.0074]
Age control	Linear	Dummies	Linear	Dummies
Extended controls			Yes	Yes
Number of observations	42,941	42,941	42,941	42,941
Mean retirement rate	0.077	0.077	0.077	0.077
Mean of OV	20,827	20,827	20,827	20,827
Std. deviation of OV	23,551	23,551	23,551	23,551

Note: Models are the same as those in table 3.1A, with the addition of interaction terms for the inclusive option value and health status. Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

investigate this further, we turn next to an assessment of the effects of OV across education groups.

The last set of tables compare the OV results across education groups. Those with lower education are more likely to self-assess their health as not so strong, and they also tend to have lower lifetime earnings. More physical labor might lead to an earlier need to contemplate retirement than those with office jobs typical among those with higher education. Lower lifetime earnings may make lower educated individuals more responsive to the financial incentives in public pensions, as public pensions will make up a larger share of their retirement incomes.

Table 3.3C Effect of percent change option value on retirement with health interactions, female sample

	Specification			
	(1)	(2)	(3)	(4)
Percent change OV	–0.0146	–0.0179	–0.0169	–0.0178
	[0.0162]	[0.0168]	[0.0157]	[0.0156]
Percent OV*health fair	–0.0404***	–0.0398***	–0.0319***	–0.0320***
	[0.0101]	[0.0101]	[0.0094]	[0.0094]
Percent OV*health good	–0.0467***	–0.0464***	–0.0323***	–0.0326***
	[0.0064]	[0.0064]	[0.0057]	[0.0057]
Percent OV*health very good	–0.0225***	–0.0223***	–0.0157***	–0.0160***
	[0.0051]	[0.0052]	[0.0046]	[0.0045]
Percent OV*health excellent	–0.0209***	–0.0209***	–0.0134***	–0.0137***
	[0.0060]	[0.0060]	[0.0050]	[0.0049]
Health fair	–0.0195**	–0.0194**	–0.0132	–0.0121
	[0.0095]	[0.0094]	[0.0094]	[0.0094]
Health good	–0.0414***	–0.0411***	–0.0286***	–0.0276***
	[0.0085]	[0.0085]	[0.0084]	[0.0082]
Health very good	–0.0713***	–0.0711***	–0.0504***	–0.0494***
	[0.0089]	[0.0088]	[0.0089]	[0.0086]
Health excellent	–0.0626***	–0.0626***	–0.0443***	–0.0436***
	[0.0069]	[0.0068]	[0.0065]	[0.0064]
Age control	Linear	Dummies	Linear	Dummies
Extended controls			Yes	Yes
Number of observations	34,674	34,674	34,674	34,674
Mean retirement rate	0.094	0.094	0.094	0.094
Mean of OV	0.328	0.328	0.328	0.328
Std. deviation of OV	0.411	0.411	0.411	0.411

Note: Models are the same as those in table 3.1A, with the addition of interaction terms for the percent option value and health status. Coefficients are the marginal effects of a 100 percent change in percent OV from probit models. Standard errors clustered on individuals are in brackets.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Tables 3.4A, 3.4B, 3.4C, and 3.4D show these results for subsamples by education group. The first two tables show women and men using the option value, while the third and fourth tables show the results using the percent gain in option value. The four specifications shown across each table are the same four as shown in tables 3.1A–D. Each row of these tables shows results from separate regressions on subsamples defined by education groups.

The results across all specifications and samples show a decreasing responsiveness of individuals to the option value pension incentive when education increases. More highly educated individuals are less responsive

Table 3.3D Effect of percent change option value on retirement with health interactions, male sample

	Specification			
	(1)	(2)	(3)	(4)
Percent change OV	0.0312***	0.0298***	0.0214**	0.0205**
	[0.0080]	[0.0079]	[0.0088]	[0.0088]
Percent OV*health fair	–0.0333***	–0.0323***	–0.0272***	–0.0265***
	[0.0054]	[0.0054]	[0.0055]	[0.0054]
Percent OV*health good	–0.0237***	–0.0230***	–0.0147***	–0.0144***
	[0.0033]	[0.0032]	[0.0031]	[0.0031]
Percent OV*health very good	–0.0235***	–0.0228***	–0.0196***	–0.0192***
	[0.0039]	[0.0039]	[0.0030]	[0.0029]
Percent OV*health excellent	–0.0247***	–0.0241***	–0.0167***	–0.0165***
	[0.0034]	[0.0034]	[0.0028]	[0.0028]
Health fair	–0.0015	–0.0037	0.002	0.0001
	[0.0092]	[0.0089]	[0.0105]	[0.0101]
Health good	–0.0273***	–0.0288***	–0.0245***	–0.0256***
	[0.0070]	[0.0069]	[0.0070]	[0.0069]
Health very good	–0.0395***	–0.0411***	–0.0259***	–0.0272***
	[0.0082]	[0.0081]	[0.0079]	[0.0079]
Health excellent	–0.0329***	–0.0340***	–0.0259***	–0.0267***
	[0.0069]	[0.0069]	[0.0066]	[0.0065]
Age control	Linear	Dummies	Linear	Dummies
Extended controls			Yes	Yes
Number of observations	42,127	42,127	42,127	42,127
	0.077	0.077	0.077	0.077
Mean retirement rate	0.514	0.514	0.514	0.514
	0.635	0.635	0.635	0.635
Mean of OV	42,127	42,127	42,127	42,127
	0.077	0.077	0.077	0.077
Std. deviation of OV	0.514	0.514	0.514	0.514

Note: Models are the same as those in table 3.1B, with the addition of interaction terms for the percent option value and health status. Coefficients are the marginal effects of a 100 percent change in percent OV from probit models. Standard errors clustered on individuals are in brackets.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

than lower-educated individuals to the same incentive. The result is strongly robust across specifications.

Overall, our regression results have confirmed earlier findings showing that Canada's retirement system has an influence on retirement decisions. Additionally, we find that the impact of the retirement income system on retirement decisions is strongest for those in weakest health, and those with lower levels of education. In both cases, this may reflect a stronger salience

Table 3.4A **Effect of inclusive option value on retirement by education group, female sample**

	Observations	Mean retirement rate	Mean of OV	Std. dev. OV	Specification (1)	(2)	(3)	(4)
High school dropout	7,400	0.122	7,272	9,711	–0.0567***	–0.0577***	–0.0497***	–0.0496***
					[0.0103]	[0.0098]	[0.0098]	[0.0093]
Completed high school	6,296	0.100	12,001	14,310	–0.0359***	–0.0376***	–0.0288***	–0.0285***
					[0.0056]	[0.0053]	[0.0060]	[0.0056]
Some postsecondary	15,249	0.085	13,876	14,684	–0.0315***	–0.0315***	–0.0246***	–0.0246***
					[0.0034]	[0.0033]	[0.0032]	[0.0031]
University degree	5,185	0.077	21,203	21,253	–0.0178***	–0.0175***	–0.0118***	–0.0113***
					[0.0043]	[0.0041]	[0.0038]	[0.0035]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1A.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.4B　Effect of inclusive option value on retirement by education group, male sample

	Observations	Mean retirement rate	Mean of OV	Std. dev. OV	Specification			
					(1)	(2)	(3)	(4)
High school dropout	11,274	0.103	12,509	13,103	–0.0433***	–0.0421***	–0.0314***	–0.0312***
					[0.0046]	[0.0046]	[0.0043]	[0.0042]
Completed high school	6,067	0.068	19,733	21,236	–0.0192***	–0.0186***	–0.0100***	–0.0095***
					[0.0040]	[0.0038]	[0.0030]	[0.0026]
Some postsecondary	16,371	0.070	20,615	18,806	–0.0158***	–0.0154***	–0.0113***	–0.0111***
					[0.0039]	[0.0038]	[0.0042]	[0.0041]
University degree	7,384	0.065	32,132	35,709	–0.0103***	–0.0097***	–0.0094***	–0.0085***
					[0.0026]	[0.0023]	[0.0015]	[0.0013]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 10,000-unit change in OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1B.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.4C **Effect of percent change in option value on retirement by education group, female sample**

					Specification			
	Observations	Mean retirement rate	Mean of OV	Std. dev. OV	(1)	(2)	(3)	(4)
High school dropout	7,213	0.122	0.196	0.267	–0.1725***	–0.1806***	–0.1405***	–0.1403***
					[0.0405]	[0.0397]	[0.0368]	[0.0357]
Completed high school	6,163	0.099	0.296	0.410	–0.1403***	–0.1482***	–0.1061***	–0.1058***
					[0.0248]	[0.0239]	[0.0249]	[0.0230]
Some postsecondary	14,986	0.085	0.341	0.388	–0.1248***	–0.1242***	–0.0900***	–0.0897***
					[0.0152]	[0.0151]	[0.0127]	[0.0125]
University degree	5,099	0.078	0.498	0.545	–0.0723***	–0.0709***	–0.0445***	–0.0425***
					[0.0207]	[0.0200]	[0.0170]	[0.0159]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 100 percent change in percent OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1A.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 3.4D **Effect of percent change in option value on retirement by education group, male sample**

	Observations	Mean retirement rate	Mean of OV	Std. dev. OV	Specification			
					(1)	(2)	(3)	(4)
High school dropout	11,046	0.104	0.319	0.373	–0.1238***	–0.1212***	–0.0846***	–0.0857***
					[0.0202]	[0.0197]	[0.0167]	[0.0160]
Completed high school	5,951	0.068	0.495	0.592	–0.0383**	–0.0359**	–0.0207**	–0.0192**
					[0.0158]	[0.0151]	[0.0097]	[0.0089]
Some postsecondary	16,097	0.070	0.499	0.517	–0.0291**	–0.0282**	–0.0226*	–0.0226*
					[0.0145]	[0.0141]	[0.0135]	[0.0134]
University degree	7,271	0.065	0.781	0.941	–0.0289***	–0.0272***	–0.0259***	–0.0234***
					[0.0089]	[0.0080]	[0.0055]	[0.0049]
Age control					Linear	Dummies	Linear	Dummies
Extended controls							Yes	Yes

Note: Coefficients are the marginal effects of a 100 percent change in percent OV from probit models. Standard errors clustered on individuals are in brackets. Extended controls are those included in columns (3) and (4) of table 3.1B.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

of public retirement benefits and greater physical need to contemplate retirement.

3.5 Understanding the Results and Implications

We now turn to some simulations to assess the magnitudes of our results and the implications in particular for disability insurance. In our simulations, we use estimates from tables 3.1A (for women) and 3.1B (for men), specification (4). We take the estimated coefficient on OV from this specification and use it for the simulations. Each simulation involves imposing some different counterfactual pension or disability insurance regime and recalculating the option value. Then, taking the new option value, we use the estimated coefficients from tables 3.1A and 3.1B, specification (4) to predict retirement probabilities for each individual in the data set.

The counterfactual scenarios we examine here should not be considered as direct policy options. Instead, we think of these simulations as a way to gauge the magnitude of our results and to compare results across countries in the project.

We consider four different simulations. We first imagine an individual for whom disability insurance is not an option, so the only incentives that matter are on the non-DI path. Second, we take an individual who represents the complementary case—only considering the DI option value. We do this simulation for two different samples. The first sample contains all individuals. The second sample is selected based on self-assessed disability status reported in the SLID. For these individuals, we expect the DI incentives may be more salient. So, the two samples and the two simulated incentives make for four total sets of simulations.

We present first the hazard rates for the two sets of incentives and the two samples. The predicted probability for each individual is calculated using either the DI path only or the non-DI path only, and the resulting probabilities are aggregated across all individuals or across only those who self-report as disabled. Figure 3.9 shows the resulting hazards, which is formed by taking the individual predicted retirement probabilities averaged by age for each simulation.

The lower two lines in each of the panels of figure 3.9 show the results for the full sample. The "All DI" line shows the results when all emphasis is put on the DI path; the "All non-DI" shows the results when all emphasis is put on the non-DI path. For women at age fifty, the difference in the predicted probabilities between the two paths is about 1 percentage point—4.5 percent versus 3.5 percent. For men, the gap is smaller at 0.65 of a percentage point. The difference between the incentives closes at age sixty-five because DI benefits transform to CPP retirement benefits at that age. So, the difference between the lifetime value of benefits for a sixty-four-year-old retiring through DI or non-DI is quite small, reflecting only one year of different

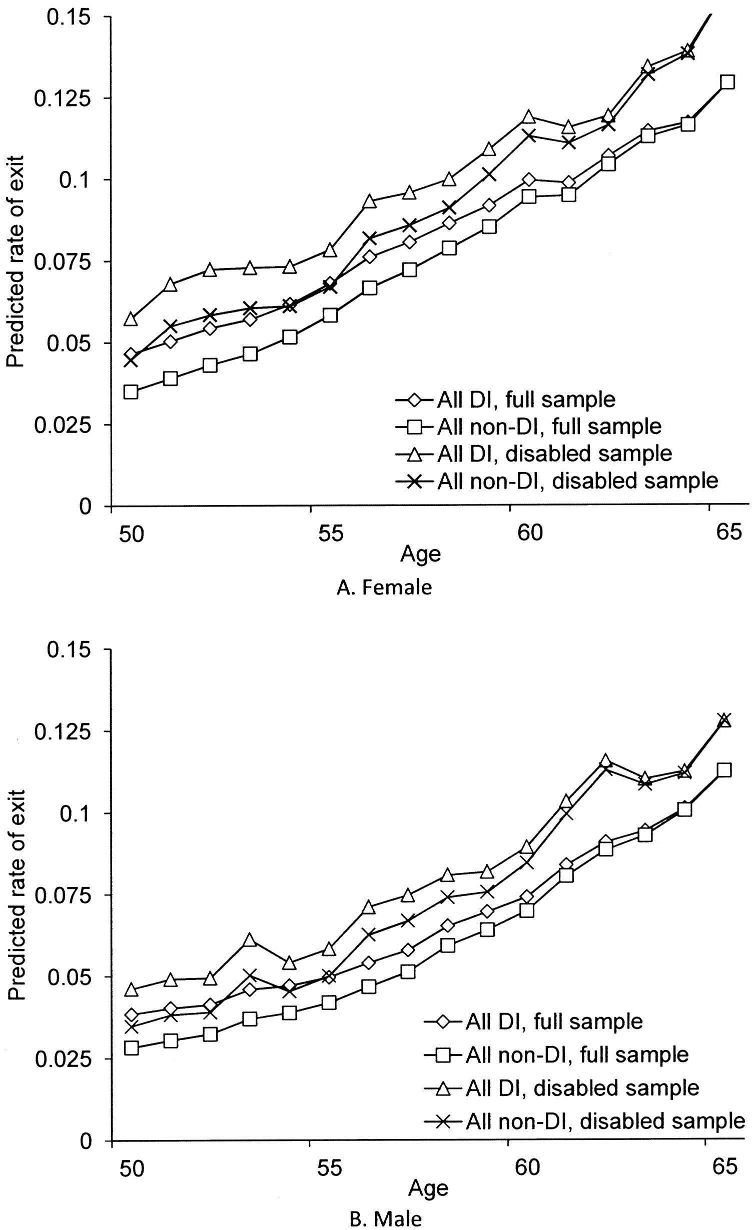


Fig. 3.9 Hazard rates

Source: Authors' calculations using the SLID.

benefits received before age sixty-five. Figure 3.9 also shows higher simulated exit rates at each age for the disabled sample. The difference between the all DI and the all non-DI path is very similar to the full sample.

Figure 3.10 takes these hazard rates and constructs a survival curve. Starting with a full 1.0 share of people working at age fifty, the curve shows how many survive after accounting for the exits suggested by the hazard rates from figure 3.9. The same four simulations are shown for women and for men. The difference in survival rates comparing across the all DI and the all non-DI lines looks fairly small in all cases. However, it is possible to aggregate across ages by adding the survival rates at each age together. The resulting number provides a projection of the number of years of work that can be expected after age fifty under each simulation.

The aggregated predictions for years of work are presented in figure 3.11. For this figure, we show not only the all DI and all non-DI simulations, but also two intermediate simulations. Here, we randomly assign the DI incentives to two-thirds of the observations and the non-DI incentives to the rest. Then, we repeat with only one-third getting the DI incentives. As above, we show results for the full sample and the disabled sample.

The results show a modest difference ranging from the all DI to the all non-DI simulation. The predicted years of work under all DI for women is 10.5 years, but under all non-DI it is 11.2 years, for a gain of 0.7 years. As a percentage of the 10.5 years, this represents a potential increase in labor supply over these ages of 8 percent if people shifted from a focus on DI to a focus on the non-DI incentives. For men, the equivalent change is from 11.9 years to 12.5, for a percentage increase of 5 percent in years worked over this age range. For both men and women, the number of years worked in the disabled sample is smaller, but the difference across simulations is similar.

These results suggest a modest impact of DI in Canada. This may reflect the relatively small scale of the program in Canada compared to other countries, and also relatively high stringency of the system after 1995.

3.6 Conclusion

This chapter has studied the retirement decisions of Canadians and the influence of the retirement income and disability insurance systems on those decisions. We confirm and extend the results of previous research that has shown retirement decisions to be dependent upon the incentives embedded in the public programs available to Canadians. In particular, we are able here to incorporate the DI aspect of the Canadian system into the analysis along with the retirement income elements. In addition, we show how the results vary by health status and education, finding that lower health and lower education Canadians are more sensitive to the retirement incentives.

We also present simulation results, comparing what would happen if individuals paid more attention to the DI or the non-DI incentives they may

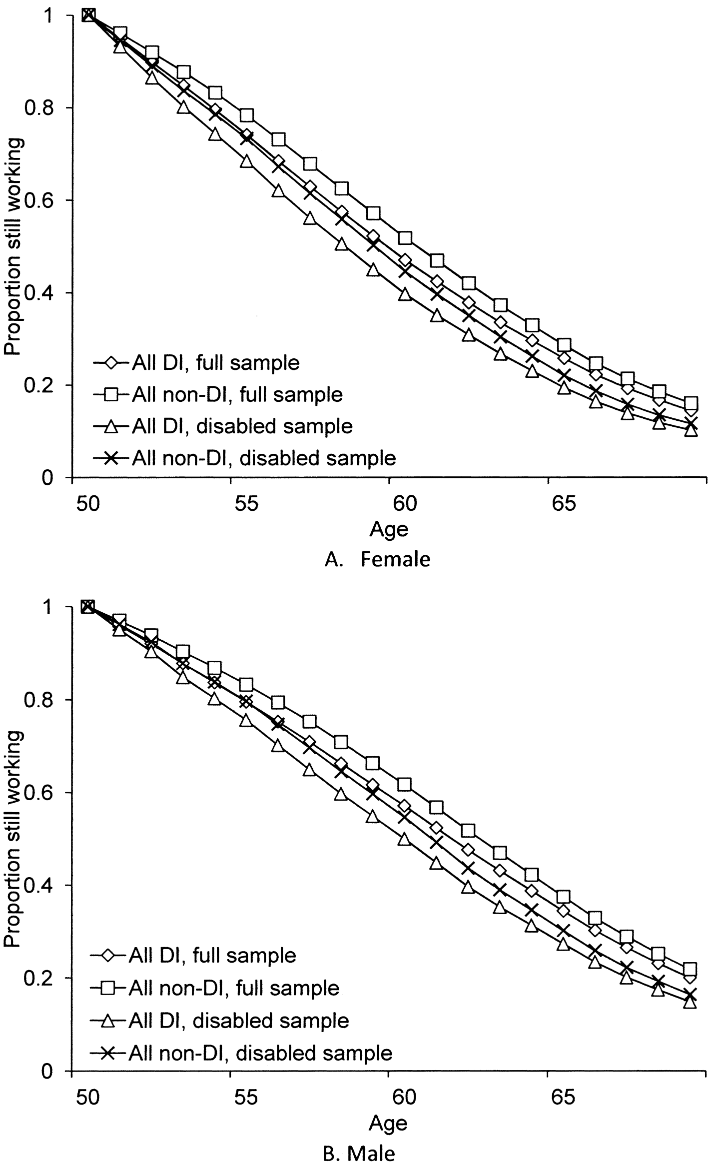


Fig. 3.10 Survival rates

Source: Authors' calculations using the SLID.

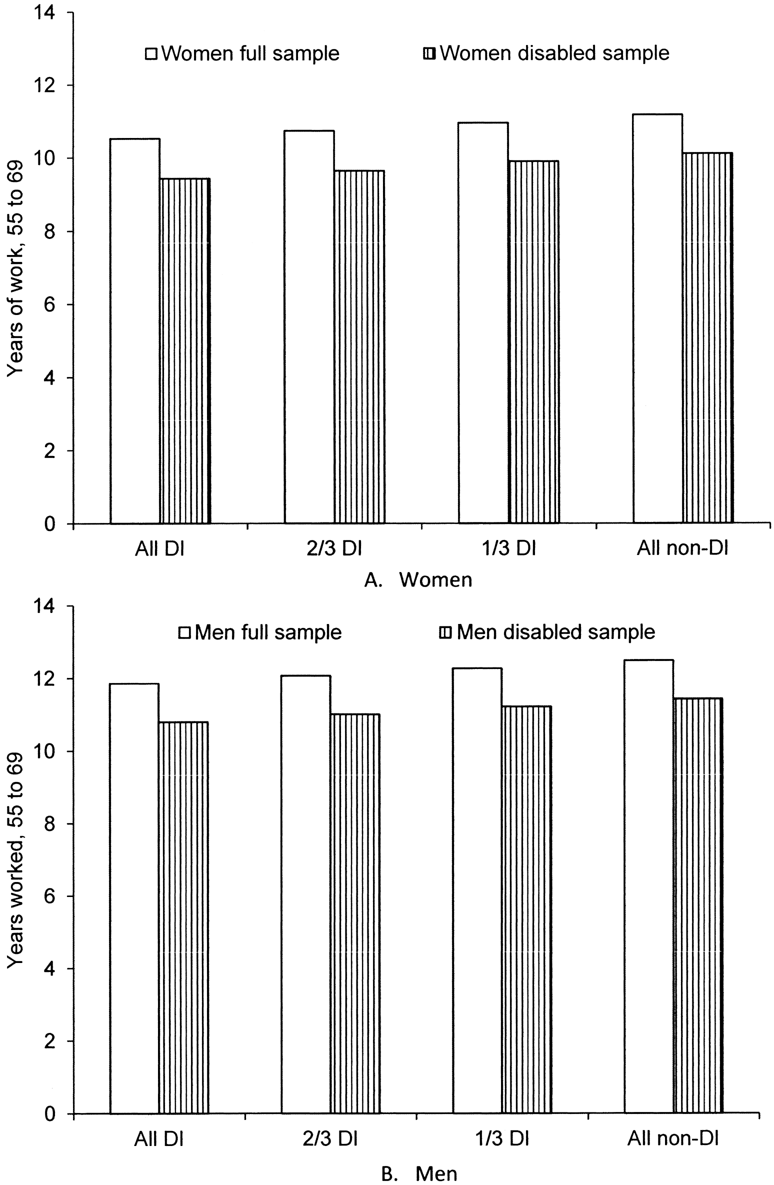


Fig. 3.11 Simulation results

Source: Authors' calculations using the SLID.

face. Our simulations suggest a modest difference in retirements across the two sets of incentives, implying a noticeable but not large extra impact of DI on retirement decisions. In comparison with similar results for other countries, however, it must be emphasized that the relative value of DI benefits is small in Canada and the probability of DI uptake is also relatively small.

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