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The Retirement Incentive Effects of Canada's Income Security Programs

Michael Baker
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SEDAP Research Paper No. 65

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November, 2001

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Abstract

Like most other developed nations, Canada has a large income security system for retirement that provides significant and widely varying disincentives to work at older ages. Empirical investigation of their effects has been hindered by lack of appropriate data. We provide an empirical analysis of the retirement incentives of the Canadian Income Security (IS) system using a new and comprehensive administrative data base. We find that the work disincentives inherent in the Canadian IS system have large and statistically significant impacts on retirement. This suggests that program reform can play some role in responses to the fiscal crises these programs periodically experience. We also demonstrate the importance of controlling for lifetime earnings in retirement models. Specifications without these controls overestimate the effects of the IS system. Finally, our estimates vary in sensible ways across samples lending greater confidence to our estimates.

Canada's Income Security (IS) programs for seniors face an uncertain fiscal future. Unfortunate collisions of demography and "pay as you go" financing have precipitated periodic crises for both the Canada and Quebec Pension Plans. But there is another trend that is equally ominous for long run fiscal balances: the substantial reduction in the work effort of older Canadians. From the beginning of the 1960s through the end of the 1990s the labour force participation rate of 55-64 year old men fell from 87 percent to 61 percent. For men aged 65+ it fell from 30 percent to under 10 percent. The decline in the working older age population both lowers the tax revenues that finance IS programs and raises the benefits payments from these programs, worsening their net fiscal position.

Ironically, the IS programs may have made a significant contribution the time trend in retirement that threatens them. The time series correlation is striking, as this period saw an enormous expansion of IS programs: the Canada/Quebec Pension Plans were greatly expanded, and new income support programs for low income seniors were introduced or expanded.

Of course, simple trend comparisons are not a sufficient basis for concluding that IS programs played a major role in these trends, or contemplating IS reform. Instead, we require formal, robust inference on the behavioural effects of program parameters. For many countries there are large and growing literatures on the incentive effects of their national social security programs. Furthermore, many governments are investing in research programs on aging to help refine the inference. In contrast, there are but a handful of studies of Canada's IS programs. One explanation of this outcome is there are few data sets in Canada with sufficient samples of older individuals and adequate information on their IS entitlements to support such a program.

In this paper we attempt to fill in some of the gaps in the Canadian literature, providing estimates of the incentive effects of the full web of federal IS programs using an extraordinary

new data set. These data are a union of numerous administrative sources, and provide a large sample of older workers and detailed information on their earnings histories, marital circumstances, spousal and job characteristics and labour supply choices.

Using this information we construct estimates of individuals' entitlements to Canada and Quebec Pension Plan (CPP and QPP) benefits, the Old Age Security Pension (OAS), the Guaranteed Income Supplement (GIS) and Spouse's Allowance (SPA).[1] Our measure of the labour market incentives provided by these programs is based on the present discounted value of the stream of benefit entitlements from these programs for a given retirement age. By recalculating this sum at each possible retirement age we create accrual variables that capture the change in total IS entitlements with additional years of work. We calculate a variety of accrual variables, which alternatively assume the worker is relatively short or long sighted when making the retirement decision. We then relate these incentive measures to individuals' labour market decisions between age 55 and age 64—the primary retirement ages.

There is a growing recognition in the literature that identification can be problematic in empirical models of retirement (Coile and Gruber 2000, Chan and Stevens 2001). This is because cross individual variation in benefit entitlement is typically the basis of identification. There are a variety of sources of variation in benefit entitlement across individuals, but clearly one of the more important is lifetime wages or earnings. The problem arises because variation in lifetime wages may in turn capture heterogeneity in work preferences. Accordingly, we are careful to document any variation in inference across specifications that, alternatively, do and do not control for individuals' lifetime earnings.

We also explore variation in the results across samples defined by the probability of being a member of a Registered Pension Plan and particular income quartile, as well as across

different definitions of retirement. The estimates vary in sensible ways, which lends greater confidence to our inference.

The rest of the paper is laid out as follows. First, we describe the previous literature and the elements of Canada's income security system and the retirement income environment. Next, we describe the construction of the data set and the incentive variables used in the analysis. We then proceed to lay out the empirical framework and present the results. Finally, we offer some conclusion.

I. Previous Literature

The economics of aging literature in Canada is relatively new and still quite small.[2] As noted above, a major obstacle is the lack of panel data that provide large samples of older workers. This problem is not unique to Canada, however, as special surveys have been initiated in some countries to remedy this problem (e.g., the US Health and Retirement Survey).

Pesando and Rea (1977) and Burbidge (1987) are early studies that document the parameters of Canada's IS system and provide theoretical analyses of some of their incentives. Specific features of the CPP/QPP programs have recently been examined by Baker and Benjamin (1999a, 1999b) and Baker (2002). These include the elimination of the CPP/QPP earnings test and the introduction of the Spouse's Allowance (SPA) in the 1970s and the introduction of early retirement to the CPP/QPP in the 1980s. Tompa (1999) investigates the determinants of the CPP take-up decision. These studies offer mixed results: some of the program reforms appear to have affected retirement behaviour (the earnings test and SPA) while

[1] On July 31, 2000 the name of the Spouse's Allowance was changed to the 'Allowance.'
[2] Our focus here is on studies of public pension and income security programs. There is a small related literature on the incentives in Registered Pension Plans. See Gunderson and Pesando (1988) and Gunderson and Pesando (1991).

others did not (early retirement). In any event, an obvious shortcoming of this research for the purposes of program reform is its focus on single features of programs in isolation.

Recently Gruber (1999) provides a step towards more comprehensive analysis by documenting the incentive effects of the entire web of IS programs based on simulated earnings histories. He shows that there are positive incentives for retirement starting at age 60 that grow particularly large by age 69.

Another recent contribution to this literature is offered by Compton (2001). She estimates the incentive effects of the full CPP/QPP program using Survey of Labour and Income Dynamics (SLID) data for 1993-1996, and concludes that program parameters have little effect on retirement decisions. There are at least two reasons, however, that this conclusion may be too strong. First, the modelling of retirement incentives in the paper is limited by the SLID's short time span. As a consequence most of a worker's earnings history is not observed, which hampers the construction of CPP/QPP benefits. In addition, as we document below, the interactions of the CPP/QPP with the income-tested retirement income programs are crucial to understanding the effect of incentives on retirement in Canada. Therefore, as noted in the discussion of the Baker and Benjamin papers no strong conclusions should be drawn from looking at one component of the system in isolation.

A second shortcoming is the method used to impute CPP/QPP benefits to potential retirees. These benefits are imputed to workers based on a sample of workers who both work and collect CPP/QPP benefits. This sample is not likely to be representative of the working population. Furthermore, the variables that are used to predict CPP/QPP benefits are included in the retirement regressions along side the imputed CPP/QPP benefit. With no variables from the first stage excluded, there is no identifying variation left for the CPP/QPP effect, which renders

its explanatory power inert. Finally, the results using this methodology find no evidence that money matters, but the precision of the estimates is low, so large incentive effects cannot be statistically ruled out either.

II. An Overview of the Income Security System

Canadians make their retirement decisions within the context of a three component IS system that is largely a creature of the 1960's. The first component, the OAS pension, was until recently a demogrant available to individuals starting at age 65. The second component is the GIS, and related SPA, which are income tested benefits. The third component is the contributory public pension plans, the CPP and QPP, in which benefit entitlement is directly related to individuals' lifetime work histories. As reference for the following overview of the system, a graph of the levels of benefits paid out by these programs since 1980 is presented in figure 1.

The Old Age Security Pension

The OAS was established in 1952, replacing existing provincial means tested, cost shared, programs that had been in place from as early as 1927. Benefits are available to any individual aged 65 or older, who meets certain residency requirements.[3] Originally benefits were available to individuals starting at age 70, but this was lowered to age 65 over a 5 year period starting in 1966.

[3] Individuals a) must be a Canadian citizen or legal resident of Canada on the day preceding the application's approval; or b) if no longer living in Canada, must have been a Canadian citizen or a legal resident of Canada on the day preceding the day he or she stopped living in Canada. A minimum of ten years of residence in Canada after reaching age 18 is required to receive a pension. The amount of a person's pension is determined by how long he or she has lived in Canada. For example, a person who has lived in Canada for at least 40 years after reaching age 18 may qualify for a full OAS pension. The benefit is pro-rated for pensioners with less than 40 years of residence.

There is no actuarial adjustment to benefits for delaying receipt beyond age 65. Benefits are fully taxable, and since 1989 they are clawed back from high income individuals. A special claw back tax of 15 percent comes into effect as a beneficiary's income reaches $55,309 (in 2001). Finally, benefits have been fully indexed to the CPI since 1972, and are financed out of general tax revenues.

The Guaranteed Income Supplement and Spouse's Allowance

The GIS, established in 1967, is an (annually) income tested benefit, available to OAS pensioners. The are separate benefits for singles and individuals living in couples. The calculation of income for the purposes of the test is similar to that used for the income tax, with the exclusion of OAS benefits. A key difference is that income for the GIS and SPA is calculated at the family level. The tax back of benefits is 50 cents for each dollar of income except in couples where the partner is under age 60 in which the tax back is 25 cents for each dollar of income.

The SPA, established in 1975, is a program for partners of OAS pensioners, who are between the ages of 60 and 64.[4] The maximum benefit is equal to the sum of the current OAS benefit and current GIS benefit at the married rate. Benefits are income tested at higher rates than the GIS. The tax on benefits is 75 cents for each dollar of income until an amount equivalent to the OAS benefit has been retrieved. At this point the tax is reduced: the sum of the remaining SPA benefit and the other partner's GIS benefits are reduced by 50 cents for each dollar of additional income. In 1986 the SPA was extended to individuals aged 60 to 64 who had been widowed and had not remarried. Benefits for these surviving spouses are somewhat larger but are taxed back similarly.

Both GIS and SPA benefits are fully indexed to increases in the CPI. Furthermore, neither benefit is subject to income taxes at the federal or provincial levels.

The Canada and Quebec Pension Plans

The third component of the IS system is the QPP and CPP which were established in 1966. The two programs are largely identical, and serve, respectively, individuals living in the province of Quebec and individuals living in the other provinces and territories of the country. The primary difference between the CPP/QPP and the OAS and GIS/SPA programs is that CPP/QPP benefits are determined by an individual's lifetime work history.

The plans are financed by a payroll tax of 4.3 percent (2001) paid by both employers and employees. The tax is levied on employment earnings in excess of the Year's Basic Exemption, currently frozen at $3,500, up the Year's Maximum Pensionable Earnings (YMPE), which equalled $38,300 in 2001. The YMPE is indexed to the growth in average earnings in the labour market.

To be eligible for benefits, an individual must have made at least one year of contributions in his/her contributory period. The contributory period starts at age 18 or January 1, 1966, whichever is later, and normally extends to age 65 or commencement of the retirement pension, whichever is earlier.

Benefit entitlement is determined by a series of calculations. In the first, the number of months in an individual's contributory period is calculated.[5] Some months are excluded. They include any months in which a disability pension was received, months spent caring for children

[4] Beneficiaries must also meet residency requirements.
[5] Earnings in excess of 1/12 of the YMPE in a given month can be used, if necessary, to "top up" earnings in other months in the same calendar year.

under the age of 7[6], any month between age 65 and the commencement of the pension[7] and 15 percent of the remaining months. These last three conditions are subject to the proviso that the total contributory period cannot fall below 120 months. In the second calculation, pensionable earnings in each of the remaining months is converted to current earnings by multiplying by the ratio of the YMPE in the given month to a five year moving average of the YMPE in the month of application.[8] In the final calculation, the product of 0.25 and the average of this real earnings history,[9] called Average Pensionable Earnings (APE), determine benefit entitlement.

Benefits can be claimed at any age between 60 and 70 subject to an actuarial adjustment. The "normal" retirement age is 65. Benefits are reduced (increased) by 0.5 percent for each month the benefit application precedes (succeeds) this age.[10] Benefit receipt prior to age 65 is conditional on a retirement test. Annual earnings in the year the pension is claimed cannot exceed the maximum retirement pension payable at age 65 for that year. This test is only applied at the point of application, however; after that point, there is no additional check on the individual's earnings.

While CPP/QPP retirement pensions are based on an individual's earnings record, there is some dependence of benefits across partners through the surviving spouse benefits. This is because part of the surviving spouse benefit is determined by the deceased's earnings history.[11] These programs also pay benefits to orphaned children and a death benefit.

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[6] If the individual had zero or below average earnings in these months.
[7] Months worked between the ages of 65 and 70 can be substituted for months prior to age 65 if they increase benefit entitlement.
[8] The moving average is calculated as the year of application and the preceding four years. The method of calculation has been in place since 1999. Prior to 1998, a three year moving average was used. In 1998 a four year moving average was used.
[9] The factor of 0.25 has been in place since 1976. In the period 1967 through 1975 the ratio was increased linearly from 0.025 to this level.
[10] This early retirement option has been available from the QPP since 1984 and from the CPP since 1987.
[11] Further details of the surviving spouse pension can be found CCH Canadian Ltd (2001) and Baker, Hanna and Kantarevic (2001).

The CPP/QPP also provide disability pensions to individuals who are unable to work due to disability. This dimension of the program may have some impact on the retirement decision, as there is speculation in the literature that older workers use disability program as a bridge to retirement.[12]

Finally, CPP/QPP benefits have been fully indexed to the CPP since 1972. They are also fully taxable under federal and provincial income tax laws.

Other Elements of the Environment

While our focus in this paper is the incentives in the IS programs, there are a number of other programs that are inputs to the retirement decision. The first is provincially run programs for seniors. These tend to be relatively small programs and benefits are often means tested.[13]

The second element is employer provided pensions or Registered Pension Plans (RPP's). In 1997 almost 42 percent of paid workers were participants in one of these plans. Recent trends have been lower in coverage and away from defined benefit (DB) plans in favour of defined contribution (DC) plans. Both types of plans can affect retirement decisions, DC plans primarily through income effects, while DB plans can have quite complex incentive effects. Relative to public pension plans, employer pensions are relatively understudied due to a lack of data.[14]

A third element is the tax deferred saving program called Registered Retirement Savings Plans (RRSP). This program allows individuals to save up to 18% of earned income, to maximum of $13,500 on a pretax basis. This so-called contribution room is reduced by a

[12] Further information on the CPP and QPP disability programs can be found in Gruber (2000).
[13] For example, The GAINS program in Ontario 'tops up' the GIS for seniors by a maximum of $83. In 2000, approximately 8 percent of Ontario OAS receipients received GAINS.
[14] Gunderson and Pesando (1988, 1991) outline the incentives in some Canadian RPPs.

Pension Adjustment for individuals who participate in a RPP. The Pension Adjustment is equal to the actual contributions to a DC plan and deemed annual contribution for individuals participating in a DB plan. Assets in RRSP's accumulate tax free, but are fully taxable on withdrawal, which must commence by age 69. While RRSP's are primarily a vehicle for savings and tax deferral, for the retirement decision they can interact with income tested programs like the GIS. RRSP distributions are income for the purposes of the GIS/SPA income tests and OAS clawbacks, and so will face very high tax rates for some individuals.

III. The Data

Lack of adequate panel data has presented obstacles to retirement research in Canada. Proper modelling of retirement incentives requires a panel data set of older workers that contains sufficient information, in particular full earnings histories, to accurately calculate their entitlements to IS programs. In this study we make use of a unique administrative data set which possesses many of these characteristics.

The starting point is the Longitudinal Worker File (LWF) developed by the Business and Labour Market Analysis (BLMA) Division of Statistics Canada.[15] It is a 10 percent random sample of Canadian workers for the period 1978-1996. These data are the product of information from three administrative data files: the T-4 file of Revenue Canada, the Record of Employment (ROE) file of Human Resources Development Canada and the Longitudinal Employment Analysis Program (LEAP) file of BLMA. The LWF data also provide information on each

[15] The construction of the database is described in Picot and Lin, (1997) and Statistics Canada (1998). Our description draws heavily on these sources.

individual's age and sex. These were established from the T-1 tax returns which individuals file each year.[16]

The T-4 file supplies the earnings data. T-4 tax forms are issued annually by employers for any employment earnings that (1) exceed a certain annual threshold and/or (2) trigger income tax, contributions to Canada's public pension plans, or unemployment insurance premiums. These data therefore, capture any employment earnings of paid employees, as well as the incorporated unemployed. Omitted from these data will be earnings from unincorporated self employment. The consequences of this deficiency are discussed below. The data also establish a province of residency for the individual, through the location from where the T-4 was issued.[17]

Employers issue ROE forms to employees in insurable employment[18] whenever an earnings interruption occurs. Earnings interruptions result from events such as strikes, layoffs, quits, dismissals, retirement and maternity or parental leave. The reason for the interruption is recorded on the ROE form. These forms are the source of measures of job tenure (starting in 1978) at a given establishment.

Finally, the LEAP is a longitudinal data file on Canadian businesses at the company level. It is a source of information on the company (employee) size and 3 digit industry of the jobs in which employee work. These administrative data sources allow us to construct a comprehensive data set for the study of retirement in Canada.

[16] To obtain this information, therefore, it is necessary that he or she filed a tax return at least once in the sample period.

[17] T-4's for some individuals will be issued from offices that are not in their province of residence. It is not possible to assess the severity of this problem.

[18] Over the sample period, insurable employment covers most employer-employee relationships. Exclusion includes self-employed workers, full time students, employees who work less than 15 hours per week and earn less than 20 percent of maximum weekly insurable earnings (20 percent*$750=$150 in 1999). Individuals working in insurable employment pay Employment Insurance (EI) contributions on their earnings and are eligible for EI benefits subject to the other parameters of the EI program.

The LWF data span the period 1978 through 1996. Earnings histories of this length are not sufficient, however, to establish individuals' entitlements to CPP/QPP benefits. Recall that contributory periods can span back to as early as 1966. The years 1975 through 1977 are filled in by reference to the T-4 earnings records for these years. T-4 records for the years 1966 through 1974, however, are not available. To predict earnings in these years, cohort specific earnings growth rates calculated from the 1972, 1974 and 1976 census family files of the Survey of Consumer Finance[19] were applied to a three year average of an individual's last valid earnings observations in the LWF sample. This allows us to construct earnings histories back unto 1971. For the remaining five years, earnings growth rates implied by a cross section age profile estimated from the 1972 SCF are used, appropriately discounted for inflation and productivity gains using the Industrial Composite wage for the period 1966-1970.[20]

The marital status and any spouse/common-law partners of individuals are identified through reference to the T-1 family file maintained by Statistics Canada. T-4 earnings histories for the period 1966-1996 are then constructed for the spouse/common-law partners, following the procedures used for the sample individuals.

Finally, two additional pieces of information were added to these data. First, to determine entitlement for income tested benefits, we need information on non-labour income. To do this we construct age profiles of family level income by sex/region/industry and sex/region/marital status cells, for individuals in and out of the labour market respectively,[21] using data from the 1986 and 1991 census family files of the Canadian Census. The measure of

[19] We use samples of paid workers with positive earnings in the relevant birth cohorts.

[20] The data on the Industrial Composite wage are from Statistics Canada (1983). The obvious limitation of this backcasting approach is that we will not predict absences from the labour market, which may be important at younger ages. However, the youngest cohort in our analysis was 30 in 1966. This means that absences for child bearing, or due to the employment instability of youth, do not play a large role for most members of our data set.

non-labour income includes investment income and income from private pensions. We then impute non labour income to individuals using the profile appropriate to their current or (assumed) future labour market state. The sample and cell definitions that are employed are more fully described in the Appendix.

Second, information on the probability of RPP coverage, by 3-digit industry,[22] is computed using cross section samples of males or females from the 1986-1990 Labour Market Activity Survey (LMAS) and the 1993-1996 Survey of Labour and Income Dynamics (SLID). In these surveys individuals are asked if they participate in any RPP. These probabilities are then imputed to individuals in the LWF, matching on the industry codes. Probabilities for the years 1991 and 1992 are simple linear interpolations. Again the sample definitions for these data sources are described in the Appendix.

Our definitions of work and retirement follow from fact that we observe the earnings of individuals as captured on the T-4 forms, but have no direct information on their labour market activity. We define work as positive T-4 earnings in two consecutive years. If we observe positive earnings in one year and zero earnings in the next, the year of positive earnings is denoted the retirement year. As noted above, T-4's are not issued to the unincorporated self-employed so movements from paid employment into this sector will also be labelled as retirement.[23] These mislabeled transitions induce measurement error in our 0/1 indicator of

[21] The age profiles are appropriately inflated by the CPI for use in future years.

[22] Some industries are aggregated to obtain sufficient sample sizes. Unfortunately, the sample sizes of these data sets would not permit us to calculate these probabilities exclusively for older individuals.

[23] In 1991, a year in the middle of our sample period, 13.2 percent of working males and 6.8 percent of working females aged 55 to 64 reported themselves as unincorporated self-employed (1991 Public Use Micordata Files of the Canadian census). Note that some of these individuals will have worked in this sector from before they turned 55, and so will never appear in our sample. It is not obvious how the exclusion of this group might affect our conclusions.

retirement. The result is that we will underestimate the marginal effects of the characteristics of individuals and their jobs, as well as the IS incentives, on the probability of retirement.[24]

Only the first observed "retirement" for each individual is considered. If a person re-enters the labour market after a year of zero earnings, the later observations are not used. Labour market return is potentially an important topic, but outside the scope of the current analysis. Furthermore, first retirements may be more important from the perspective of the fiscal health of various IS programs. Finally, individuals are only followed until age 64. Therefore, an individual who has positive earnings in every year up to age 64 will pass out of our sample before we observe their retirement, and contribute a censored observation. The age 64 cutoff makes sense given that there is mandatory retirement at this age in most jurisdictions in Canada over the period we examine.

Given we identify the year proceeding a year of zero earnings as the retirement year, the focus of our analysis is the period 1985-1995. We draw separate samples of males and females aged 55 through 65 who worked in 1985. Each individual contributes observations from this year to the year of retirement or age 64, whichever comes first. Younger cohorts of individuals are added as they turn 55 in the years 1986-1991 again conditional on working in that year.[25] [26] The sample is selected conditional on working so that the incentives for retirement conditional on being in the labour force are examined. While it makes sense to insist on some initial labour market activity in an analysis of retirement, our requirement of earnings in a given one-year

[24] This conclusion follows from the observations that our retirement indicator is dichotomous (i.e., 0/1) and the measurement error is not "classical". Furthermore, the error is "one-sided" in that we may mistakenly code a "0" as a "1" when someone enters unincorporated self-employment, but we will not miscode "1's" as "0's", since we define working as receiving a T-4 form. In this case, there is attenuation bias in the estimated marginal effects. See Hausman, Abrevaya, and Scott-Morton (1998).

[25] Individuals with missing age, sex or province variables are excluded.

[26] Agricultural workers and individuals in other primary industries are excluded. We make this exclusion because our definitions of retirement are based on earnings, and the earnings streams for these workers, given high rates of

interval will exclude individuals who retain some attachment to the labour market but who experience an extended period of joblessness.[27]

IS Incentive Variables

Our analysis requires careful construction of each individual's IS incentives. The starting point is an individual's IS entitlement. We calculate entitlement on a family rather than an individual basis, so we also must calculate the IS entitlement of any spouse and common law partner, in a given year. The calculations incorporate all components of the federal IS system.

OAS eligibility is primarily determined by age, which we observe directly in the data. Two complications are the residency requirement and the benefit clawback. The residency requirement is not implemented because we lack information on place of birth and year of arrival in Canada. The clawback provisions (starting in 1989) are fully implemented, however, based on projections of labour and non-labour income.

Eligibility for the GIS/SPA is determined by age and family income. Age is observed in our data. We also implement the income test based on projections of labour and non-labour income.

We determine CPP/QPP entitlement using individuals T-4 and projected earnings histories as described above. The drop out provisions for low earnings months up to 15 percent of the contributory period are fully implemented. Disabilities or time spent in childcare are not observed, however, and therefore deletions for these reasons are not captured.[28] The reforms of

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self-employment and special provisions in the Employment Insurance system for fishers and other seasonal workers, are difficult to interpret.

[27] Depending on when the period of joblessness falls in the calendar year, our sample captures all individuals whose period lasts 11 months or less, and some individuals whose period is as long as 22 months.

[28] Note that the dropout provisions for childcare came in to effect in 1977 under the QPP and 1978 under the CPP. The childbearing years of many females in our sample will have been prior to these dates.

the CPP/QPP system over the period are also accounted for, including the introduction of early retirement, the retirement test on benefit receipt at ages 60-64 and the actuarial adjustment to benefits for initiating benefit receipt at ages other than 65, in 1984 and 1987 respectively. Note, however, that the disability benefit is not included in this calculation, nor is any child benefit (either disability related or survivor) as there is no information on children in the data set.

IS entitlement is calculated for both current and future years. To do this we require a projection of individuals' (and their spouse/common-law partners') potential labour and non-labour income in future years. After experimenting with a number of projection methods, earnings are projected by applying a real growth rate of zero percent per year to the average of an individual's observed earnings in the three years preceding the retirement year.[29] Non labour income is projected following the method outlined above. For each individual, entitlement with and without the imputed level of non-labour income is calculated and then averaged using as weights the cell specific probability that non-labour income is positive. Both projected earnings and non-labour income are net of federal and provincial income taxes. Also deducted are the employee's portion of the CPP/QPP payroll tax that they would pay if they worked. In either case the tax provisions of the year in which the calculation is made are assumed to be in effect in all future years.

Since IS entitlement is calculated at the family level we require some assumption about any spouse/common law partner's retirement decision. A complete model of family labour supply is beyond the scope of this paper. The simplifying assumption made here is that any

[29] Within sample evaluation revealed this method a better predictor (in a mean-squared error sense) of future earnings than methods involving a projection equation that included demographic variables, lagged earnings and individual fixed effects.

partner starts collecting entitlements at the earliest age possible under the current rules of IS programs.[30]

Once these calculations are completed we construct the expected net present value of the family's Income Security Wealth (ISW) associated with each retirement date. For single workers this is the sum of future benefits discounted backwards by time preference and survival probabilities for each possible year of retirement. For married workers we account for the likelihood of the joint survival of worker and the spouse/common-law partner, and the survivor provisions of the CPP/QPP and the SPA, as described in more detail in Gruber (1999). We use a real discount rate of 3 percent and survival probabilities from the age/sex specific Canadian life tables from Statistics Canada (Statistics Canada 1984).

The result is a profile of the present discounted value (PDV) of ISW at all possible retirement dates. This allows us to construct three different incentive variables that are current in the literature.

The first, and most commonly used, is the one year accrual which is simply the difference of ISW between adjacent retirement ages. It reveals the effect of choosing to work an additional year.

The second is the peak value accrual introduced by Coile and Gruber (2000). This is the difference between ISW at the current age and ISW at the financially optimal retirement age, the age at which ISW is maximized. Relative to the one year accrual the peak value calculation

[30] For most of the sample period this is age 65 for OAS and GIS, age 60 for the Allowance and age 60 for the CPP/QPP. For CPP/QPP benefits prior to age 65 and any income-tested benefit, the assumption implies a cessation of the spouse/common-law partner's employment (i.e., retirement). Gruber (1999) and Baker and Benjamin (2000) provide estimates of age/employment profiles and employment hazards (the conditional probability of labour market exit) for older men and women over the sample period. This evidence provides some justification for this assumption about labour market exit rates in our analysis of the male sample, in which the spouse/common-law partners are females. On the other hand, this assumption may prematurely remove the male spouse/common-law partners of individuals in our sample of females from the labour market. This is unlikely to have a large effect on

accommodates non-linearities in the PDV of ISW profile. This captures the idea that continued work preserves an option to retire in the future, which is valuable if there are significant increases in ISW at later ages. After the optimal retirement age the peak value calculation collapses to the one year accrual.

The final measure is the option value accrual of Stock and Wise (1990). Similar to the peak value calculation, the comparison is of the current age to an optimal retirement age in the future, which is defined in terms of utility rather than in terms of dollars of ISW. To implement this calculation we adopt the indirect utility function used by Stock and Wise, but directly parameterize it rather than estimating its parameters. The individual's indirect utility function is assumed to be

$$(1) \qquad V_t(R) = \sum_{s=t}^{R-1} p_{s|t} d^{s-t} (y_s)^g + \sum_{s=R}^{T} p_{s|t} d^{s-t} [k \cdot B_s(R)]^g$$

where R is the retirement date, d is the discount rate, p is the probability of being alive at some future date conditional on being alive today, y is income while working, B is retirement benefits, g is the parameter of risk aversion, k is a parameter to account for disutility of labour ($k \geq 1$) and T is maximum life length. Following Stock and Wise (1990), we set k=1.5 and g=0.75, and set d=0.03 following Coile and Gruber (2000). Sensitivity analysis suggests that the results are not dramatically different for sensible variations in these parameter values. Relative to the peak value measure, the option value accrual provides a specific economic rational for the optimal retirement date accounting for the disutility of work and value of leisure. Its primary disadvantages are its (possibly incorrect) assumed specification of the indirect utility function, and that earnings enter directly into the utility calculation and thus will drive some part of the

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our estimates, as the independence across spouse/common-law partners in determination of most of the benefits means that spousal retirement is only a minor contributor to IS incentive calculations.

variation of the option value across individuals. If earnings are in turn correlated with some unobserved component of tastes for retirement, the identification of the option value effects can be problematic.

IV. Empirical Framework

Our estimating equation relates the retirement decisions of individuals to their demographic and economic characteristics as well as their ISW. Both the level of ISW and the different incentive variables enter the equation. The level captures wealth effects: more wealth through IS programs will lead to increased consumption of all goods, including leisure, if leisure is a normal good. The incentive variables capture a substitution effect: if there is a large financial incentive to additional years of work, then individuals will retire later. The equation estimated is:

$$R_{it} = \delta_0 + \delta_1 ISW_{it} + \delta_2 ACC_{it} + \delta_3 AGE_{it} + \delta_4 EARN_{it} + \delta_5 APE_{it} + \delta_6 SPEARN_{it} + \delta_7 SPAPE + \delta_8 RPP_{it} + \delta_9 X_{it} + \upsilon_{it}. \quad (2)$$

where R_{it} is a variable which equals one in the year of retirement and 0 otherwise, ISW_{it}, is the expected PDV of ISW in year t, ACC_{it} is one of the incentive variables outlined above, AGE_{it} represents a set of dummy variables for each age in our sample, and a measure of the difference in ages across spouse/common-law partners, $EARN_{it}$ and APE_{it} represent cubics in measures of the individual's projected earnings in year t and his/her Average Pensionable Earnings (for CPP/QPP calculations), $SPEARN_{it}$ and $SPAPE_{it}$ are the corresponding variables of any spouse/common-law partner, RPP_{it} is the measure of the probability of RPP coverage at the 3-

digit industry level,[31] and X_{it} are a set of additional control variables, including a dummy variable for marital status, a quadratic in tenure on the job and a dummy variable which equals one if tenure is censored at 1978,[32] a quadratic in the individual's and his/her spouse/common-law partner's labour market experience measured as the number of years of positive T-4 earnings between 1975 and year t, 11 industry dummies, dummies for 6 categories of establishment size and province and year effects. To capture potential non-linear relationships between earnings and retirement decisions, a full set of interactions between the cubics in $EARN_{it}$ and APE_{it}, and $SPEARN_{it}$ and $SPAPE_{it}$ are included. The equations are estimated separately for males and females as a probit.

V. Results

Descriptive Statistics

Descriptive statistics for the male and female samples are presented in table 1 (a full set of variable definitions is provided in the Appendix). We have 550,839 observations on 110,972 males, and 347,775 observations on 71,066 females. On average, therefore, we observe about five observations for each individual. The means are calculated over observations in the sample, rather than individuals. This has implications for the interpretation of some of the statistics. For example, the probability of RPP coverage is higher than estimates of RPP participation in the population (see above), but make sense if individuals with high probabilities of RPP coverage have more stable employment careers and therefore add more observations to the sample.

[31] The standard errors here are potentially biased due to a correlation of the error term across individuals within 3-digit industry (the "grouped data problem"). Correcting for this bias would lead to larger estimated standard errors on the parameter on RPP.

[32] Again, the quadratic specification allows a more flexible affect of tenure on the retirement decision than a linear specification. In the LWF, the tenure variable begins counting in 1978. Therefore, an individual observed in the

Perhaps the most interesting observations come from comparisons of the male and female results. The females have lower projected earnings and estimated APE as might be expected, but tenure and experience are quite similar for the two sexes. This is likely because our tenure and experience measures are censored in year 1978 and 1975 respectively. Presumably if we could observe tenure and experience over the full working life the results would be lower for females. Also, the baseline retirement rates are quite similar for males and females. Females are less likely to work at the sample ages, but conditional on working at age 55 display similar retirement patterns.[33]

The hazard rates to retirement in our sample are presented in Figures 2 and 3 for males and females respectively. For both sexes the hazards are relatively flat through the 50's leading to a jump at age 60. This is the first age that individuals can claim CPP/QPP benefits. For males the hazard continues to rise through the 60s, with another pronounced jump at age 64, the age before mandatory retirement in many jurisdictions. For females the hazard levels off at ages 61 through 63, and then jumps up at age 64, as in the male sample.

In table 2 we present summaries of our incentive measures by age. We report the median value, as well as the 10^{th} and 90^{th} percentiles and standard deviation to give some indication of their variation. For both males and females the one year accrual is positive at the median until age 60, but then turns sharply negative. This implies that there is an incentive to retire and start drawing IS benefits at age 61. Given that the main IS program available at this age, the

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same job between, for example, 1978 and 1985, has tenure of *at least* 7 years. The dummy variable for this censoring helps account for the uncertainty about the *exact* tenure.

[33] For example, in the 1998 Survey of Consumer Finance data 65 percent of males aged 55-59 were working in the survey week compared to 46 percent of females. For ages 60 to 64 the rates are 39 percent and 23 percent respectively.

CPP/QPP, has a retirement test, responding to this incentive would entail some sort of separation from the current job.[34]

The one year accrual represents the change in ISW for an additional year of work. There are a number of features of the IS system that determine whether it is positive or negative. For example, ISW could increase through the dropout provisions of the CPP/QPP: an additional year of work may replace a poor earnings year, or 15 percent of poor years between ages 60 and 64, in the benefit entitlement calculation.[35] This effect is attenuated in the years we examine, however, due to the low real value of the YMPE in the 1970's. Set in 1966 to equal average earnings, the YMPE fell to as low as 67 percent of the Industrial Composite wage by 1973. In 1975 the YMPE was set on course to equal the Industrial Composite again, but this did not happen until 1987. The result is that poor earnings years during this period may still have been good years relative to the YMPE, which is what matters for benefits calculation. Therefore, it is less likely they would be dominated by earnings in years after the YMPE had regained its value.

Another factor is the actuarial adjustment to benefits starting at age 60. While the adjustment is intended, on average, to keep the PDV of benefits constant across retirement ages, it is unlikely that the linear structure of the adjustment in the CPP/QPP achieves this purpose. Furthermore, the actuarial adjustment interacts with the income testing of GIS and SPA benefits for some individuals. Higher CPP/QPP benefits available by delaying retirement are partially offset by lower GIS entitlement (at age 65) through the income test. Therefore, the income test acts like a tax on those features of the CPP/QPP that adjust the pension entitlement with continued work. In August 2001, 34.6 percent of OAS pensioners received some GIS benefits.

[34] The SPA would also be available to those eligible.
[35] If the earnings in the extra year of work are higher than the lowest earnings currently included in the CPP entitlement calculation, then the extra year of work will replace the low earnings year. Between the ages of 60 and

The initial positive values at the median (ages 55 through 60) show how the drop out provisions can increase the PDV of ISW. Starting at age 60 however, the lower value of the drop out's and the interaction of the actuarial adjustment with the means testing of the OAS/GIS/SPA turns the median negative. Median accrual falls to -$4440 for males and -$3404 for females by age 64. Note also that the percentiles and variance reveal considerable variation in the one-year accrual across individuals. It is effectively zero by age 56 at the 10th percentile, but remains positive through age 65 at the 90th.

The peak value accrual displays a similar patter to the one year accrual, turning from positive to negative at age 61. As seen in the one-year accrual results there are no strong non-linearities at the median, so the peak value calculation does not convey much additional information. Also, note that the peak value and one year statistics are identical once the one-year accrual turns negative.

Finally in the last columns are the statistics for the option value accrual. They are in units of utility and so are hard to interpret. Their most important characteristic is that in contrast to the two other measures, the option value accrual remains positive, at the median and 1st and 9th deciles, throughout the age range. This reflects the fact that the optimal retirement age at the median is about age 71.

Results

In table 3 we report estimates of equation (1) for males. Moving across blocks we vary the incentive measures, while moving across columns within blocks we sequentially add control variables to the estimating equation. The results in the first block are for the one-year accrual.

64, an extra year of work also extends the contributory period, which entitles the worker to drop out more low earning periods. Fifteen percent of the earning periods in the contributory period may be dropped out.

In the first column (specification 1) there are no other control variables so the IS variables can have their maximum impact. The estimate for the level of ISW is, surprisingly, negative, suggesting that leisure is an inferior good. One explanation of this result is an omitted variable. For example, higher lifetime earners will have higher levels of ISW, but also may have greater preferences for work. The accrual variable has the expected negative sign and is quite large. A $1000 increase in accrual lowers the retirement rate by 2.4 percentage points, which can be compared to a baseline retirement rate in the male sample of 12.2 precent (table 1).

In the next column we add the demographic controls, industry, province and year effects, the firm size dummies and simple (linear) controls for age. The result is a marginal reduction in the effect of the incentive variable. Note also that the estimated effect of the level of ISW continues to be negative but is just over half its previous value.

In the third column we replace the linear age controls with a full set of age dummies. These will potentially soak up omitted institutional features of the environment as well as any age specific preferences in a more flexible way. The result is again marginal changes in the inference (relative to the first column).

In the fourth column we add the cubics in own and spouse's projected earnings and APE, as well as the interactions between the two. This is potentially an important innovation because ISW is mechanically a function of past earnings, and accrual depends on projected earnings, but both of these measures of earnings may have independent effects on retirement. In our results, we do observe quite substantial changes in inference. First, the estimated parameter on the level of ISW is now positive as expected. This suggests that in previous specifications, ISW was picking up some independent effect of earnings on retirement. An additional $10,000 in ISW is estimated to increase the retirement rate by 0.15 percentage points; the expected wealth effect.

Second, the estimate on the one year accrual variable is now dramatically smaller. An additional $1000 of accrual decreases the retirement rate by only 0.89 percentage points compared to 2.4 percentage points in specification 1. This change in inference is consistent then with the evidence of Coile and Gruber (2000) who use a similar specification, and Chan and Stevens (2001) who compare simple estimates and fixed effects estimates.[36] The incentive effects of the IS system would appear to be considerably over estimated in specifications which do not attempt some control for omitted factors which are correlated with lifetime earnings and individuals' propensities for work.

A corresponding set of results for the peak value accrual is presented in the succeeding columns of the next block. There are some strong similarities to the one year accrual results. First, the estimate on the level of ISW turns from negative to positive as more controls are added, although it ends up statistically insignificant in the richest specification (specification 4). Second, the estimated effect of the incentive variable falls dramatically as the earnings controls are added. That said, the estimated effects of the IS system are smaller here. For example, in specification 4 a $1000 increase in peak accrual would decrease the retirement rate by 0.38 percentage points. Reference to table 2 reveals that the main difference between the one year and peak value accruals is between ages 55 and 59, the peak value predicting a greater slope in the run up in retirement rates leading to age 60. Reference to the retirement hazard (figure 2) provides little support for this prediction, however, at least at the mean.

Finally in the last block are the results for the option value accrual. Note that because the accrual is measured in units of utility, calibrating the marginal effects in dollar values no longer makes any sense. The results for this measure stand in some contrast to the previous results.

[36] Chan and Stevens (2001) find a substantial drop in the magnitude of their incentive coefficients when they include individual fixed effects. If the variation picked up by their fixed effects is driven by differences in earnings histories

First, the estimated parameter on ISW bounces between negative and positive across specifications in no systematic pattern. Second, the estimated effect of the incentive variable is fairly insensitive to specification.

Results for the female sample are reported in table 4. The pattern of the results for the one year accrual is very similar to that in the male sample. The estimated effects of the IS system in specification 4 are also very similar to the male results, although note that the parameter on ISW is not statistically significant. For example a $1000 increase in one year accrual lowers the retirement rate by 0.7 percentage points in comparison to 0.89 percentage points in the male sample.

The peak value results are also similar to the male counterparts, except that here both the level of ISW and the incentive variable are statistically insignificant in specification 4. We observe the same large reduction in the magnitude of the effect of the incentive variable, however, once the controls for APE and projected earnings are added. Finally, in contrast to the results for males, the option value results also display this pattern and the IS variables are both statistically insignificant in specification 4.

In sum, for males both the one year and peak value accrual estimates vary with changes in specification in expected ways, and indicate that the IS system has important impacts on retirement behaviour. The option value estimates are harder to interpret, and change in unexpected ways with specification. For females, it is only the one year accrual results that indicate an important role for the IS system. The estimates for peak value and option value accrual are both statistically insignificant in specification 4. In the subsequent analysis we focus on the one year and peak value results for males and the one year results for females, although results for the full set of measures are reported.

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across individuals, then our results are consistent with theirs.

Sensitivity Analysis

Given our argument that identification in retirement models can be problematic, it is important to provide some additional checks on the inference in tables 3 and 4. In tables 5 and 6 we assess the sensitivity of our inference on a number of margins. One important issue is the definition of retirement. Our working definition clearly misses some of the various paths individuals take to this state. For example, individuals may effectively retire but still generate some earnings through occasional employment. These earnings would lead us to label the individual as still working.

To explore the consequences of our choice we adopt two alternatives definitions or retirement, which capture dimensions of this heterogeneity. In the first we allow for the possibility that individuals may proceed to retirement through a period of unemployment, funded by Employment Insurance benefits. This is possible because Employment Insurance benefits generate a T4U form that is recorded in our data. We model this possibility by pooling unemployment benefits with earnings for the determination of the retirement year. Retirement under this definition is the year preceding the first year of zero combined unemployment benefits and earnings. This definition is more flexible than our standard retirement definition as it allows for retirement through other programs.

In the second alternative definition, we designate large reductions of earnings as retirement, without demanding that the reduction be to zero. To make this operational, we use the retirement test that applies to all individuals claiming CPP or QPP benefits at ages 60 through 64. The test requires that in the year benefits are claimed, earnings be no more than the maximum retirement pension: roughly 25 percent of a three year moving average of the YMPE (roughly average labour market earnings). We define retirement as the year preceding the first

year that earnings falls below the threshold. Note that by this definition a transition from full time employment to part time work may now be labelled a retirement.

The results are presented in the second and third rows of the panels of table 5 for males and table 6 for females. As a point of comparison, in the first row of each table we simply replicate the estimates from specification 4 in tables 3 and 4. For males, the UI definition leads to similar or larger estimates of the accrual effects, but now the ISW estimates are negative, although insignificant for one year and peak value accrual. More importantly the marginal effects for a $1000 increase in accrual are very similar to the base results for both the one-year and peak value measures. The estimates for the earnings definition tell a very similar story. Here the marginal effects for both the accrual and ISW estimates are virtually identical to the base results. The strong conclusion here is that changing the definition of retirement has very little effect on the one-year and peak value results for males.

Greater variation in inference is observed in the results for females. The marginal effect of one-year accrual is just over half its value in the base results when we use either the UI or earnings definition of retirement. The estimated effect of the level of ISW also varies across these definitions. The results for peak value are more robust in the sense that the accrual effects are small and statistically insignificant regardless of the definition of retirement that we use. The estimates for the level of ISW vary across definitions as they did in the one-year results. Therefore, for females we do observe some sensitivity of the inference to the definition of retirement. This may be due to the fact that there are histories of movements in and out of part time work for some females in these cohorts, or that due to the lower earnings of females, dips below the earnings threshold do not represent such significant falls in earnings.

In the next rows of each table we determine whether the inference varies in sensible ways as we attempt to isolate those individuals who should be relatively more responsive to IS program parameters. The IS system will be only one element of retirement income for some individuals. For example, RPP income and/or RRSP income may also play an important role. In these cases we might expect that the parameters of the relevant RPP and/or RRSP rules would also affect retirement behaviour, and so IS program parameters would be less important. To make this idea operational we split the sample by the imputed probability of RPP coverage. Those with a probability of less than 0.5 are denoted as "RPP low", while the remainder of the sample is denoted "RPP high". Note we are implicitly assuming that the assignment of individuals to these two groups is exogenous to any preferences for retirement that also affect any behavioural response to the IS system.

The results are reported in rows 4 and 5 of tables 5 and 6. As expected we observe larger behavioural effects for both males and females in the RPP low group. These are the individuals who are predicted to be more dependent on IS income and so their labour supply decisions are more sensitive to program rules. The proportionate differences in the accrual effects are largest for the one-year measure, while the proportionate changes in the effect of ISW tend to be very similar for the one-year and peak value accrual specifications.

In the next rows we take a different approach. Here we divide the sample into quartiles based on average earnings at ages 50 through 54 (that is, prior to the sample observations). For both males (one year and peak value) and females (one year), we see larger behavioural effects among low income individuals, although the relationship is not monotonic. Again the assumption is that these individuals will be more dependent on IS income in their retirement years and consequently their retirement decisions are more dependent on IS program parameters.

This systematic variation in the estimates across individuals by their predicted dependency on the IS system provides us greater confidence that we are capturing the behavioural effects of IS program parameters.

VI. Conclusions

This paper provides estimates of the retirement incentives of the Canadian IS system using a unique data source. Our results suggest that this system has substantive effects on the retirement decisions of males and females in Canada. The estimated effects are larger and more robust for males. Also, we obtain the largest effects when we use relatively myopic measures of the incentives.

We also contribute more generally to the retirement literature by evaluating the identification of the incentive effects we estimate. Controlling for lifetime earnings in a flexible way leads to substantially smaller estimates of these behavioural effects. These results add to the evidence in Coile and Gruber (2000) and Chan and Stevens (2001) that identification in retirement models can be problematic.

Finally, we examine the sensitivity of our inference to differences in sample and the definition of retirement. This exercise provides additional confirmatory evidence of the effects of pensions on retirement, and show that our results are not sensitive to our chosen definition of retirement.

These results potentially have important implications for IS policy. Evaluation of proposed pension reforms must account for the dynamic effect of the reformed system on retirement decisions. Reforms may change not only the distribution of retirement income and fiscal balances, but also the timing of retirement decisions.

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Appendix

Census Data

The data are from the 1986 and 1991 public use microdata files. In each year, males or females who are 54 and older are selected. Non-labour income is defined as the sum of "Investment Income of census family or non-family person" plus "Retirement pensions and other money income of census family or non-family person" (recorded separately as "Retirement Pensions, Superannuations and Annuities of census family or non-family person" and "Other Money Income of census family or non-family person" in the 1991 sample). Separating individuals who work (weeks and earnings greater than 0) and don't work (weeks and hours equal to 0), the probability non-labour income is positive and its conditional mean are calculated for the following cells:

Males who are Employed: region (East; Ontario; West) by industry (Manufacturing; Construction; Transportation and Communications; Wholesale and Retail Trade; FIRE and Business Services; Government, Health and Education Services; Accommodation, Food, Beverage and Other Services) by age(54-55, 56-57, …,60-61, 62-64 65+),

Males Who are Not Employed: region (East; Ontario; West) by marital status (married, spouse/common-law partner's age < age-1; married, spouse/common-law partners age = age1+/-1; married, spouse/common-law partner's age > age+1; not married) by age (54-60, 61-63, 64-66,...73-75, 76+),

Females who are Employed: region (East; Ontario; West) by industry (Manufacturing, Construction, Transportation and Communications; Wholesale and Retail Trade; Finance Insurance and Real Estate (FIRE) and Business Services; Government, Health and Education

Services; Accommodation, Food, Beverage and Other Services) by age (54-55, 56-57, …, 60-61, 62-64 65+),

Females Who are Not Employed: region (East; Ontario; West) by marital status (married, spouse/common-law partner's age < age-1; married, spouse/common-law partners age = age1+/-1; married, spouse/common-law partner's age > age+1; not married) by age (54-60, 61-63, 64-66, …, 73-75, 76-80, 81+).

LMAS and SLID Data

These data are cross section samples from the 1986-1990 LMAS and the 1993-1996 SLID. In each year, samples of males or females, aged 23-69, who are paid workers in jobs in the month of September of the indicated year are constructed. The RPP coverage probabilities are then calculated by 3-digit industry. Probabilities for 1991-1992, the two years not covered by the LMAS or SLID, are simple linear interpolations of the 1990 and 1993 data.

List of Variables from LWF data

Agediff: A variable recording the difference in age between an individual and his/her spouse/common-law partner (in years).

AGE55-AGE64: A dummy variable that equals 1 if an individual is the indicated age and 0 otherwise. *Age55* is the excluded variable.

APE: a variable recording an in estimate of an individual's current Average Pensionable Earnings.

Experience: A variable recording the number years since 1975 that an individual has had positive T-4 earnings.

Married: A dummy variable that equals 1 if the individual is married and 0 otherwise.

RPP: A variable that ranges between 0 and 1 recording the proportion of workers in an individual's 3-digit industry that is a member of an RPP.

Tenure: A variable recording the number of years since 1978 that an individual has been with the current firm.

Tenure Censored: A dummy variable that equals 1 if an individual has been with his/her current firm continuously since 1978.

Y85-Y95: a dummy variable that equals 1 in the indicated year and 0 otherwise. *Y90* is the excluded variable.

S04-S500p: a dummy variable that equals 1 for the indicated size of the workforce at the place of work and 0 otherwise. Categories are 0-4,5-19,20-49,50-99,100-199,200-499,500+. *S5099* is the excluded variable.

IND1-IND10: A dummy variable that equals 1 for the indicated industry of employment and 0 otherwise. *IND1* is the excluded variable. The ten are:

IND1 – manufacturing (SIC 100 to 399)
IND2 – construction (SIC 400 to 449)
IND3 – storage and transportation (SIC 450 to 499)
IND4 – wholesale trade (SIC 500 to 599)
IND5 – retail trade (SIC 600 to 699)
IND6 – finance, insurance, real estate (SIC 700 to 769)
IND7 – business services (SIC 770 to 809)
IND8 – government services (SIC 810 to 849)
IND9 – education, health and social services (SIC 850 to 909)
IND10 – accommodation, food, and other services (SIC 910 to 999)

NF: A dummy variable that equals 1 if resident of Newfoundland and 0 otherwise.

PEI: A dummy variable that equals 1 if resident of PEI and 0 otherwise.

NS: A dummy variable that equals 1 if resident of Nova Scotia and 0 otherwise.

NB: A dummy variable that equals 1 if resident of New Brunswick and 0 otherwise.

QU: A dummy variable that equals 1 if resident of Quebec and 0 otherwise.

ON: A dummy variable that equals 1 if resident of Ontario and 0 otherwise (excluded variable).

MB: A dummy variable that equals 1 if resident of Manitoba and 0 otherwise.

SA: A dummy variable that equals 1 if resident of Saskatchewan and 0 otherwise.

AB: A dummy variable that equals 1 if resident of Alberta and 0 otherwise.

BC: A dummy variable that equals 1 if resident of British Columbia and 0 otherwise.

TERR: A dummy variable that equals 1 if resident of Yukon or Northwest Territories and 0 otherwise.

Table 1: Summary Statistics

	Males		Females	
	Mean	Standard Deviation	Mean	Standard Deviation
Retired	0.122	0.328	0.130	0.336
Probability of RPP	0.585	0.256	0.433	0.263
Married	0.564	0.466	0.422	0.494
Tenure	8.683	4.521	8.607	4.430
Tenure Censored	0.438	0.496	0.374	0.484
Experience	13.865	3.371	13.109	3.737
Spouse/common-law partner's Experience	5.295	6.875	5.561	7.273
Age	58.968	2.676	58.732	2.640
Age Difference	1.958	3.709	-0.738	2.735
Projected Earnings	28634	38007	17068	12172
Projected Spousal Earnings	4935	1151	6433	19389
APE	29767	7585	20616	10656
Spouse/common-law partner's APE	8298	12092	12110	15824
Observations	550,839		347,775	
Individuals	110,977		71,066	

Notes: The reported statistics are means (averages) calculated over all observations in the male and female data sets, respectively (rather than over all individuals). All dollar values are in 1998 Canadian dollars. APE is Average Pensionable earnings. Definitions of all variables are provided in Appendix.

Table 2: The Distribution of Different Measures of Income Security Wealth Accrual

			One-Year Accrual				Peak Value Accrual				Option Value Accrual			
Age	N	Median ISW	Median	1st Decile	9th Decile	Std. Dev.	Median	1st Decile	9th Decile	Std. Dev.	Median	1st Decile	9th Decile	Std. Dev.
Male Sample														
55	60286	157853	1636	586	2504	707	4824	1608	13433	4807	22972	9203	36292	15214
56	63460	165216	1418	6	2622	954	3720	255	11940	4787	21426	9714	33320	14399
57	65700	171713	971	0	2685	1066	2190	0	10133	4391	18998	8645	29810	13679
58	66687	177573	632	0	2745	1128	1354	0	8087	3797	16512	6954	26440	12733
59	66761	182815	420	0	2826	1179	925	0	6087	3119	14063	5390	23148	11750
60	60578	188676	49	-1929	2443	1622	77	-1929	4212	2985	12216	4203	20365	10169
61	52427	193976	-388	-2237	1840	1571	-386	-2237	2456	2525	10449	3223	17573	9890
62	44954	195554	-1024	-3041	1110	1598	-1024	-3041	1484	2229	8757	2197	14907	9350
63	38168	197002	-1651	-3792	580	1754	-1651	-3792	756	2095	7144	1256	12412	8789
64	31818	188842	-2196	-4440	149	1931	-2196	-4440	205	1975	5589	564	10077	7871
Female Sample														
55	43104	155089	915	152	2050	699	3905	1055	10341	3758	14659	4095	27767	9819
56	43870	147083	865	141	2079	734	3451	672	9466	3598	13850	4662	24947	8777
57	44122	145894	825	63	2124	783	2699	327	8148	3281	12261	4309	22115	7748
58	43482	148384	757	0	2145	831	1935	81	6642	2857	10719	3632	19456	6810
59	42452	152285	701	0	2197	877	1170	0	5127	2488	9175	2852	16967	6094
60	36937	156092	164	-1487	2099	1390	293	-1484	4016	2568	7936	2196	14936	5556
61	30662	160337	-63	-1722	1651	1335	-41	-1722	2824	2214	6848	1776	13016	5253
62	25357	165506	-518	-2248	1029	1340	-515	-2246	1769	1908	5730	1274	11070	4822
63	20839	169825	-1040	-2846	669	1441	-1038	-2846	1070	1768	4661	779	9211	4149
64	16950	173793	-1406	-3404	399	1580	-1405	-3404	538	1666	3585	363	7665	3878

Notes: N=number of observations, ISW=Income Security Wealth, Std. Dev.=standard deviation. All dollar values in 1998 Canadian dollars. Definitions of the different measures of Income Security Wealth accrual are provided in the text.

Table 3: Estimates of the Retirement Probits with Various Measures of Income Security Wealth Accrual Male Sample

	One-Year Accrual				Peak Value Accrual				Option Value Accrual			
	1	2	3	4	1	2	3	4	1	2	3	4
ISW	-0.010 (0.0004)	-0.006 (0.002)	-0.006 (0.002)	0.009 (0.003)	-0.012 (0.0004)	-0.016 (0.002)	-0.017 (0.002)	0.004 (0.003)	-0.005 (0.0004)	0.021 (0.002)	0.021 (0.002)	-0.010 (0.003)
$10,000 Increase	-0.20%	-0.11%	-0.11%	0.15%	-0.23%	-0.30%	-0.31%	0.07%				
Accrual	-1.335 (0.012)	-1.178 (0.022)	-1.231 (0.023)	-0.524 (0.025)	-0.645 (0.006)	-0.599 (0.010)	-0.601 (0.010)	-0.218 (0.014)	-0.344 (0.003)	-0.308 (0.003)	-0.308 (0.003)	-0.286 (0.011)
$1,000 Increase	-2.40%	-2.08%	-2.16%	-0.89%	-1.20%	-1.08%	-1.09%	-0.38%				
Demographic Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Linear Age	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO
Age Dummies	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Industry Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Firm Size Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Province Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Year Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Earnings Controls	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES

Notes: Standard errors in parentheses. All dollar values in 1998 Canadian dollars. Definitions of the different measures of Income Security Wealth accrual are provided in the text. The different control variables are described in the appendix.

Table 4: Estimates of the Retirement Probits with Various Measures of Income Security Wealth Accrual Female Sample

	One-Year Accrual				Peak Value Accrual				Option Value Accrual			
	1	2	3	4	1	2	3	4	1	2	3	4
ISW	-0.003 (0.001)	0.001 (0.002)	0.000 (0.002)	0.004 (0.004)	-0.003 (0.001)	-0.006 (0.002)	-0.006 (0.002)	0.004 (0.004)	0.006 (0.001)	0.041 (0.002)	0.042 (0.002)	0.002 (0.004)
$10,000 Increase	-0.06%	0.01%	0.01%	0.12%	-0.05%	-0.12%	-0.11%	0.13%				
Accrual	-1.739 (0.020)	-1.814 (0.030)	-1.899 (0.031)	-0.206 (0.036)	-0.783 (0.009)	-0.838 (0.014)	-0.828 (0.014)	-0.009 (0.016)	-0.532 (0.005)	-0.592 (0.006)	-0.592 (0.006)	-0.021 (0.014)
$1,000 Increase	-3.20%	-3.26%	-3.39%	-0.70%	-1.51%	-1.58%	-1.56%	-0.03%				
Demographic Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Linear Age	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO
Age Dummies	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Industry Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Firm Size Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Province Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Year Controls	NO	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES
Earnings Controls	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES

Notes: Standard errors in parentheses. All dollar values in 1998 Canadian dollars. Definitions of the different measures of Income Security Wealth accrual are provided in the text. The different control variables are described in the appendix.

Table 5: Sensitivity Analysis - Males

	One-Year Accrual		Peak Value Accrual		Option Value Accrual	
	ISW	Accrual	ISW	Accrual	ISW	Accrual
Base	0.009	-0.524	0.004	-0.218	-0.010	-0.286
	(0.003)	(0.025)	(0.003)	(0.014)	(0.003)	(0.011)
	0.15%	-0.89%	0.07%	-0.38%		
Estimates by Alternative Definitions of Retirement						
UI Def	-0.002	-0.723	-0.005	-0.212	-0.024	-0.354
	(0.003)	(0.026)	(0.003)	(0.015)	(0.003)	(0.011)
	-0.03%	-1.06%	-0.07%	-0.32%		
Earnings Def	0.007	-0.466	0.003	-0.166	0.006	-0.044
	(0.003)	(0.026)	(0.003)	(0.013)	(0.003)	(0.012)
	0.15%	-0.95%	0.06%	-0.34%		
Estimates by Predicted Probability of RPP Participation						
RPP Low	0.013	-0.620	0.006	-0.234	-0.014	-0.377
	(0.005)	(0.040)	(0.005)	(0.021)	(0.005)	(0.016)
	0.23%	-1.06%	0.11%	-0.41%		
RPP High	0.008	-0.399	0.003	-0.192	0.007	-0.047
	(0.004)	(0.032)	(0.004)	(0.018)	(0.004)	(0.016)
	0.13%	-0.65%	0.05%	-0.32%		
Estimates by Age 50-54 Income Quartile						
1st Quartile	0.030	-0.437	0.029	-0.115	0.013	-0.313
	(0.006)	(0.058)	(0.006)	(0.028)	(0.007)	(0.031)
	0.59%	-0.81%	0.56%	-0.22%		
2nd Quartile	0.021	-0.099	0.017	-0.126	0.005	-0.160
	(0.007)	(0.054)	(0.007)	(0.032)	(0.008)	(0.033)
	0.35%	-0.16%	0.28%	-0.20%		
3rd Quartile	0.024	0.254	0.025	0.073	0.008	-0.221
	(0.007)	(0.053)	(0.007)	(0.033)	(0.007)	(0.032)
	0.40%	0.43%	0.42%	0.12%		
4th Quartile	-0.001	-0.032	-0.003	-0.054	-0.002	-0.015
	(0.007)	(0.052)	(0.007)	(0.030)	(0.007)	(0.019)
	-0.02%	-0.05%	-0.04%	-0.09%		

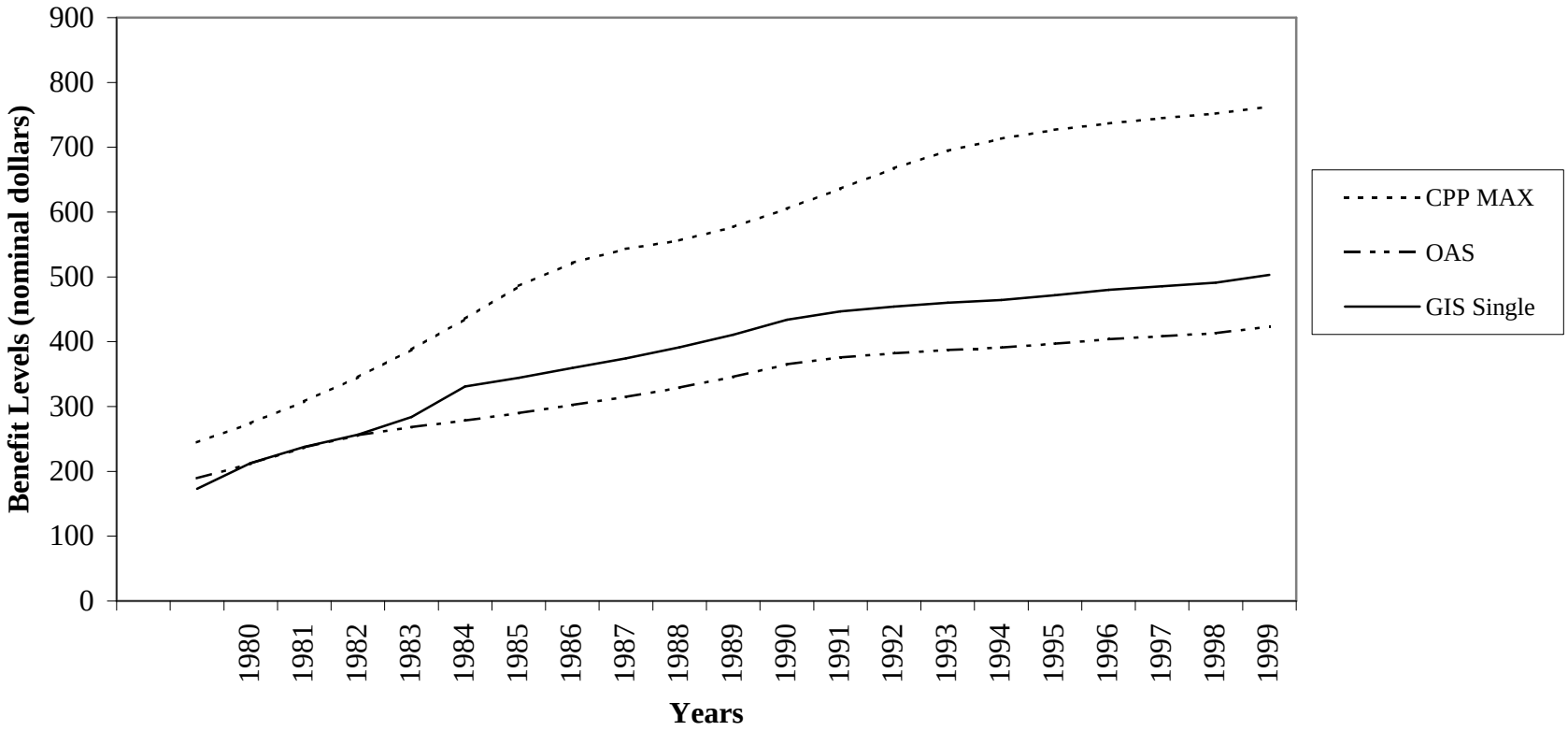
Notes: Standard errors in parentheses. Marginal effects are reported below the standard errors were applicable. They represent the percentage point increase implied by the corresponding coefficient for an increment of $1,000 for the accrual measures and $10,000 for the ISW measures. All dollar values in 1998 Canadian dollars. Definitions of the different measures of Income Security Wealth accrual are provided in the text. All estimates are for specification 4 (see tables 3 and 4).

Table 6: Sensitivity Analysis - Females

	One-Year Accrual		Peak Value Accrual		Option Value Accrual	
	ISW	Accrual	ISW	Accrual	ISW	Accrual
Females						
Base	0.004	-0.206	0.004	-0.009	0.002	-0.021
	(0.004)	(0.036)	(0.004)	(0.016)	(0.004)	(0.014)
	0.12%	-0.70%	0.13%	-0.03%		
Estimates by Alternative Definitions of Retirement						
UI Definition	-0.005	-0.233	-0.004	0.026	0.000	0.038
	(0.004)	(0.038)	(0.004)	(0.017)	(0.004)	(0.015)
	-0.08%	-0.34%	-0.06%	0.04%		
Earnings Definition	0.014	-0.195	0.013	-0.014	0.021	0.060
	(0.004)	(0.040)	(0.004)	(0.020)	(0.005)	(0.016)
	0.30%	-0.42%	0.28%	-0.03%		
Estimates by Predicted Probability of RPP Participation						
RPP Low	0.010	-0.222	0.010	-0.021	0.005	-0.052
	(0.005)	(0.050)	(0.005)	(0.022)	(0.005)	(0.019)
	0.19%	-0.41%	0.19%	-0.04%		
RPP High	-0.008	-0.189	-0.007	0.003	-0.002	0.038
	(0.007)	(0.055)	(0.007)	(0.026)	(0.007)	(0.024)
	-0.12%	-0.30%	-0.11%	0.00%		
Estimates by Age 50-54 Income Quartile						
1st Quartile	0.011	-0.511	0.011	-0.067	0.007	-0.052
	(0.008)	(0.112)	(0.008)	(0.032)	(0.008)	(0.028)
	0.24%	-1.09%	0.24%	-0.15%		
2nd Quartile	0.017	-0.258	0.015	-0.077	-0.001	-0.161
	(0.008)	(0.086)	(0.008)	(0.044)	(0.009)	(0.034)
	0.30%	-0.45%	0.27%	-0.14%		
3rd Quartile	0.006	-0.354	0.000	-0.260	-0.021	-0.224
	(0.009)	(0.076)	(0.009)	(0.042)	(0.010)	(0.037)
	0.09%	-0.56%	0.00%	-0.41%		
4th Quartile	-0.005	-0.120	-0.011	-0.044	-0.010	-0.183
	(0.009)	(0.071)	(0.007)	(0.028)	(0.009)	(0.036)
	-0.06%	-0.17%	-0.13%	-0.26%		

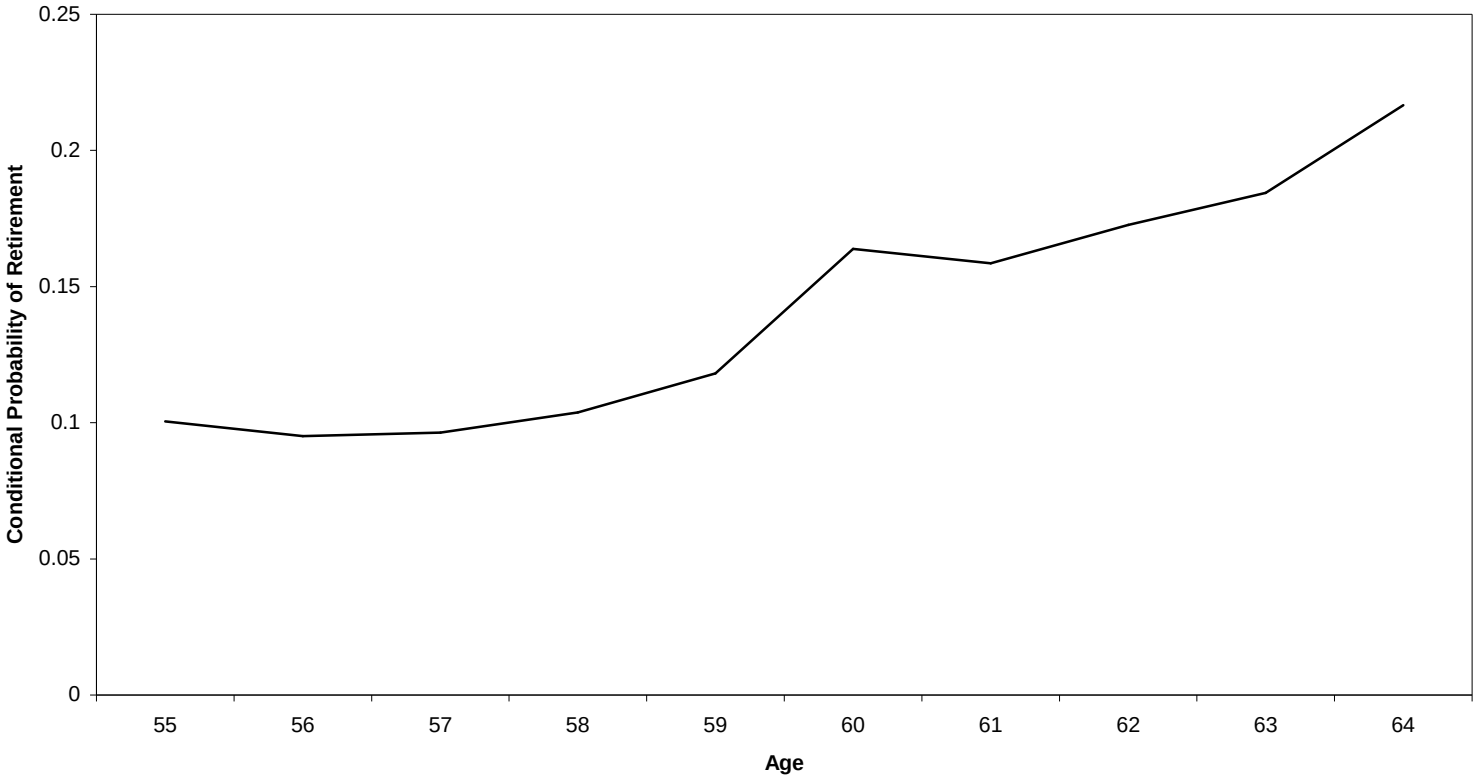
Notes: Standard errors in parentheses. Marginal effects are reported below the standard errors were applicable. They represent the percentage point increase implied by the corresponding coefficient for an increment of $1,000 for the accrual measures and $10,000 for the ISW measures. All dollar values in 1998 Canadian dollars. Definitions of the different measures of Income Security Wealth accrual are provided in the text. All estimates are for specification 4 (see tables 3 and 4).

Figure 1: CPP, OAS, and GIS Benefits in the 1980s and 1990s



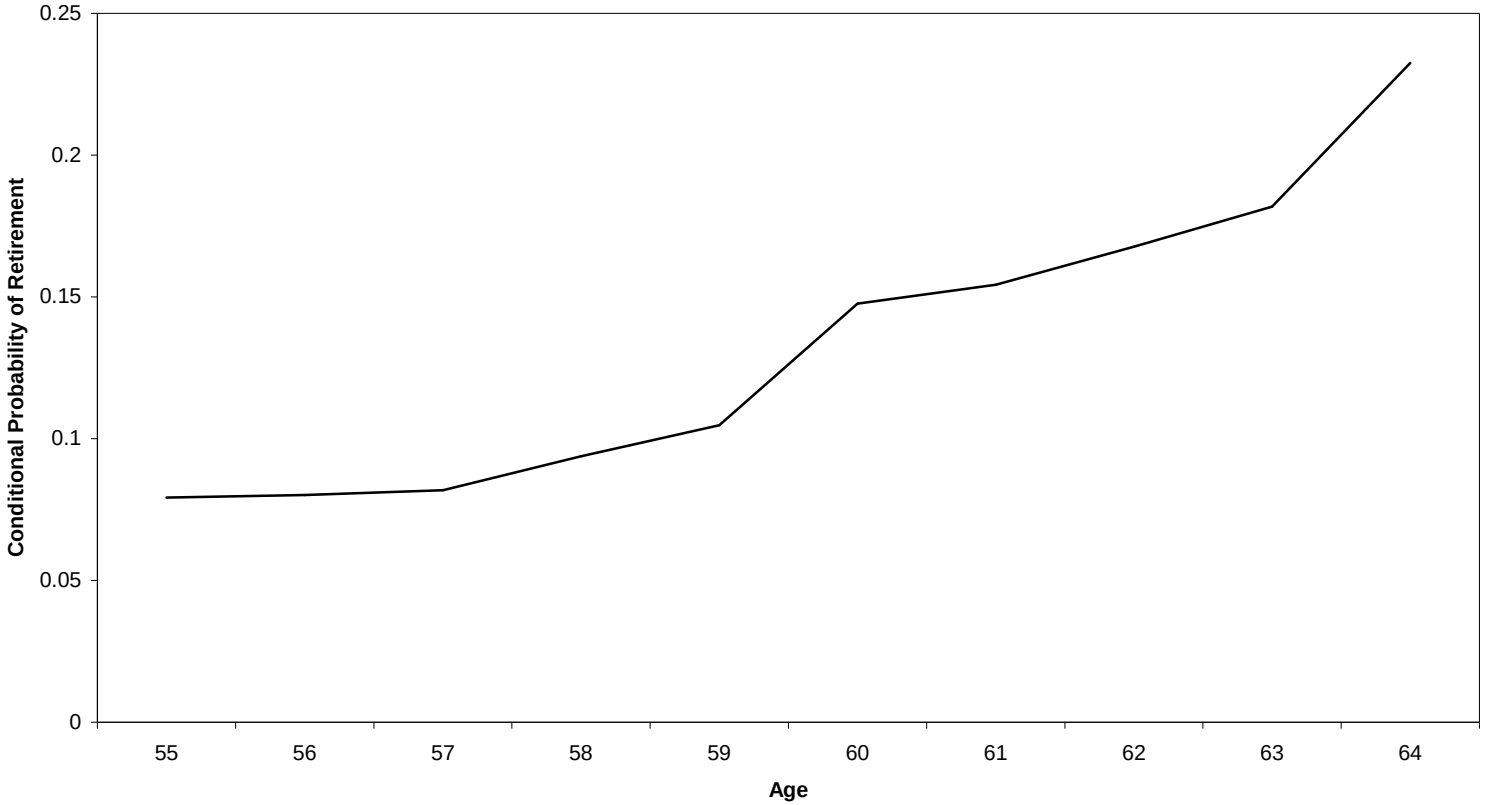
Notes: CPP benefit is maximum pension for that year. GIS benefits are for single claimant. Source is http://www.hrdc-drhc.gc.ca/isp/studies/trends/stats_e.shtml

Figure 2: The Conditional Probability (Hazard) of Retirement at Different Ages Calculated from the Female Sample



Notes: The conditional probability of retirement (hazard) is the probability of retirement at a given age, conditional on working at an age one-year younger.

Figure 3: The Conditional Probability (Hazard) of Retirement at Different Ages Calculated from the Male Sample



Notes: The conditional probability of retirement (hazard) is the probability of retirement at a given age, conditional on working at an age one-year younger.

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