The Labour Market Behaviour of Older Individuals

by

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Abstract

This dissertation investigates several aspects of the labour force participation and retirement decisions of older individuals, introduced in Chapter 1.

Chapter 2 examines how several components of Canada's income security system could affect individuals' incentives to retire. The components of Canada's income security system are documented and we show how they act to change the incentives to retire through a series of simulations. This chapter also provides a thorough survey and critical review of the international evidence on public pensions and retirement, with the broad weight of the evidence suggesting that the structure of public pensions contributes to the decision to retire.

In Chapter 3 I fill some of the gaps in the Canadian literature on retirement decisions, which has focused almost exclusively on the role of public pensions. In this chapter I extend the analysis of Baker et al. (2003, 2004a) to examine not only the effects of public pensions, but also the effects of health and employer-provided pensions on individuals' decisions to enter retirement. Using data from the Survey of Labour and Income Dynamics, my main finding is that having poor health, or the occurrence of health events such as the onset of a disability, significantly increases an individual's likelihood of entering retirement. Another key contribution to the Canadian literature is the finding that individuals are responsive to the financial incentives found in employer-provided pension plans. Additionally, my estimates indicate that individuals consider their entire financial picture when making their retirement decisions.

Chapter 4 seeks to explain the substantial increases in older men's labour force participation rates that have been observed since the mid-1990s. Using data from the U.S. March Current Population Survey, the Canadian Labour Force Survey, and the United Kingdom Labour Force Survey, I investigate the hypothesis that husbands treat the leisure time of their wives as complementary to their own leisure at older ages. Given this complementarity, a large portion of the increase in older men's participation rates may be explained as a response to the recent increases in older women's participation in the labour force, which are largely driven by cohort effects. The methodology of Dinardo, Fortin, and Lemieux (1996) is used to decompose the changes in older married men's participation rates, demonstrating that increases in wives' participation in the labour force can explain roughly one quarter of the recent increase in participation in the U.S., up to one half of the recent increase in participation in Canada, and up to two fifths of the recent increase in the U.K. Older men's educational attainment is also an important factor explaining recent increases in participation, yet cannot be expected to drive further increases in participation rates. In contrast, expected increases in older wives' participation over the next decade are expected to drive further increases in older men's participation rates.

Table of Contents

List of Tables

List of Figures

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Co-Authorship Statement

Chapter 2 (Public Pensions and Retirement: International Evidence in the Canadian Context) was co-written with Professor Kevin Milligan (UBC). My contribution to the production of this piece of research is outlined below.

- Identification of research program – a small contribution, as the initial idea was generated by my co-author.
- Design of research program – a moderate contribution, in consultation with my co-author.
- Performing the research – a large contribution, including the description of Canada's system and the review of the relevant international literature. My co-author was primarily responsible for producing the simulations in this chapter.
- Manuscript preparation – a large contribution, as drafts were prepared and revised jointly with my co-author.

Chapter 1

Introduction

The potential social and economic consequences of population aging have sparked considerable interest in the labour market behaviour of older individuals. Concerns about population aging generally fall into two broad categories. First, population aging is expected to result in higher expenditures on health care, public pensions and other publicly funded programs used by our seniors. Given that many of these programs are funded on a 'pay-as-you-go' basis, the fiscal sustainability of these programs has been called into question.[1] Second, there are concerns that the retirement of the baby boom generation could lead to skill shortages with the loss of experienced people from the labour force. To address these concerns some countries have expressed a desire to alter the structure of retirement.[2] Developing a solid understanding of the determinants of older individuals' labour market behaviour is therefore a necessary first step in addressing these concerns. In this thesis, I investigate several factors that influence the labour force participation and retirement decisions of older individuals.

It is useful to begin by clarifying how I conceptualize retirement in this thesis, as the term 'retirement' can have several meanings. I have characterized retirement as an individual's permanent withdrawal from labour market activities after participating in the labour force through most of his or her adult life, as this appears to be the activity of greatest interest to policy makers. Individuals who have permanently withdrawn from the labour market are not likely, for example, to delay receipt of public pension benefits and are not offering their skills to employers.[3] When examining the retirement decision using survey data, I have defined entry to retirement as a departure from the labour force for more than one

[1]Note that Canada's public pensions (CPP/QPP) appear to be sustainable following several reforms in 1997 that led to the creation of a reserve fund to cover future pension payments.

[2]For example, Canada's 2005 Budget Plan (Department of Finance, 2005) states that "With the upcoming labour scarcity, there is a need... to ensure that older Canadians do not face disincentives to work" and that "minimizing institutional and financial disincentives to work has the potential to raise the labour force attachment of older Canadians."

[3]Another common characterization, for example, defines entry to retirement as the point when an individual leaves a career job. Such individuals, however, may continue working in a post-career job, either full-time or part-time, and would not qualify for many income-tested public pension benefits.

year.[4] The window of observation is restricted for practical reasons, but is adequate given that very few individuals over the age of 55 who withdraw from the labour force for such an extended period of time actually return to the labour force. To note, I have chosen to not make use of self-reports of retirement for several reasons. First, the use of self-reports leaves the concept of retirement very ambiguous. Second, although self-reported retirees will tend to fit an expected profile of retirement, in many data sets the measurement of self-reported retirement is based on reasons why individuals left their last job and will miss any individuals who were laid off or left jobs for health reasons and then entered retirement (see Gower (2004)). I should also note that my chosen definition of retirement (and the examination of retirement in this thesis) does not address the various paths that individuals may take into retirement. However, as Gustman and Steinmeier (1983, 1984) demonstrate, the majority of workers face hours constraints that would prevent them from gradually phasing out of full-time jobs into retirement and it is most common for individuals to move directly from full time employment to full retirement (see Gustman and Steinmeier (1986)).

I begin in Chapter 2 (co-authored with Kevin Milligan) with an examination of evidence on the impact of Canada's public pensions on the retirement decisions of the elderly. The components of Canada's income security system are documented and we show how they act to change the incentives to retire through a series of simulations. For example, on one hand we demonstrate that CPP/QPP actuarial adjustments do not adequately compensate individuals for foregone years of pension receipt and reduce eventual GIS payments, thereby creating disincentives to remain in the workforce at older ages. On the other hand, individuals that have experienced several work interruptions over their lifetime may have the incentive to continue working as this would allow individuals to drop some low-earnings years from their work history when calculating the average income that determines the level of CPP/QPP benefits they are eligible for. We then provide a thorough survey and critical review of the international evidence on public pensions and retirement. The broad weight of the evidence, including several recent Canadian studies of retirement behaviour, suggests that the structure of public pensions contributes to the decision to retire.

While there is a fairly extensive international literature examining retirement decisions, the literature in Canada has focused almost exclusively on the role of income security programs. In Chapter 3, I extend the analysis of Baker et al. (2003, 2004a) to examine not only the effects of public pensions, but also the effects of health and employer-provided pensions on individuals' decisions to enter retirement. Using panel data from the Survey of Labour and Income Dynamics (1995-2002) I am able to observe individuals' labour market transitions, health status, job characteristics, and income from various sources. I use an option value framework for the analysis of financial incentives, creating two variables to

[4] This definition of retirement, its implications, and some alternatives are discussed at greater length in Chapter 3, where this definition is used.

capture the financial incentives associated with public and employer-provided pensions. First, a wealth measure is created representing the discounted present value of income from various sources. Increases in wealth from public or employer-provided pensions are expected to reduce the number of years a person is in the labour force. Second, I measure an individual's incentive to immediately enter retirement as the amount of wealth an individual could accrue by delaying retirement until a future optimal date (referred to as a peak accrual value). Health is treated as a preference shifter, with the expectation that poor health increases the disutility of work and therefore increases the likelihood of entering retirement. A probit model is used to estimate the effects of financial incentives and health on entry to retirement, with specifications controlling for individual fixed effects, spousal and family characteristics, and the endogeneity of health reports.

My main finding in this chapter is that having poor health, or the occurrence of health events such as the onset of a disability, significantly increases individuals' likelihood of entering retirement. I address identification issues associated with using self-assessed health measures and find that having poor health raises the likelihood of entering retirement by more than twenty percentage points. Another important contribution of this chapter is the finding that employer-provided pensions have significant wealth and accrual effects, which had not been accounted for in previous Canadian studies. I also find that the financial incentives in Canada's income security programs have significant accrual effects on the retirement decision. Overall, the results presented in this chapter suggest that reforming Canada's retirement income policies could address many concerns about population aging if designed to affect individuals' timing of retirement.

Augmenting the concerns about population aging, in many countries the participation rates of older men had fallen for several decades. In the mid-1990s, however, a clear reversal in the labour force participation rates of men age 55-64 occurred in Canada, the United States, the United Kingdom, and several other European countries. In Chapter 4, I seek a common explanation for the recent increases in older men's participation. Using data for Canada, the U.S., and U.K., I investigate the hypothesis that husbands treat the leisure time of their wives as complementary to their own leisure at older ages and that the recent increase in older men's participation rates is largely a response to recent increases in the participation of older wives. Modelling the husband's and wife's participation decisions as a system of simultaneous probit equations, I am able to identify the effect of a wife's participation in the labour force on the husband's participation decision using a measure of cohort effects as an instrument for wives' participation. The results show that in all three countries, husbands have clear preferences for sharing leisure time with their wives as a wife's participation in the labour force has a positive and significant effect on the likelihood of husbands to participate. Using the decomposition methodology pioneered by DiNardo et al. (1996), known as the DFL methodology, a decomposition of older married men's participation rates is then undertaken, demonstrating that a substantial portion of the recent increases in older married men's participation can be explained as a response to the higher likelihood of wives to participate in the labour force.

In this chapter I also investigate the role played by changes in the age structure and educational attainment of married men age 55-64. This group has become relatively younger (as the baby boom cohort enters this group) and more educated over the past decade, driving a substantial portion of the recent increase in participation, especially in the United States. Looking forward to how these factors will affect future trends in older men's participation rates, expected increases in older wives' participation will continue to place upward pressure on older married men's participation rates. However, it appears that the effects of education have been exhausted as the education levels of upcoming cohorts of older men are not substantially higher than the current cohort of older men, and therefore cannot be relied upon to drive further increases in older men's participation rates.

In Chapter 5 I provide some concluding remarks and outline some areas for future research related to this thesis.

Chapter 2

Public Pensions and Retirement: International Evidence in the Canadian Context

2.1 Introduction

The engagement of governments in pensions is internationally pervasive. Mulligan and Sala-i-Martin (2004) observe that 166 countries have some type of public pension program. Given this ubiquity, great interest has arisen in developing an understanding of the economics of public pensions. One branch of this inquiry asks how pensions affect the labour market decisions of the elderly. The motivation may lie in a desire to expand our knowledge of how the existing or future structure of public pensions might affect retirement decisions. Moreover, in some countries there may be an explicit desire to alter the structure of retirement through reforms to public pensions. In either case, a thorough investigation of the effects of pensions on retirement becomes a necessary first step.

An understanding of the effects of public pension programs on labour supply begins with a basic lifecycle model of labour supply. In the simplest model, an individual chooses a path of lifetime consumption and labour supply to maximize utility subject to the constraint that the discounted present value of lifetime income equals the discounted present value of lifetime consumption. The fundamental tradeoff that must be contemplated is between higher consumption (afforded through more work) and higher leisure. If one works more, the higher income allows one to consume more. However, more work implies less time available for leisure. Every worker therefore chooses a lifetime path for work that balances the desire for consumption and leisure.

Public pensions potentially change a worker's decision in two ways. The first is through changing the total lifetime income of the worker (which is equivalent to his or her wealth).

The discounted present value of benefits net of contributions made to the program is part of the lifetime budget constraint. If the discounted flow of benefits equals the discounted flow of contributions, then public pensions will have no effect on individual behaviour. However, if benefits exceed contributions, then a person's lifetime income is increased by the presence of the program. Assuming leisure is a normal good, this increase in wealth induces a person to reduce labour supply and enjoy more leisure. Although in theory this reduction in labour supply could be spread over an individual's lifespan (i.e. a reduction in the number of hours worked in each period), it is more likely to reduce the number of years that an individuals works.[1] This mechanism is called the *wealth effect.*

Another way public pensions can affect retirement decisions is through the accrual of rights to future pension income. If working an additional year raises the discounted sum of the future benefits, a worker will have a stronger incentive to continue working for the additional year, when comparing the advantages of retirement (more leisure) to the advantages of more work (even higher retirement income when she or he does retire). For example, benefits in most countries are based on some function of average lifetime earnings. More work will increase lifetime earnings, which may translate into higher future public pension benefits. Other features of public pensions that change benefits depending on the timing of retirement, such as actuarial adjustments, delayed retirement credits, and means-tested programs, can also influence how extra years of work translate into higher (or lower) future benefits. This channel is called the *accrual effect.*

If pensions were paid based on contributions, then the accrual effect can be made to disappear. This occurs in employer-provided defined contribution plans or in public pension plans such as Sweden's new public system of 'notional' accounts.[2] The level of the explicit or implicit pension wealth does not depend on the timing of the retirement decision in a contributions-based system, so the accrual effect disappears. Without an accrual effect, the structure of the pension can be said to be 'neutral' with respect to the retirement decision. That is, the decision to retire does not depend on the structure of the system, but instead reflects the individual's undistorted choice about the tradeoff between extra leisure and extra retirement income. With non-zero accrual effects, the retirement decision will be distorted, with a different and suboptimal mix of leisure and income. This non-neutrality generates costs akin to the standard efficiency losses of taxation.

More recent modeling of the effects of retirement benefits on labour supply has focused on the accrual effect. The canonical model comes from Stock and Wise (1990). Utility is derived from income (which affords consumption), with disutility from work. In each period an individual compares the expected present value of lifetime utility from retiring

[1]Most workers face hours constraints in that employers typically offer jobs only at standard hours of work. For example, Gustman and Steinmeier (1983, 1984) show that the majority of workers face hours constraints that would prevent them from gradually phasing out of full time jobs into retirement.

[2]See Palmer (2000) for a description of Sweden's system.

immediately to the expected present value of retiring at each future age, trading off income and work. The maximum of the difference in expected present values of retiring at each future age and immediate retirement is called the "option value" of postponing retirement. If the option value is negative, the individual will choose to retire immediately. If the option value is positive, the individual will choose to continue working and retains the option of retiring at a future date. In the next period, any individual who continued to work will determine the option value of postponing retirement again, given any new information. The key insights of the option value model are the forward-looking nature of the decision and the tradeoff between earlier retirement and higher retirement income.

Beyond the narrow economic variables, retirement takes place in a social context. The behaviour of one's spouse and peers could influence the retirement decision. In addition, health may affect retirement either because current work becomes impossible or because future health affects the time period over which pension benefits may flow. The focus of much of the economics literature on the financial motivations for retirement in no way precludes the impact of other factors. Our focus in this paper on the economics of the decision should therefore be interpreted in the broader context of social science research.

We begin by describing Canada's retirement income security system. We pay particular attention to how each component of the system contributes to both the wealth and the accrual effects described above. We then proceed to simulations that lay out the strength and the magnitude of the retirement incentives present in Canada's system, and show how it varies across different individuals. The next question we address is how important these incentives may be for retirement decisions. To do so, we present a comprehensive survey of the international literature on public pensions and retirement. We finish with a summary of the major findings of our study.

2.2 Canada's Retirement Income Security System

Canada's retirement income security system includes four distinct components. In this section, we provide the institutional detail on each component, describing how it might affect the incentives to retire. The descriptions are not meant to be exhaustive listings of the rules governing benefits. Instead, the focus is on the parts of the rules that have the greatest impact on retirement incentives.

Before beginning the description of the system, we will clarify our use of certain terms. We use income security generically to refer to public pension programs for the elderly in any country. When referring to the primary income security program in the United States, we capitalize it and call it by its name of Social Security.

2.2.1 Canada Pension Plan - Quebec Pension Plan

The largest component of the income security system is the Canada Pension Plan and Quebec Pension Plan (CPP/QPP). The CPP and QPP are earnings-related pensions funded by payroll taxes on employees and employers. The two plans are administered separately by the federal government for the CPP and the Quebec government for the QPP. Most details across the two programs are similar.

The calculation of the benefit is the product of three parts. The first part is determined by earnings histories. The contributory period is the window of time between 1966 or age 18 (which ever is later) and age 60. If retirement occurs after age 60, the contributory period is extended, up to a maximum of age 65. Months in which a disability benefit was received, or were spent caring for a child under age 7, are dropped from the contributory period. The worker may also drop the lowest-earning 15 percent of the months in the contributory period. For work after age 65, the earnings are only included in the calculation if it results in an increased benefit.

In each month in the contributory period, the ratio of earnings to 1/12 of the Year's Maximum Pensionable Earnings (YMPE) is calculated. The YMPE is set annually, and equaled $40,500 in 2004. These ratios are capped at one, so that earnings in excess of the YMPE are not considered for the pension benefit calculation. The final step in the earnings-rated part of the pension formula is to take the average of the ratios over all of the months in the contributory period.

The second part of the benefit calculation aims to update the earnings history to the level of earnings prevailing at the time of retirement. This is accomplished by taking the average YMPE in the five years preceding the time of retirement (the five years includes the year of retirement). We call this the pension adjustment factor.

The third part of the benefit calculation adjusts the pension for the age of retirement. The 'full' pension is received if retirement is at age 65. For every month before age 65, an actuarial adjustment of 0.5 percent is deducted from the full benefit. Symmetrically, retirement after age 65 receives a bonus of 0.5 percent per month of delay. These actuarial adjustments are capped at 5 years, meaning that the earliest one can claim regular benefits is at age 60, at a 30 percent (30 percent is 60 months times 0.5) reduction from the full benefit level.

The product of these three parts is then multiplied by the CPP/QPP replacement rate of 25 percent and divided by 12 to arrive at the monthly benefit. This is summarized in the following formula.

$$\begin{aligned}\text{Monthly Benefit} &= (\text{earnings rating}) \cdot (\text{pension adjustment factor}) \\ &\quad \cdot (\text{actuarial adjustment}) \cdot 0.25 \cdot (1/12) \qquad (2.1)\end{aligned}$$

The monthly benefit, once initiated, is updated quarterly for changes in the consumer price index. Upon the death of the recipient, any surviving spouse may be eligible for survivor benefits.[3]

How does the CPP/QPP affect retirement incentives? First, there is a wealth effect embodying the total discounted amount of future benefit flows. This encompasses both the regular benefits and the spousal benefits. Higher wealth (or equivalently, a higher annual flow of retirement income) is predicted by theory to lead to earlier retirement.

In addition, the CPP/QPP pensions have many channels of influence on the accrual incentive to retire. First, if the extra periods at work have high enough earnings so that they are included in the pension calculation, then the retirement pension will be larger when it is eventually taken. This means that more work leads to a higher pension once it is initiated. The 15 percent 'throw-out' rule and the earnings averaging rules help to determine the strength of this impact. Second, the actuarial adjustment depends specifically on the age of retirement. If retirement is delayed one month past age 60, then one month of pension receipt is foregone. However, the actuarial adjustment leads to a higher pension benefit once benefits are eventually initiated. The actuarial adjustment attempts to balance these amounts. Through this actuarial mechanism, the timing of retirement has an effect on the net present value of pension benefits received.

2.2.2 Old Age Security

The Old Age Security (OAS) pension is a uniform demogrant with a maximum benefit of $466.63 per month in September 2004. The pension amount is updated quarterly for changes in the Consumer Price Index, and the income is taxable as regular income. It is available to all individuals over the age of 65 meeting residency requirements.[4] There is a clawback of OAS benefits from very high income individuals: the OAS for an individual is reduced by 15 cents per dollar of personal net income exceeding $59,790 (in 2004). As such the full OAS pension is eliminated when an individual's net income exceeds $96,972 (in 2004).

The effect of the OAS pension on retirement incentives occurs mainly through the wealth effect. The OAS benefit does not depend on the date of retirement directly, so there is no direct accrual effect from working extra years. For those who are subject to the OAS

[3]Survivor benefits are paid at a rate of 60 percent of regular benefits if the survivor is age 65 or more, and 37.5 percent plus a fixed amount for survivors under age 65. These amounts differ in the Canada and Québec Pension Plans.

[4]When first introduced in 1952 OAS was only available to individuals over the age of 70. The eligibility age was reduced to 65 over the last half of the 1960s. To be eligible for benefits, individuals must have been a Canadian citizen or legal resident of Canada at some point before application and must have resided in Canada for at least 10 years after reaching age 18 (if currently in Canada) or twenty years (if currently outside Canada). The benefit is prorated for pensioners with fewer than forty years of Canadian residence (after the age of 18), unless they are "grandfathered" under rules that apply to the persons who were over age 25 and had established attachment to Canada prior to July 1977.

clawback, however, there will be some accrual effect. The accrual effect for them arises because extra work increases the CPP/QPP benefit which then serves to decrease the OAS benefit through the clawback. However, the clawback affects relatively few seniors so this interaction between the CPP/QPP and the OAS is of less general importance.[5]

2.2.3 Guaranteed Income Supplement

The Guaranteed Income Supplement (GIS) is paid to Canadians from age 65. It is also indexed to prices, but is not taxable income. The pension benefit was set in September 2004 at $560.69 for single individuals and $365.21 for each member of a couple. The unique feature of the GIS is the income test. For each dollar of family income (excepting OAS income), the GIS benefit is reduced by 50 cents for singles and by 25 cents each for married couples. For 2004, 34.5 percent of OAS recipients also received GIS benefits.

The GIS affects retirement incentives in two strong yet distinct ways. First, for those who are age 65 or more and would receive the GIS if they retired, labour market earnings will reduce GIS payments by 50 cents on the dollar. This is in addition to the income taxes that would be payable on the labour market earnings, so continued work past age 65 is strongly discouraged by the GIS.

The second channel through which the GIS affects retirement incentives is more subtle but perhaps even more important. Extra work after age 60 leads to a higher CPP/QPP pension through the actuarial adjustment. However, each dollar of extra CPP/QPP income that is earned will lead to a decrease of 50 cents in GIS income, for those who receive GIS. Essentially, for GIS recipients, the value of the actuarial adjustment is cut in half. For this reason, extra work past age 60 can have a strong impact on the retirement income received in the future. The simulations later in the paper explore this mechanism in more detail.

2.2.4 The Allowance

The Allowance is paid in two circumstances. First, it is paid to the 60-64 year old spouses of current OAS recipients. Second, it is paid to 60-64 year old widows or widowers. The amount paid is equal to the OAS pension plus the married component of the GIS pension. Like the GIS, it is clawed back on family income. However, the clawback rates are 75 cents on the dollar for the 'OAS' portion of the Allowance, and 50 cents on the dollar for the 'GIS' portion of the Allowance.

The Allowance affects retirement through the same two channels as described above for the GIS. However, the direct channel of the clawback on labour market earnings is stronger here because of the 75 percent clawback. In addition, the more subtle channel of

[5]According to Myles (2004), in 1996 3.1 percent of OAS recipients were subject to the clawback but still received partial OAS benefits while 1.6 were not eligible for OAS because their benefits were fully clawed back.

the interaction with CPP/QPP benefits is much less important for the Allowance because the Allowance can only be received for a maximum of five years. This means that only five years' worth of CPP/QPP actuarial adjustments will be effectively reduced, in contrast to the GIS which reduces them for all ages past age 65.

2.2.5 Summary

The four components of Canada's retirement income system each separately embody interesting features that influence the decision to retire. However, when the four components are combined, the interactions among the individual components provide some of the sharpest incentives to retire. Describing these interactions is made easier by reference to numerical examples, so we turn next to some simulations.

2.3 Simulations

The goal of this section of the paper is to quantify the strength of the incentives to retire described in the previous section. To do so, we take a 'typical' individual and calculate his or her income from all four components of Canada's income security system. We then compare the differences in the incentives when we vary his or her private pension income, amount of lifetime earnings, and continuity of lifetime earnings. Finally, we show some policy simulations to demonstrate the sensitivity of the incentive measures to small changes in policy parameters.

We do not aim to provide a comprehensive analysis of the incentives to retire, for that is beyond the scope of the paper. Instead, we use the simulations as an illustrative tool to point out how the components of Canada's retirement income system work individually and interactively to influence the decision to retire. Because of the illustrative nature of the simulations, no attempt should or can be made to infer nationally representative results from the results presented here.

The section begins with a description of the methodology that underlies our calculations. This is followed with the presentation of the simulation results first for the base case, then for several alternative scenarios.

2.3.1 Methodology

In order to calculate an individual's pension entitlement, we require several pieces of information. We need a complete earnings history back to 1966 (or age 18), sex, age, marital status, province of residence, and information on private pensions or other income. These pieces of information can then be combined using a pension income calculator to arrive at public pension income in any given year. By recalculating the pension income for all ages after retirement and discounting for time preference and for mortality probabilities, we arrive at a measure of the expected net present value of public pension income. We call this the Income Security Wealth (ISW) corresponding to a particular retirement age. When this calculation is repeated for all potential retirement ages, an age profile for ISW can be described and the rate of ISW accrual from year to year can be derived. Both the level of ISW and its rate of accrual are the objects of our attention.

We use the pension income calculator developed for and described in Baker, Gruber and Milligan (2003, 2004a) for our calculations. The calculator first derives the CPP/QPP benefit, given a lifetime earnings history. Next, it calculates the retirement income for each age during retirement, by assigning the CPP/QPP benefit, OAS, GIS, and the Allowance both to the worker and his or her spouse. We project benefits into the future assuming they remain constant in real terms. All clawbacks are accounted for. The calculator then takes the taxable components of income and applies provincial and federal taxes to arrive at an after-tax measure of retirement income at a given age.[6] The flow of retirement income across ages is discounted using an assumed rate of time preference (three percent real) and sex-specific mortality probabilities (taken from Statistics Canada (2002b)). The output of the calculator is an age-profile of ISW for all potential retirement ages under consideration.

For our calculations, we seek to define a 'typical' individual in order to characterize retirement incentives. We consider someone in 2002 who is 55 years old and lives in Ontario. This implies that the year of birth was 1947, and that the first year of work eligible for the CPP/QPP is 1966 at age 19. The worker is contemplating retirement at some age between 55 and 70. For the earnings history, we take a series of average weekly earnings and annualize it.[7] In our base case, we assume that the worker earned in every year from age 22 to the present, with no interruptions. From 18 to 21 we assume zero earnings (proxying for years in school). This means that there are three zeros in the earnings history, from ages 19 (in 1966) to 21 (in 1968). When projecting earnings into the future from 2002, we assume that earnings stayed constant in real terms at the 2002 level. We also assume in our base case that the worker has no income outside of earned income and public pension income - this means no Registered Retirement Savings Plans, employer-provided pensions, or other sources of income. Finally, we assume that the CPP pension is not taken until retirement - no work occurs after the CPP pension is taken.[8]

We simulate our base case for married and single males and females. The married couples are assumed to each have the same birth year and earnings history. When considering the retirement age of the husband, we hold constant the wife's retirement age at 60. Similarly, when considering the wife's retirement age, we hold constant the husband's retirement age at

[6] To clarify, the current year tax policy is used when calculating tax payable.

[7] There is no consistent series covering the entire time period necessary for our analysis. We build our series from three CANSIM II series: V78310 for 1965 to 1983, V250810 for 1984 to 2000, and V1597104 for 2001 and 2002.

[8] Under the CPP and the QPP, you must have stopped work in the month the pension is taken. After that, work may begin again and the pension is not changed.

60. This base case is not meant to produce results that are representative for the Canadian economy. Instead, the aim here is to demonstrate how the incentives vary in one simple case. A more complete and representative analysis featuring the fullness of heterogeneity we observe in the Canadian labour force is beyond the scope of this paper.

In addition to the base case, we conducted three sets of simulations in which we varied the base scenario in different dimensions. In the first, we try adding sequentially higher amounts of private pension income to examine the effects of the GIS and Allowance clawbacks. In the second, we look at differences across workers of different wage levels by running simulations with an earnings history comprised of earnings that are only a certain percentage of the average weekly earnings. Finally, we twist the earnings history in a different way by studying the effect of 'incomplete' earnings histories in which the worker had absences from the labour market. These extra simulations will help to provide more information on how the retirement incentives vary across individuals.

Table 2.1 presents a basic description of our base simulated individuals. We consider the case of a single man or woman, with no income aside from public pensions. The first two rows show the probability of living to a certain age, given that the individual is currently age 60. Females display greater longevity, with the probability of surviving until age 95 at more than twice that for males, 0.113 to 0.039. Average life expectancy from age 55 (the age at which the conditional probability of living is 0.50) is 84 for females, and 79 for males. The full survival curves, conditional on surviving to age 55, are shown in Figure 1. Not only are females different because they have a higher probability of survival, but the shape of the survival curve is also different. For example, after age 84, the drop in probability of survival is greater for women than for men. Because the lifetime pension measures we use will compare positive and negative flows across ages, both the level and the shape of the survival curves will play a role.

The rest of Table 2.1 shows pension flows at a particular age. Because the earnings for our simulated male and female are assumed to be the same, these pension flows could be for a single person of either sex. The third row displays the OAS entitlement, expressed in 2002 dollars. It pays $5,328 per year, starting at age 65. The next 4 rows of the table show the CPP entitlement (the simulated individual is from Ontario) and the GIS entitlement if the worker retires at age 60 (in 2007) or age 65 (in 2012). If taken at age 60, the CPP pays $6,335 annually. The full GIS amount in 2002 is $6,336, so the CPP payments reduce the GIS payments by $3,167.50 ($6335*0.50), leaving $3,169 in GIS payments starting at age 65. If the same individual continues to work until age 65, the CPP entitlement grows to $9,501.[9] This supplemental $3,166 in CPP leads to a reduction in the annual GIS payment of $1,583 ($3,166*0.50), which leaves GIS payments of $1,586 annually. This example gives

[9]Note that this is greater than the $9,465 maximum pension available in 2002. The pension for our simulated individual is higher because he or she will reach age 65 in 2012, when the maximum pension will be larger.

some preliminary indication of how the GIS and CPP interact with each other to change retirement incentives. The extra CPP benefit received for delayed retirement from age 60 to 65 is reduced by half through the GIS. How this change in annual pension flows changes the lifetime totals is the subject of the simulations that follow.

2.3.2 Base Case Results

The results for the base case are presented in Table 2.2. The first column shows the level of ISW in 2002 dollars for each case at age 55. The columns across the table contain the year-to-year accrual of ISW across different potential ages of retirement, from the point of view of the 55 year old in 2002. So, for example, the age 57 column contains the difference in ISW for retirement at age 57 and at age 58. At the right end of the column, we report the final level of ISW at age 70. Down the table we consider four family types: single and married males, and single and married females.

We start with the single male. For ages 55 and 56, the rate of accrual is $1,269 and $1,073. The dropout provision plays an important role here. Fifteen percent of months may be dropped from the CPP/QPP calculation. From ages 19 to 59, there are 41 years, which generates just over six years of dropouts. Since we assumed no earnings between ages 19 and 21, this means that someone retiring at age 55 has three 'zero' earnings years from ages 19 to 21, then 5 more from ages 55 to 59 before claiming the CPP/QPP at age 60. The six dropout years cancel six of the zero years, but two zero years remain in the calculation. An extra year of work at age 55 therefore replaces one of the zero years. This generates the positive accrual.

At age 57, however, the accrual changes to being very close to zero. The reason again is driven by the dropout provision. Retirement at age 57 means that there are three zero years before claiming at 60. When added to the three zero years from ages 19 to 21, the three years from ages 58 to 60 combine to total six years of zero earnings, which is equal to the number of dropout years. If retirement is delayed one year, therefore, the extra year of work no longer crowds out a zero year from the calculation but instead crowds out a high earnings year. Because the difference in earnings between the extra year of work and the year that is replaced is small, the benefit to continued work drops sharply at this age. Similar explanations underlie the small positive accruals at ages 58 and 59.

It is important to stress that the drop in the accrual at age 57 is specific to the setup of this simulation. If a different number of low earnings years were in the earnings history, the drop would be elsewhere in the profile. The main thrust to be learned here is that the benefit to working an extra year between ages 55 and 59 depends heavily on the difference between the extra year of earnings and the year that it replaces in the CPP/QPP calculations. Later in this section, we demonstrate this more directly by showing the accrual paths for simulated individuals with several years of work interruptions.

At age 60, the accrual turns negative, reaching -\$1,544. There is still a benefit from extra work through the replacement of a bad earnings year in the dropout mechanism. However, there are negative thrusts that dominate in this simulation which come from two intertwined sources. First, at age 60, extra time at work means that a year of CPP/QPP benefit receipt is foregone. In compensation, the year of delayed retirement leads to an actuarial adjustment of the CPP/QPP benefit when it is taken. Ideally, the actuarial adjustment will compensate the worker for the foregone pension income in that year. The second influence on the accrual rate after age 60 is the effect of the CPP/QPP actuarial adjustment on the GIS benefit. The extra six percent of the pension that is awarded for delaying retirement is counted as income when calculating the GIS benefit. This means that 50 cents on the dollar for the actuarial adjustment disappears from the GIS payment. This affects every GIS payment from age 65 until death. Effectively, this shrinks by half the benefit of the actuarial adjustment and tilts the incentives toward negative values. We explore this further below in simulations where the individual is not in receipt of the GIS to separate out the effects of the GIS and the CPP/QPP actuarial adjustment.

At age 65, the accrual becomes more sharply negative at -\$6,503. The reason for the jump down at age 65 is again the GIS. The extra year of work at age 65 produces an increase in the CPP/QPP benefit through the actuarial adjustment, which would decrease the GIS as discussed above. However, extra work at age 65 also produces earned income which directly decreases the GIS payment. In fact, at the assumed level of earnings, equal to the average weekly wage in Canada, the GIS is pushed to zero as it decreases by 50 cents on the dollar of earned income. From ages 65 to 69, the accrual stays negative, but diminishes in absolute value. The decrease is driven by the fact that there are ever fewer years over which the pension will be received. So the extra year of work may change future pension flows, but there are fewer years over which those flows are received.

The second row shows the same simulations, but for a married man. At ages 55 and 56, the accrual is higher than in the single man case. This occurs because the higher CPP/QPP benefit that is earned with extra work pays off not only in a higher benefit for the husband, but also in a higher survivor pension for his wife after he dies. This amplifies the accrual effect seen for the single man. After reaching age 65, the accrual is more negative for the married man, reaching -\$7,904. Earned income after reaching age 65 directly claws back the GIS, and a married family has a higher GIS payment if retired. For this reason, extra work after age 65 hurts the married man more because both his and his wife's GIS payments are reduced as he earns income.

The third and fourth rows repeat the exercise for females. Because the same earnings profile is used as for the males, the observed differences are driven solely by differences in mortality probabilities. While it is certainly not typical for females to have the same earnings history as males, forcing them to be equal in this simulation allows us to isolate the influence of non-earnings factors by holding the earnings history constant. Because females live longer on average, changes in pensions have longer lasting effects on women. At ages before 60, the female accrual is higher than the corresponding male simulation because the increment to the CPP/QPP pension earned by an extra year of work is received over more years, on average. This makes the payoff to extra work higher.

From age 60 on, working an extra year means forgoing a year of CPP/QPP receipt, but gaining a higher CPP/QPP pension in every subsequent year. The net present value of the 'investment' in an extra year of work will be different for men and women not only because women are more likely to live longer, but also because the shape of their survival curve differs from men. This leads to the results for ages 60 plus that are observed in the table. The accrual for females is less negative from 60 to 64, but more negative after age 65.[10] This result is driven solely by differences in mortality across males and females.

The difference between single and married females is less pronounced than was the case for single and married men. This is a result of the survivor pension. For males, it is more likely that the female will out-survive him. This means that any increment to his CPP/QPP pension will be reflected in her survivor pension. However, for females, it is less likely that the husband will out-survive her. While in expectation there will be some survivor benefit received by her husband, it is smaller in expected value than the survivor benefit of a surviving wife. This serves to shrink the difference between single and married females, as the extra work by the married female does not lead to a big boost in her husband's expected future survivor benefits.

2.3.3 Extended Simulation Results

To complement the simulations in the base case, we present several extended simulation results to illuminate and clarify some of the pathways through which Canada's retirement income security system affects retirement incentives. In all cases, we performed the extended simulations on the single male. We made this choice to try to simplify the environment, allowing us to focus more easily on the factors under consideration in a particular simulation. Without spouses, there are fewer 'moving parts' in the simulations. The male-female and married-single differences in the extended simulations look very similar to the corresponding difference in Table 2.2.

The first extended simulation considers single men with different amounts of private pension income. Because private pension income is included as income for the GIS calculation,

[10] This occurs because the probability of surviving to very old ages drops more quickly for females than for males. Thus, the positive returns to extra work at very distant ages is discounted very heavily for both males and females, while the foregone pension benefit is discounted more heavily for males than for females. This results in a more negative accrual for females. At age 69, males again become less negative, but this is driven by the exhaustion of GIS benefits - the CPP pension for retirement at age 70 is so large that the entire GIS pension is clawed back.

those with higher private pension income will receive less GIS. Over some threshold, the private pension will be sufficient to completely crowd out the GIS payments. The no-GIS case is of great interest when compared to the base case, because with no GIS payments the pure effect of the CPP/QPP can be seen in isolation from its interaction effect with the GIS. This gives a better picture of the channels through which the incentives are generated.

The private pension simulations are presented in Table 2.3. The same columns appear as were seen in Table 2.2, with ISW at age 55, the accrual rates by age, and finally the age 70 ISW level. In the first row, we repeat the base case results for the single male for comparison. In the subsequent four rows we show the results for differing levels of annual private pension income, from $2,000 in the 2nd row to $8,000 in the 4th row.[11] In all cases, we assign the private pension income to the man starting at the age of retirement.

In the rows for $2,000 to $6,000, the single male still receives GIS upon retirement. This means that the higher CPP/QPP pension resulting from the extra work between ages 55 and 59 will diminish the GIS payment. This serves to attenuate the gain from extra work in this age range relative to the no-GIS case in the last row. As one moves from the base case of $0 of private pension income to $6,000, the gain from an extra year of work is actually slightly smaller for higher private pension income. This occurs because the higher private pension income pushes the worker into a higher tax bracket during his retirement years in this simulation. This means that his gain in CPP/QPP income from working an extra year is taxed at a higher rate when he has a private pension income, thus diminishing his accrual rate between ages 55 and 59.

For the $8,000 row, the accrual is much higher than the other rows, reaching $1,603 at age 55. This occurs because at $8,000 of annual private pension income in these simulations, the single male receives no GIS payments. Thus, the differences we see in row 5 are driven by the removal of the impact of the GIS on retirement incentives. At ages 55 to 59, the worker no longer sees half of his CPP/QPP gain from continued work taken away from his GIS payment. This generates the stronger work incentives at all ages for the $8,000 case.

At age 61, the ordering of the magnitude of the incentives in the base case compared to the $6,000 case is reversed. At age 60, a delay in retirement leads to an increased actuarial adjustment to the CPP/QPP pension. For those with higher private pension income, there is less GIS income to be affected by the CPP/QPP actuarial adjustment, so the accrual is less negative for those with higher private pension income. At age 61 however, the increased CPP/QPP payment the individual receives leads to the person no longer being eligible for a GIS payment. As such, the individual receives the full actuarial adjustment by delaying retirement one more year, eliminating the effect of the GIS and resulting in a positive

[11]Obviously, many Canadians earn more than $8,000 in private pension income. We do not show higher amounts because they show very little difference when compared with the $8,000 case. This is because the GIS payments are already at zero in the $8,000 case, so extra pension income only affects ISW through possibly higher income taxes, and through the OAS clawback for the top few percent of seniors.

accrual.

From age 65, the negative accrual becomes monotonically smaller with increasing private pension income. This results from the direct impact of the private pension income and earnings on the GIS. With a larger private pension income, there is less GIS to be clawed back by earned income. This diminishes the negative effect of the GIS on work incentives.

The second set of extended simulations varies the earnings history of the single man. Instead of assigning him the full average weekly earnings in each year, we study cases in which he earned 80 percent, 60 percent, 40 percent, and 20 percent of the national average. Importantly, the smaller wages in each earnings history are applied only to years prior to age 55; from age 55 we assume that earnings are at the full national average. We make this perhaps odd assumption in order to hold as much constant as possible to isolate the effect we wish to consider: What is the impact of having a low earnings history compared to a high earnings history on work incentives at older ages?

The results of this simulation appear in Table 2.4. Again, in the first row we have reproduced the single man base case results from Table 2.2. Rows 2 through 5 show the earnings histories of 80 percent through 20 percent of the average earnings. Several factors combine here to generate the observed patterns. At ages before 60, extra work generates higher CPP/QPP income at retirement through the earnings formula. An extra year of work will replace a low-earnings year in the formula, resulting in a higher CPP/QPP benefit. The differences across rows in Table 2.4, therefore, are driven by differences in the level of the low-earnings years that are being replaced. For the simulation with 20% of the average earnings in each year, the gain to continued work is positive up to age 61, because the extra year of work is replacing a year of very low earnings. For the simulation with earnings at 80% of the average earnings level, an extra year of work generates higher accruals than in the base case, but still turns negative at age 60 as the negative effect of the CPP/QPP actuarial adjustment and the GIS interaction still dominate.

The final simulations appear in Table 2.5. In this set of simulations we examine the impact of having different amounts of work interruptions on the accrual of ISW. At the top of the table we reproduce the base case. In the subsequent four rows we substitute increasing numbers of zero earnings years into the earnings history at ages before 55. In the 2nd row, we replace earnings with a zero in all years ending in a 4 or 9. In the third row we then replace all earnings in years ending in a 3 or 8 with a zero. We continue this pattern down to the last row in which earnings in four out of every five years have been replaced with a zero. For ages from 55 on, we do not replace earnings with zeros so that the potential earnings from continued work are the same across all five rows. This isolates the effect of interruptions in the earnings histories from having low earnings years after age 55.

For ages 55 to 59, the benefit of continued work is very similar across all four rows with work interruptions. This occurs because there are so many zero years in the earnings history that an extra year of work post-55 always replaces a zero year in the CPP/QPP formula. This highlights the important impact of work histories featuring interruptions - they tend to increase the work incentives because continued work brings a larger boost in the CPP/QPP earnings rating. From age 60 to age 64, the benefit of continued work varies down the table, with less negative (and more positive) accruals for the simulations with more earnings interruptions. Again, this makes sense because these workers are more likely to be replacing zeros in their CPP/QPP calculation than workers with complete earnings histories. After age 65, the direct effect of earnings on the GIS takes all of the accruals to be negative. The accruals for the simulations with more interrupted histories are less negative because they continue to be able to use their extra years of earnings to replace zero earnings years in their CPP/QPP calculation.

2.3.4 Policy Simulations

The final set of simulations we present aim to illustrate the sensitivity of the incentive measures to small changes in policy parameters. It is beyond the scope of this paper to analyze or recommend any policy alternatives, so the interpretation of these results should remain narrowly focused on their illustrative power.

We examine the effect of four separate policy changes. We describe each policy change briefly:

- Policy Simulation A: Change the actuarial adjustment in the CPP/QPP from 0.5 percent per month to 0.7 percent per month.
- Policy Simulation B: In the CPP/QPP, grant a full 'throw-out' year for every year of work starting at age 60.
- Policy Simulation C: For the GIS clawback calculation, use the CPP/QPP pension entitlement from age 60 rather than the actual CPP/QPP income.
- Policy Simulation D: For the GIS clawback calculation, exempt labour market earnings from the income measure.

The results of the simulations are presented in Table 2.6. Policy A changes the actuarial adjustment in the CPP/QPP. This should be expected to increase the annual accruals because delayed retirement results in a larger actuarial adjustment than under the status quo case. Indeed, the simulations show that accruals at every age from the age of entitlement at age 60 are higher than under the status quo system, averaging $1,307 higher.

Policy B increases throw out months 'earned' from work after turning 60 from 0.15 under the status quo up to 1 full month for every month worked. Because the base case worker has almost the maximum amount of CPP/QPP, the ability to throw out extra years does not have a substantial impact. In simulations not shown here, for workers with more incomplete earnings histories the impact of this policy is greater.

The third policy change is policy C. This change aims to counteract the interaction between the GIS and the CPP/QPP actuarial adjustment by making GIS payments no longer depend on the age the CPP/QPP is claimed. This is achieved by using the CPP/QPP entitlement from age 60 in the clawback calculation for the GIS. That is, the actual CPP/QPP income received is not used but instead a 'fictive' amount calculated as though the individual had retired and claimed CPP/QPP at age 60 is used instead. As expected, this policy change has a substantial impact on the key age 60-64 range. No longer does extra CPP/QPP earned through the actuarial adjustment have a negative impact on future GIS receipts. Over the five years from 60 to 64, the average increase in the accrual is $2,582.

Policy D is the final policy change we consider. This policy exempts earned income from the GIS clawback calculation. For those age 65 and older, the clawback of the GIS on earned incomes provides a strong disincentive to stay in the labour force. With the exemption, the final row of Table 2.6 makes clear that for those aged 65 and over there is a substantial improvement in the accrual with earned income exempted from the GIS calculation. The improvement averages to $3,755 over the ages 65 to 69.

These policy simulations have demonstrated that the incentive measures discussed in this paper are sensitive to small changes in policy. A full evaluation of various policy alternatives potentially would be very informative, but is beyond the scope of this paper.

2.3.5 Summary of Simulations

The simulations in this section have attempted to demonstrate how Canada's income security system generates disincentives to remain in the work force at older ages. The profiles of the simulated individuals are not meant to be particularly representative of Canadian older workers overall, but instead were chosen to bring forward different interesting features of the retirement income system that affect work incentives. In summary, there are several factors that account for the patterns of accruals across different individuals in the simulations. They are:

- Accruals increase when extra work replaces a low earnings year through the CPP/QPP formula.

- Accruals are larger (in absolute value) for married individuals because extra CPP/QPP benefits also increase survivor pensions.

- Accruals are different for women because any change in the flow of pension income is received over more years of life and because of differences in the shape of the survival curve.

- Accruals decrease because the CPP/QPP actuarial adjustment does not sufficiently compensate for the foregone year of pension receipt.

- Accruals decrease because the actuarial adjustment of the CPP/QPP decreases eventual GIS payments.

- Accruals decrease because earnings directly reduce the GIS and Allowance benefits received.

It is important to stress that these simulated accruals are not overly large compared to many other countries. One way to compare the accruals across countries is to calculate the implicit tax on (or subsidy to) continued work at each age as the ratio of the accrual to earnings. In our base case simulation for single males, continued work at age 55 implies a subsidy rate of 3.6% while continued work at age 65 implies a tax rate of 18%. These implicit taxes are similar for individuals in the United States (Diamond and Gruber, 1999). However, in France the subsidy rate to continued work at 55 for a relatively comparable individual is 75% while continued work at age 60 implies a tax rate of 66% (Blanchet and Pélé, 1999). In Belgium, the subsidy rate for continued work at 55 is only 0.2% while the tax rate for continued work at age 60 is 59% (Pestieau and Stijns, 1999).

Within our Canadian results, the most striking feature is that the disincentives to continue working are strongest among GIS recipients, who represent the bottom one third of the income distribution among individuals age 65 and over. This is exemplified by the simulations presented in Table 2.3, whereby accruals are most negative among individuals with the lowest private pension income. These findings suggest that the work disincentives are strongest among the worst off retirees; perhaps those who would benefit most from a few extra years of work to increase subsequent retirement income.

2.4 International Evidence

In order to best understand the role played by the retirement incentives uncovered in the simulations, we provide in this section a detailed review of the empirical evidence on public pensions and retirement. The scope of the review covers the main international evidence in order to provide context for the Canadian evidence. Broad surveys on Social Security are provided by Feldstein and Liebman (2002) and specifically on the labour market impact of social insurance programs by Krueger and Meyer (2002).

Empirical work estimating the effects of income security programs on labour supply can be roughly divided into four groups. The first set of studies tried to estimate the retirement impact of pension wealth without focusing on the substitution effect of pension accruals. Contemporaneous with the first group of studies, several papers take a more 'structural' approach by estimating parameters from an explicit model of behaviour. A sharp break in the nature of the research occurred in the early 1990s as a result of the confluence of three factors. First the Health and Retirement Study became available for researchers in the United States, which provided much richer data to study retirement. Second, the Stock and Wise (1990) 'option value' framework introduced the dynamic and forward looking nature of the retirement decision. Finally, expanded computing power facilitated analysis of vast arrays of micro data in the Health and Retirement Study and from other sources. Following this break, the third set of studies built on the earlier work by incorporating dynamic measures of pension accruals into the analysis. Finally, the fourth set of studies has attempted to use natural experiments - policy changes - to estimate the sensitivity of retirement decisions to changes in incentives. To summarize the results of the body of research, we have provided a listing of each study and its core result in Table 2.7.

2.4.1 Research on related topics

Before embarking on a tour through the evidence on public pensions and retirement, we briefly review some Canadian research on two related topics in order to provide more context. The first is the effect of private pensions. Pesando and Gunderson (1988, 1991) map out pension wealth profiles for common employer-provided pensions in Canada (flat benefit and final earnings plans) with the goal of identifying the incentives to work created by the structure of pensions plans. Unlike Lazear (1983), who finds that pension wealth peaks at the date that an individual first qualifies for early retirement, Pesando and Gunderson (1991) find that there is no clear peak age for pension wealth, and in fact the pension wealth profiles exhibit discontinuities. Given these profiles, Pesando and Gunderson (1988) argue that mandatory retirement bans and related legislation limit the ability of employers to design pension plans that create work disincentives through postponed retirement provisions that reduce pension wealth for retirement at older ages.

The second related topic is mandatory retirement. Kesselman (2004) and Gunderson (2003) provide thorough overviews of mandatory retirement practices in Canada. Kesselman (2004) argues against contractual mandatory retirement (ie. within an agreement between employers and employees in the form of a pension or collective agreement) as this often forces workers to leave their jobs earlier than desired and that banning mandatory retirement could help reduce the pressures associated with earlier retirement (eg. fiscal pressures or potential skill shortages). Gunderson (2003) argues against age discrimination but does not oppose contractual mandatory retirement as it may be preferred by workers and employers. Grierson and Shannon (2004) provide evidence that banning mandatory retirement in Canada would have little effect on the share of older people working, using the implementation of mandatory retirement bans in Manitoba and Quebec to identify this effect.

2.4.2 Early evidence on pension wealth and retirement

The first body of research on public pensions and retirement we examine is characterized by a focus on the level of pension wealth rather than the dynamic incentives that are featured in later work. Below, we review the main findings and provide a critical analysis of the key papers in the literature. We start with research that uses time series data, and therefore relies on variation in income security parameters or benefits over time to identify the effect of income security programs on labour supply. For example, Pellechio (1979) uses Canadian time series data from 1946 to 1975 to determine the effect of ISW on retirement using OAS, as well as the introduction of CPP/QPP, on non-participation rates of individuals age 65 and over. He finds that ISW has a positive and marginally significant impact on non-participation and that the introduction of CPP/QPP had a positive but insignificant impact on non-participation rates.

However, use of time series data can be misleading in determining the impact of income security programs. Over this period, there was a general tendency for participation rates of the elderly to decline and for benefit generosity to increase. The positive association found between ISW and non-participation may spuriously reflect the coincidence of the two trends which may have been changing for unrelated causes.[12] In addition to this, the introduction of CPP/QPP coincides with a reduction in OAS eligibility age to 65 and the introduction of GIS. The effects CPP/QPP relative to these other programs cannot be easily disentangled.

Studies that use cross-section data covering individuals in one year of data use differences in income security benefits across individuals to identify the effects of income security programs. Since policies are the same for everyone at a given point in time, cross-sectional variation in income security benefits actually reflects differences in individual characteristics - such as earnings histories and marital status - that determine benefits. As such, these studies may actually be identifying the effects of these characteristics on labour supply rather than the effect of income security programs.

To overcome this problem, many studies have tried using panel data to identify the parameters from changes in income security programs over time that influence the benefits individuals receive. The use of panel data, however, will not necessarily overcome the identification issues associated with cross-sectional or time series data. Boskin (1977), for example, uses a sample of white married males in their sixties from panel data to estimate the effects of Social Security benefits on the probability of retirement and finds that benefits have a positive and significant effect on retirement. However, when time effects are controlled for, the Social Security benefits are found to have a much smaller or insignificant effect, indicating that the original estimates are largely picking up general trends in benefits and retirement over time, and that identification of the effects of Social

[12] A linear time trend is included in Pellechio's model. The coefficient on the time trend is positive but not significantly different from zero.

Security benefits is relying on differences between individuals.

An influential paper by Boskin and Hurd (1984) uses U.S. panel data from the Retirement History Survey (RHS) from 1969-1973, a time when Social Security benefits grew rapidly due to ad hoc changes to U.S. Social Security legislation and the over-indexation of benefits. The rising benefits would have created an unexpected increase in Social Security wealth which could be expected to induce early retirement. Using a sample of white married men, Boskin and Hurd estimate the probability of retirement by age (59-65). They claim their results strongly support the hypothesis that unexpected changes in Social Security wealth have a positive effect on retirement and that younger individuals too young to claim benefit and with low assets would be little affected by the changes in SSW. However the positive estimates of the marginal effects of Social Security wealth on retirement are not statistically significant. In fact, only negative effects are statistically different from zero. Furthermore, since their econometric model controls for cohort effects and estimates the retirement probability by age, they effectively absorb any changes over time in benefits across individuals, and therefore rely on variation in benefits related to cross-sectional differences in individual characteristics for identification.

Boskin and Hurd (1978) also use U.S. panel data from the RHS (1969-1971) to estimate the probability of making the transition from work to retirement. Using a sample of white married males age 62-65, they find that higher Social Security benefits imply a higher probability of retirement. However there appear to be several identification issues for their econometric model. The main identification issue is a lack of clarity about the identification of the effect of Social Security benefits. First, they include gross wages, Social Security benefit levels, and net wages in the model. Given that the latter two variables are actually functions of the gross wage, it is not clear how they can disentangle the effects of each variable separately. Second, they use instrumental variables to control for the fact that tastes for work may influence both Social Security benefits (through work habits and the marginal tax rate) and the probability of retirement. However, the instruments are merely a nonlinear combination of past wages and other income which implies they are not picking up any exogenous variation in benefits.

Diamond and Hausman (1984) use the U.S. National Longitudinal Survey of Older Men (1966-1978) to determine the effects of bad health, unemployment, and permanent income on retirement in two stages. First, they use a sample of males age 45-69 to estimate hazard models for the transition into retirement. The find that Social Security benefits, interacted with age indicators to account for age-related provisions, have large positive effects on the probability of retirement. However, since age indicators do not enter the hazard model separately, the Social Security variables may simply be picking up spikes in the retirement hazards not related to Social Security programs. Furthermore, the key finding of this study is that simulations based on these results imply roughly half of all retirements of men age

62-64 are due to the availability of reduced Social Security benefits. However, this is based on a comparison of estimated retirement rates to estimated retirement rates setting the Social Security benefit to zero, effectively eliminating any general age effects of retirement decisions which should not be attributed to Social Security. It also appears to be the case that their model is largely picking up the general trend of increasing Social Security benefits and decreasing participation rates. For example, when the model is estimated using a sample from 1973-1978 (a period with relatively large drops in participation rates and relatively large increases in Social Security benefits) the effect of Social Security is much higher than in the full 1966-1978 sample. In the second stage, Diamond and Hausman use a probit model and a competing risks model to estimate the probability of older unemployed workers entering either retirement or new employment. Similar to the first stage, they find that higher Social Security benefits (interacted with age) lead to a higher probability of retirement.

Burtless (1986) uses U.S. panel data from the RHS to estimate the age at which an individual retires. He uses an econometric model that describes the utility maximizing behaviour of individuals when choosing their retirement age and allows for anticipated increases in Social Security benefits to affect individuals differently than unanticipated increases in benefits. Based on a sample of men aged 58 to 63 in 1969, (excluding farmers, disabled men, men who retired before age 54, and men receiving substantial income from welfare programs, federal civil service pensions and railroad retirement benefits,) Burtless finds that increasing Social Security benefits by 20 percent (10 percent in 1969 and 1972) have a short run effect of reducing the expected retirement age by 0.09 years (roughly 1 month) and a long run effect of reducing the retirement age by 0.17 years (roughly 2 months) and increasing the probability of retirement at ages 62 and 65 by about 2 percent. Given these estimates, Burtless concludes that the observed decline in retirement ages and employment of older males over this period cannot be explained by Social Security alone. As with other studies in this era, however, Burtless's reliance on changes in Social Security over time should make us question whether the results found merely reflect a spurious correlation between rising benefits and falling retirement ages.

A few recent studies follow methodologies comparable to this early set of studies. Compton (2000) attempts to determine the effect of Canada's income security programs on retirement decisions using data from the Survey of Labour and Income Dynamics 1993-1996. Compton uses a sample of individuals age 50 and over to estimate a hazard model for entry to retirement and uses a sample of individuals age 55 and over to estimate an ordered probit for exit from full time employment to full time employment, partial retirement, or full retirement. A weakness of this approach is the lack of sufficient historical earnings information to accurately construct the earnings history and pension entitlement of each individual.

The key covariate used to identify the effect of income security programs in these models is the individual's expected CPP benefits. Overall, Compton finds that income security programs have no effect on retirement decisions. It is not clear, however, whether an individual's benefits are measured appropriately. To measure expected benefits, Compton estimates the CPP/QPP benefit level that an individual could expect at age 60 using reported benefits from SLID, and then imputes this amount for individuals in the sample (even if they are over age 60). While the estimation procedure does account for the fact that she can only observe CPP/QPP benefits among recipients, the variables used in estimating CPP/QPP are not exogenous to the retirement decision and are also included in the econometric models. This leaves the identification of the retirement effect to depend on the shapes of the assumed distribution, which is a fairly tenuous base for inference. Furthermore, Compton attempts to separate wealth and substitution effects by including variables for investment income and home ownership in the model. It is not clear that investment income can capture wealth effects, nor is it clear that these variables can capture the wealth effects of income security programs. Finally, the results show insignificant effects of financial incentives on retirement only because the standard errors are very large. The lack of precision means that large effects cannot be ruled out based on this evidence.

Tompa (1999) investigates various determinants of individuals' decisions to take up CPP/QPP retirement benefits. Tompa uses a sample of individuals turning age 60 between 1987 and 1994 from the Longitudinal Administrative Databank at Statistics Canada, a subset of the T1 Family File (T1FF is a yearly cross-sectional file of all tax filers and their families) to estimate a hazard model for the duration from age 59 to the age of first take-up of benefits. Tompa finds that for women, higher levels of CPP/QPP income actually reduce the likelihood of taking up CPP/QPP, while for men the level of CPP/QPP income is insignificant for the take-up decision. It is not clear, however, that Tompa's analysis provides us with much information about how levels of CPP/QPP benefits affect the take-up decision, and especially retirement, since the CPP/QPP income variable included in the model is the observed benefit an individual is collecting, not the benefit that a person would be entitled to at each age. Tompa does find that poor job prospects, health and joint retirement decisions are important determinants of CPP/QPP takeup.

2.4.3 Structural models of retirement

Structural estimation involves a more explicit use of an economic model of behaviour. The advantage of structural estimation is that one may study the long run equilibrium effects of changes in policy and perform policy experiments on the model, once the structural parameters are estimated. The disadvantages of this approach are a sometimes less rigorous attention to the identification of parameters and the requirement of sometimes strong assumptions about the 'correct' specification of the model.

Fields and Mitchell (1984) estimate a structural model to determine the effects of several changes to Social Security in the US introduced in 1983. The reforms included raising the normal retirement age, delaying cost of living adjustments, lowering early retirement benefits and increasing late retirement payments. To obtain the parameter values of the structural model, they use a sample of white, married, male private sector employees between age 59 and 61 in 1969, following individuals to 1979, to estimate a conditional ordered logit model of retirement ages. Retirement age is defined as the age at which a worker left his 1969 job. To make the data relevant to the early 1980s, they inflate earnings profiles to reflect the increase in average wages between the 1970s and 1982, inflate private pension benefits for inflation, apply tax formulas for 1982, and use 1982 Social Security benefit rules to calculate benefits. They find that the reforms mentioned above would have a positive impact on the average retirement age. For example, increasing the normal retirement age from 65 to 68 would on average increase retirement ages by 1.6 months. While it is not clear that the data used to estimate this model is appropriate, the interesting point to take from this study is that a three year increase in the normal retirement age is not expected to increase retirement ages by three years, rather it may only increase retirement ages by a couple months.

Similar to Fields and Mitchell (1984), Gustman and Steinmeier (1985) also estimate a structural model to examine the effects of the U.S. program reforms in 1983. Their model is more parsimonious in that they use a modified life-cycle model with a CES utility function over consumption and leisure (individual characteristics will affect the weight placed on leisure) and the standard lifetime budget constraint, but allow individuals to work full time or part time (at a lower wage). They use a sample of white males who are not self-employed when working full-time from the RHS (1969-1975) to estimate the parameters of this model. They find that increasing the normal retirement age from age 65 to age 67 would reduce the probability of entering retirement at age 65 by roughly 4 percentage points. At age 67, the probability of entering retirement would increase by roughly 1 percentage point, indicating results similar to Fields and Mitchell (1984) whereby increasing the normal retirement age will not increase the average retirement ages by the same amount.

To summarize, the structural modeling line of research has yielded significant insights into what would happen under proposed 'counterfactual' reforms. By estimating deep structural parameters governing behaviour, a good base is made for inference about reforms such as extending the retirement age.

2.4.4 Estimation of accrual and level effects of pensions

A newer generation of studies attempts to estimate the effects of income security programs on labour market behaviour by estimating reduced form models that incorporate both the incentives for an individual to continue working and measures of income security wealth using cross section or panel data. This literature follows the work of Stock and Wise (1990) whereby individuals' decision to retire depends on the option value of continuing to work. That is, an individual will compare the expected present value of retiring to the value of continued work with the option to retire in the future. Recent studies have several features in common; these features be discussed here prior to discussing the individual papers.

The reduced form models typically take the form of a probit model in which the dependent variable is dummy variable indicating whether an individual enters retirement. The key explanatory variable is a forward looking measure intended to capture the incentives of income security programs and is measured in one of three ways. First, the simplest measure is referred to as a single year accrual which captures the effect of another year of work on future income security benefits. This is defined as the expected present discounted value of income security benefits if a person were to retire in the next year, less the expected present discounted value of benefits if a person were to retire in the current year. The single year accrual measure will be positive if continuing to work for an additional year increases the future benefits from income security benefits.

A second incentives measure, peak value, accounts for the income security benefits accrual possible if the individual retires many years into the future. For this measure, the expected present discounted value of benefits for all possible future retirement ages is evaluated and an optimal date of retirement based on these benefits is determined. The peak value is then the expected present discounted value of benefits if the individual retires at this optimal date less the value if the individual retires immediately.

The third incentives measure is similar to the peak value but for this measure the expected present discounted value of wage and non-labour income in addition to benefits for all possible future retirement ages is evaluated to determine an optimal date of retirement. Furthermore, an indirect utility function is placed over wages and benefits, often using behavioural parameters estimated by Stock and Wise (1990). The option value is then the expected present discounted value of indirect utility over wages and benefits if the individual retires at an optimal date less the value if the individual retires immediately. While this third measure is more parsimonious than the first two, it is computationally cumbersome and requires relatively more assumptions regarding individuals' expectations of future income.

In these retirement models there are several identification issues. First, individuals are more likely to prefer retirement as they age. A linear age variable will potentially capture this effect if preferences for leisure evolve linearly with age. Wage earnings may also proxy for differences in the preference for work. However, both age and wages enter in the calculation of income security benefits in the incentives measures. As such, including age and wage measures as covariates may make it more difficult to isolate the effects of program incentives from worker heterogeneity. We can expect that the inclusion of such variables will result in understating the effect of program incentives. Similarly, the option value measure, as it captures the full financial incentive on retirement of both future wage earnings and income security benefits combined, may reflect in part this wage proxy for heterogeneity, rather than the financial retirement incentives.

A second issue arises because it is common to find that the retirement rate at the 'normal' retirement age (or age of first eligibility for benefits) is much larger than predicted rate based on financial incentives alone. This likely reflects a liquidity constraint - many employees have not saved enough to retire without receiving Social Security or employer-provided pension benefits. Inclusion of indicator variables for each age allows for such jumps in retirement rates, but we might not be able to isolate the effect of financial incentive measures from plan eligibility ages.

Gruber and Wise (2004) provide a country-by-country analysis of retirement behaviour that follows the standard approach described here. The goal of the Gruber and Wise volume is to provide comparable estimates of the effect that income security programs have on retirement behaviour across countries, following up on the work of Gruber and Wise (1999) which identified the income security program incentives to retire early in several countries.

In each chapter, the authors from the country estimate the probability of entering retirement as it depends on the incentives found in each country's income security programs. The retirement probits for each country include a measure of the incentives that income security programs provide (ie. the one year accrual, peak value or option value measure), a control variable for income security wealth, and controls for age, earnings, industry sector, and demographics such as sex and education. The common finding among most of the country analyses (some of which are described in more detail below) is that the retirement incentives inherent in most income security programs are strongly related to retirement and this finding rarely depends on whether age indicators or a linear age variable is used in the specification. In a few cases, however, the estimated effect of incentives is not statistically significant and of the wrong sign. In many cases, the effect of income security wealth is not statistically significant from zero and is often of the wrong sign. These results may partly be due to relatively little variation in income security wealth in some countries, while there is more variation in the incentives measures. However, the overwhelming impression from the twelve country studies is the consistency of a positive impact of ISW levels on retirement and a negative impact of higher accruals.

Baker et al. (2004a) provide the Canadian analysis of the effect of income security programs on retirement behaviour. The primary data source used in this analysis is the Longitudinal Worker File developed by the Business and Labour Market Analysis Division of Statistics Canada. The data set combines information from three administrative data files: the T-4 file of Revenue Canada, the Record of Employment file of HRDC and the Longitudinal Employment Analysis Program of Statistics Canada. The Longitudinal Worker File provides information on individuals' wages and salaries, 3-digit industry codes, province and size of establishment for each job the individual holds in a given year, their age, sex and job tenure. The focus of the analysis is the period 1985-1995. Separate samples of males and females aged 55-69 in 1985 are drawn, and then younger cohorts of individuals are added as they turn 55 in 1986-1995. The sample excludes agricultural workers, individuals in other primary industries and individuals with missing age, sex, or province variables. The sample is selected conditional on working (defined as positive T-4 earnings). If an individual has positive earnings in one year and zero earnings in the next, the year of positive earnings is considered the retirement year.[13]

In the empirical analysis, incentives measures are constructed as described above. There are a few things to note about the income profiles required in the construction of these measures. While earnings histories are available for each individual back to 1978, information on earnings back to 1966 and in the future must be imputed for the purposes of calculating CPP/QPP entitlements. Similarly, several assumptions regarding spouses are required to impute non-labour income profiles. For OAS entitlement, the authors are not able to deal with residency requirement. For CPP/QPP entitlements, the authors are not able to account for years spent using disability benefits or years spent caring for children.

Baker et al. (2004a) provide several specifications for the retirement probit, estimated separately for men and women, using either the one year accrual, peak value or option value incentives measures and either a linear age variable or age indicator variables. In all specifications they find that income security wealth has a positive and significant effect on retirement and that incentives to continue working have a negative and significant effect on entry to retirement. The largest estimates for men are found when using the one-year accrual measure with a linear age variable, whereby a US$1,000 increase in accrual is associated with a 2.21 percentage point decline in retirement rates. A US$1,000 increase in accrual is associated with a 1.52 percentage point decline in retirement when age indicator variables are included in the model. The reduced effect of these incentives when age dummies are included in the model may be associated with these variables picking up the effect of the income security program's eligibility ages. For example, the size of the estimate for the age 60 indicator is consistently and substantially larger than the age 59 indicator, implying that the availability of CPP/QPP benefits may have some impact on retirement decisions beyond what can be explained by the changes in financial incentives alone. As discussed above, however, it is impossible to separate the effect of program eligibility from general tastes and trends in retirement behaviour.

In a complementary analysis, Baker et al. (2003) find similar, although slightly smaller

[13]Baker et al. (2003) test other definitions of entry to retirement that include EI earnings with labour market earnings, or included earnings below a minimum threshold with zero earnings, and do not find that the different definition significantly affects the direction of the results.

effects of income security programs on retirement behaviour when using a sample of men age 55-64. For example, they find that a $1,000 increase in the one-year accrual results in a 0.98 percentage point decrease in retirement rates among men, compared to the 1.52 percentage point decrease associated with a US$1,000 increase in the one-year accrual in the comparable specification described above. The smaller estimates result in part from a much richer set of controls for the earnings of each individual. This provides one of the main findings of the paper - that richer earnings controls may attenuate some of the estimated parameters observed in the literature.

The 2003 piece also extends their 2004 analysis by checking the results in subsamples of the main data to see if the pattern of results across samples conforms with the patterns predicted by theory and economic intuition. They find that the incentives measures have a larger effect among individuals with a lower probability of being covered by an employer-provided pension plan (RPP) than individuals with a high probability of RPP coverage. Furthermore, the incentives measures have the largest effect on individuals in the lowest average lifetime income quartile. In contrast, among men in higher income quartiles, the incentives measures have a positive or insignificant effect. These estimates indicate that individuals likely to be more dependent on income from income security programs are more sensitive to program rules. It also suggests that the work disincentives bite hardest among those who may most need extra income in their retirement years.

Coile and Gruber (2004) find similar results to Baker et al. (2003, 2004a) for the United States using data from the Health and Retirement Survey (1992-1998). The HRS is a survey of individuals age 51-61 in 1992 and their spouses. They construct person-year observations for each year between 1980 and 1997 in which the individual is between the ages of 55 and 69 and working at the beginning of the year, using information from the earnings histories available in the HRS. To note, they exclude any individuals that would have retired prior to age 55 or appear to have re-entered the labour force following retirement.

Coile and Gruber (2004) also provide several specifications for their probit model, comparable to Baker et al. (2004a), but find that Social Security has a much smaller effect. In all specifications, Social Security wealth has a positive estimated effect, however the effect is not always significantly different from zero. The results for the incentives measures are more ambiguous. When using a linear age variable in the regression, a $1000 increase in the one year accrual variable is associated with a positive effect on retirement rates (0.0015 percentage point increase) among men.[14] The negative effect of the peak value and option value incentives measures are significant in most specifications, however the peak value does not significantly affect retirement rates among women. Interestingly, probits using age indicator variables consistently demonstrate relatively large increases in retirement rates at age 60, similar to those in Canada, yet the individuals in this study are not eligible for Social

[14]There is also a positive but insignificant effect when age indicator variables are used in the regression.

Security benefits until age 62.[15]

Coile and Gruber (2000) estimate similar retirement models that incorporate both Social Security and private (employer-provided) pension incentives, and find that the results differ from those for Social Security alone. The incentives variables used in their probit models include income from private pensions, derived from the pension determination information in the HRS.[16] In comparison to the results using only Social Security, incorporating pensions results in a negative and significant coefficient on the one-year accrual variable. Furthermore, the effect of the peak value incentives is half as large and the coefficient on Social Security wealth is significant when pensions are included in the incentives measure, suggesting that people are less responsive to changes in pension incentives than Social Security wealth.

Coile and Gruber (2000) also provide specifications with additional control variables including an indicator of poor health, affecting the magnitude and significance of their estimates. Limited attention has been paid to the role of health in Canada. Campolieti (2002) estimates probit models for the participation of older workers in Canada as it depends on an indicator of disability status, but does not control for public pensions or any other form of income in models. Magee (2002) uses information in SLID to determine the effects of self-reported health and disability on several reasons for job separation and finds that health or work-related disability does not have a significant effect on the probability of job separation due to retirement. These results may not tell us much about retirement, however, since job separation due to illness and disability is also a possible response to the job separation question and those who separate from a job due to illness and simultaneously retire may not be associated with retirement in this study.

Several studies using European data have found results similar to those for the U.S. and Canada. Börsch-Supan (2000) uses data from the German Socio-Economic Panel (1984-1996) to estimate retirement probits similar to those found in Gruber and Wise (2004). Using a sample of 55 to 70 year old men and women, they find that the incentives to delay retirement created by income security programs (measured using the option value) have negative and significant effects on the probability of retirement. Furthermore, their simulations suggest that if Germany were to move to an actuarially fair benefit formula, early retirement would occur less frequently. The model does not separately control for income security wealth. Interestingly, there are no spikes in the pattern of estimated coefficients reported for age indicators despite spikes in Germany's distribution of retirement ages at age 60 and 65. This would indicate that observed increases in retirement at these ages are due solely to the incentives found in income security programs and in the absence of these

[15] There are much larger spikes in the estimated retirement rates at age 62 and 65 than at age 60.

[16] They omit observations that are missing pension data, thereby dropping 40% of the observations used in the income security analysis. Most of these omitted observations were individuals from smaller firms with lower retirement rates, earnings, education and tenure.

programs there would merely be a pattern that reflects older workers being more likely to retire than younger workers.

Börsch-Supan (2000) also uses country level data to provide a qualitative investigation into the relationship between the incentives found in income security programs and labour force participation in Europe. Börsch-Supan finds that in almost all cases spikes in the distribution of retirement ages can be identified with ages in which certain pension rules start of cease to apply, as these rules often create kinks in the income security accrual profiles. (Here, income security accrual is measured as the percentage change in income security wealth for one year of delayed retirement for the average worker within a country.)

Blöndal and Scarpetta (1998) attempt to provide a quantitative cross-country time series analysis of the relationship between income security program incentives and retirement behaviour in their work for the OECD. They estimate labour force participation rates of older men (55-64) using an accrual rate (measured as the percent change in old-age pension benefits for a 55 year old male by working for 10 more years), replacement rates of unemployment, disability, old-age pension and special early retirement benefits, the unemployment rate of prime age males, the share of the prime age population in the total working age population, union density, and the standard age of entitlement to old-age pensions as explanatory variables. They find that higher accrual rates are significantly associated with higher participation rates.

While in theory this type of cross-country analysis could be useful as it relies on cross-country variation in income security programs to identify the effects of these programs, in practice it is not clear that this type of analysis is informative as it requires extreme simplifications of very complex programs in order to measure variables in a way that would be comparable across countries. For example, in this study, the accrual rate is measured for a specific type of individual who delays retirement for a long period of time. In many countries, accrual profiles are highly non-linear. As such, unless accrual profiles in all countries are linear it is not clear that the analysis will adequately measure the incentives provided by income security programs. As an example, based on calculations of the accrual rate using income security wealth calculations by Blanchet and Pélé (1999, Table 3.5) the accrual rate for a 55 year old postponing retirement until 65 is -25% while the accrual rate for postponing retirement until 60 is 7% and postponement until age 57 is 16%. In this case, the accrual rate used by Blöndal and Scarpetta would not properly capture the retirement incentives contained in France's income security programs.

2.4.5 Natural Experiments

As discussed earlier in this section of the paper, the key problem with using cross-sectional and time series data for the study of retirement is the difficulty in ensuring that the estimated effects of income security programs are not merely picking up differences across individuals or general trends in retirement and benefits over time. One potential solution to this problem is to identify natural experiments - situations in which program changes affect one group in the population (the treatment group) but not a different yet similar group (control group) - and see how the treatment group behaves differently in response to program changes. In general, these studies have shown mixed evidence on the effect of income security programs on retirement behaviour.

One of the first examples of natural experiments being used to identify the effects of income security programs on labour supply is a study by Krueger and Pischke (1992) in which they rely on a change to U.S. Social Security provisions in 1977 that reduced benefits for some individuals based only on their year of birth. Specifically, prior to 1977, a situation referred to as double indexation existed because average monthly earnings (AME) were increasing with inflation and under the benefit calculation rules, the replacement rate attached to each bracket in the benefits formula was set to increase with inflation. As a result, workers who postponed retirement could increase their benefits at a rate greater than what would be actuarially fair. To eliminate this double indexation, the amendment introduced a new benefit formula in which average indexed monthly earnings (AIME) are used instead of AME (AIME is indexed to average wage growth) and the replacement rates were held constant while the brackets for each replacement rate were adjusted for changes in the average annual wage. These amendments were phased in over 5 years. The affected group, therefore, was individuals born 1917-1921. This group became known as the 'notch generation.' In effect, these changes resulted in an exogenous and unexpected reduction in ISW for the notch generation that can act as an experiment for identifying the effects of ISW.

Krueger and Pischke use a sample of 60-68 year old males from the March CPS (1976-1988) to estimate logit models for labour force participation rates that control for both ISW and the growth in ISW for delaying retirement one year, as well as age and time effects. Their findings suggest that the negative relationship typically found between ISW and labour supply is spurious. For example, when year effects are not controlled for, ISW is found to have a negative effect on participation rates and the growth in ISW for delayed retirement has a positive and significant effect. However, when time effects are accounted for, both ISW and growth in ISW have an insignificant and positive effect on participation. Furthermore, they use logit models controlling for coverage by the 1977 changes in benefits (similar in concept to a DD estimator) and find that the changes had a negative effect on labour force participation rates and weeks worked and a positive effect on the proportion of individuals reporting being retired.

Several natural experiments have been found in Canada. Baker and Benjamin (1999a,b) rely on differences in the timing of program changes in CPP and QPP to identify the effects of income security programs on retirement behaviour. Baker and Benjamin (1999a) look at the introduction of early retirement provisions in CPP/QPP which were introduced earlier in Quebec (1984) than the rest of Canada (1987). Using a standard Differences in Differences (DD) analysis (with the control group defined by geography), they found that while the introduction of these provisions significantly increased the rate of CPP take-up, it did not have a significant impact on labour force participation, indicating that those taking up the early pension benefits were only marginally attached to the labour force and the new provisions did not affect labour force behaviour.

One problem with this type of analysis, however, is that it is only able to capture the immediate effects of policy changes. In this case, many individuals age 60-64 at the time that early retirement provisions were introduced would have already planned their retirement based on their savings, employer-provided pensions, and the previously existing policy rules. As such, only individuals with little other income would have the immediate incentive to collect benefits. Younger cohorts would have time to adjust their lifetime leisure-consumption plans and employers may adjust their pension provisions in light of the changes to CPP/QPP.[17] Thus, while no immediate effects on labour supply are found, a long-run analysis may find some effect.[18]

Baker and Benjamin (1999b) consider the effect of the elimination of the earnings test in CPP (1975) and QPP (1977) for individuals age 65-69, potentially making work more attractive. The DD estimator used here again relies on geography to define the control group. A DDD estimator, which uses individuals age 60-64 as an additional control group, is also used. From their analysis, it is clear that the removal of the earnings test resulted in higher take-up rates but had no significant effect on retirement, employment or participation rates. From the DDD analysis, they conclude that the removal of the test is associated with large shifts from part year full time work to full year full time work among older men. However, it is not clear that the 60-64 year old group is a suitable control group because forward-looking 60-64 year olds would find their incentives affected by this policy change as well.

Baker (2002) uses DD estimators to determine the effect that the introduction of the SPA in 1975 had on the labour market behaviour of married men (age 65-75 with spouses age 60-64) and women (age 60-64 with spouses age 65-75). For the control groups, it is assumed that any individuals who did not immediately qualify for SPA benefits (i.e. men with younger or older spouses, single men, and women with younger spouses or younger women with spouses over 65) would not be affected by the policy change. Baker finds that men eligible for the SPA experienced a relative decline in their labour force participation with the introduction of the program. Among eligible women, they find some negative effect

[17] Gruber (2000) tests whether early retirement provisions affected younger males and found no effect.

[18] For example, Baker and Benjamin (1999a) demonstrate that after the early retirement provisions were introduced, retirement hazards at age 60-64 increased. However, it is not possible to disentangle general trends in retirement from the long-run effects of policy change.

of the SPA on women's participation in that participation rates of SPA eligible women did not rise with the participation rates of other women. This finding is not consistent across control groups, however, and the largest effects are found when women age 60-64 with spouses under age 65 are used as control groups. Given that the spouses in the treatment group (men 65-75) were affected by the elimination of the earnings test in 1975, these results could be biased by the contemporaneous reform.

In summary, evidence based on natural experiments has been mixed and largely inconclusive. In some cases, such as the study of the 'notch' generation in the United States by Krueger and Pischke, little effect of income security programs was found. In other cases, such as Baker's study of the Spouse's Allowance in Canada, a strong and significant effect was found. The weakness of this approach for the study of retirement may lie in the time necessary to respond to a change in policy. The short run impact may differ from the long run impact.

2.5 Conclusions

This paper has described Canada's retirement income security system and provided an empirical context in which to understand its impacts on the retirement decisions of elderly Canadians. In the simulations, we find that many components of the system act independently and in concert to change the incentives to retire. While these incentives are not large compared to some European countries, it is worth reflection that they are strongest for those who receive the GIS. Moreover, Baker et al. (2003) find that the reaction of these lower-income individuals to the work disincentives is stronger than it is for higher-income individuals. Since GIS recipients are from the bottom one third of the senior income distribution, this means that the strongest disincentives are faced by those who perhaps might most benefit from some extra income in their retirement years.

Looking at the international empirical research record, we find a fairly consistent and robust pattern of evidence suggesting that financial incentives in public pension programs affect retirement decisions. While other factors such as family, health, and community likely enter the decision to retire in addition to the financial motive, the clearest and most direct policy lever to affect retirement decisions is through the structure of public pension programs. This means that decisions made in the presence of these work disincentives differ from those that would be made under a 'neutral' system, implying a policy-induced inefficiency.

We close by noting that some inefficiency in the provision of retirement income to seniors may be unavoidable in a practice. As with the provision of many public programs, there is a trade-off between equity and efficiency. For many low-income seniors, the retirement income security system in Canada provides a significant portion of their total income and contributes significantly to poverty alleviation. Sensible reforms will seek a balance between equity and efficiency improvements.

Table 2.1. Basic statistics on simulated individuals

	Ages				
	60	65	75	85	95
Male Probability of living to age, given alive at 55	0.959	0.895	0.662	0.299	0.039
Female Probability of living to age, given alive at 55	0.975	0.938	0.796	0.493	0.113
Annual OAS entitlement	0	5328	5328	5328	5328
Annual CPP entitlement if claim CPP at 60	6335	6335	6335	6335	6335
Annual GIS entitlement if claim CPP at 60	0	3169	3169	3169	3169
Annual CPP entitlement if claim CPP at 65	0	9501	9501	9501	9501
Annual GIS entitlement if claim CPP at 65	0	1586	1586	1586	1586

Note. — All dollar values in 2002 Canadian dollars. All reported entitlements are annual flows at 2002 rates for singles.

Table 2.2. Base case simulations

	ISW at 55	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	ISW at 70
		accruals															
Males																	
Single	142109	1269	1073	71	23	16	-1544	-2737	-3430	-4050	-4488	-6503	-6328	-6147	-5955	-4794	98585
Married	249141	1637	1355	93	39	13	-1064	-1929	-2577	-3201	-3749	-7904	-7762	-7790	-7850	-7492	200960
Females																	
Single	174951	1457	1233	81	28	17	-1084	-2452	-3202	-3886	-4392	-6573	-6465	-6352	-6232	-4787	132342
Married	250039	1654	1340	104	49	-1	-734	-1886	-2602	-3297	-3917	-8114	-8045	-8152	-8295	-7662	200481

Note. — All dollar values in 2002 Canadian dollars. Reported are the one-year accruals of ISW from ages 55 to 69, as well as the age 55 and age 70 ISW level amounts.

Table 2.3. Private pension simulations

	ISW								accruals							ISW
	at 55	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	at 70
Base Case	142109	1269	1073	71	23	16	-1544	-2737	-3430	-4050	-4488	-6503	-6328	-6147	-5955	-4794	98585
Private Pension Amount																	
$2,000	131118	1007	844	54	24	15	-2341	-2884	-3332	-3787	-4175	-5563	-4719	-3129	-3335	-3512	96285
$4,000	117926	902	756	47	20	15	-2025	-2531	-2999	-2769	-1194	-2324	-2609	-2866	-3087	-3282	93980
$6,000	104481	898	764	47	12	20	-544	350	-88	-516	-889	-2033	-2333	-2604	-2838	-3048	91679
$8,000	96950	1603	1360	84	24	32	1079	603	151	-291	-673	-1743	-2056	-2341	-2590	-2813	89379

Note. — All dollar values in 2002 Canadian dollars. Reported are the one-year accruals of ISW from ages 55 to 69, as well as the age 55 and age 70 ISW level amounts. The simulations are for single males.

Table 2.4. Range of Earnings Simulations

	ISW at 55	accruals 55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	ISW at 70
Base Case	142109	1269	1073	71	23	16	-1544	-2737	-3430	-4050	-4488	-6503	-6328	-6147	-5955	-4794	98585
Earnings History																	
80%	137017	1359	1186	329	283	274	-994	-1943	-3031	-3652	-4152	-6378	-6196	-6009	-5815	-5624	96654
60%	127608	1358	1241	582	565	558	-318	-851	-1640	-2284	-3388	-6227	-6027	-5836	-5632	-5433	94276
40%	116777	1367	1272	848	825	832	132	-299	-723	-1176	-1579	-5271	-5293	-5641	-5433	-5218	91420
20%	105946	1367	1319	1100	1100	1091	582	260	-76	-450	-789	-4745	-4618	-4493	-4529	-4506	88559

Note. — All dollar values in 2002 Canadian dollars. Reported are the one-year accruals of ISW from ages 55 to 69, as well as the age 55 and age 70 ISW level amounts. The simulations are for single males.

Table 2.5. Work interruption simulations

	ISW at 55	55	56	57	58	59	60	61	accruals 62	63	64	65	66	67	68	69	ISW at 70
Base Case	142109	1269	1073	71	23	16	-1544	-2737	-3430	-4050	-4488	-6503	-6328	-6147	-5955	-4794	98585
Years Worked																	
80%	132187	1366	1359	1367	1358	1367	-713	-1496	-2838	-3529	-4008	-5965	-5799	-5630	-5881	-5157	97988
60%	123610	1367	1358	1367	1359	1366	-126	-662	-1363	-2052	-3140	-5910	-5726	-5545	-5365	-5182	95356
40%	115018	1358	1367	1359	1366	1359	226	-218	-656	-1152	-1539	-4974	-5280	-5460	-5263	-5068	92443
20%	105082	1367	1359	1366	1359	1367	626	301	-50	-438	-766	-4564	-4444	-4352	-4450	-4685	89078

Note. — All dollar values in 2002 Canadian dollars. Reported are the one-year accruals of ISW from ages 55 to 69, as well as the age 55 and age 70 ISW level amounts. The simulations are for single males.

Table 2.6. Illustrative Policy Simulations

	ISW at 55	accruals															ISW at 70
		55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	
Base Case	142109	1269	1073	71	23	16	-1544	-2737	-3430	-4050	-4488	-6503	-6328	-6147	-5955	-4794	98585
Policy																	
A	134174	1131	950	55	24	15	1253	-249	-2116	-3072	-3853	-6027	-5917	-5799	-3985	-3133	103451
B	142109	1269	1073	71	23	16	-1484	-2688	-3403	-4035	-4484	-6516	-6333	-6155	-5963	-4582	98918
C	140747	1974	1669	107	36	28	944	-205	-846	-1428	-1805	-4983	-5139	-5268	-5362	-5431	115038
D	142109	1269	1073	71	23	16	-1544	-2737	-3430	-4050	-4488	-2347	-2375	-2395	-2401	-1436	117358

Note. — All dollar values in 2002 Canadian dollars. Reported are the one-year accruals of ISW from ages 55 to 69, as well as the age 55 and age 70 ISW level amounts. The simulations are for single males. Policies A through D are described in the text.

Table 2.7. Summary of Retirement Studies

Paper	Primary Data Source	Analysis	Key Results
Boskin (1977)	U.S., PSID (1968-72)	Estimate the effect of Social Security benefits on the probability of retirement using a logit model.	• An increase in benefits from $3000 to $4000 per year raises the probability of retirement from 7.5 to 16%.
Pellechio (1979)	Canadian time series data (1946-1975), Economic Council	Estimates effect of ISW from OAS and introduction of CPP on nonparticipation rates age 65+ using a 2SLS model	• A $2300 increase in ISW (1971 dollars) raises the nonparticipation rate from 67.9 to 73.2 (6.1 percentage points). • Introduction of CPP/QPP raised the nonparticipation rate.
Boskin and Hurd (1978)	U.S. RHS (1969-1971)	Estimate the effect of Social Security benefits on the probability of retirement using a logit model with instrumental variables.	• A $1000 increase in benefits raises the probability of retirement by 8 percentage points over two years. (The estimated probability of retirement is 11.5%.)
Diamond and Hausman (1984)	U.S. NLS of Older Men, (1966-1978)	Estimate hazard models for the transition into retirement and probit models for the transition from unemployment to either retirement or employment.	• About half of all retirements of men age 62-64 are due to the availability of reduced Social Security benefits.
Boskin and Hurd (1984)	U.S. RHS (1969-1972)	Estimate effect of ISW on the probability of retirement by age using a logit model that captures cohort effects.	• A US$10000 increase in ISW (in 1969 dollars) raises the retirement rate by 7.8 percentage points. • The increase in Social Security benefits can account for the entire 8.2 percentage point decline in participation rates of older men from 1968 to 1973.

Table 2.7 – Continued

Paper	Primary Data Source	Analysis	Key Results
Fields and Mitchell (1984)	U.S. RHS (1969-1979)	Estimate the effect of Social Security program reforms using a structural model.	• Increasing the normal retirement age from 65 to 68 would on average increase retirement ages by 1.6 months.
Gustman and Steinmeier (1985)	U.S. RHS (1969-1975)	Estimate the effect of Social Security program reforms using a structural model.	• Increasing the normal retirement age from 65 to 67 would reduce the probability of retirement at 65 by 4 percentage points while increasing the probability of retirement at 67 by 1 percentage point.
Burtless (1986)	U.S. RHS (1969-1979)	Estimate short and long run effects of Social Security benefit increases on retirement age using an econometric model that accounts for anticipated and unanticipated benefit increases.	• In the short run, increasing benefits by 10% in 1969 and 1972 reduced the retirement age by 0.09 years • In the long run, increasing benefits above their 1969 level by 20% reduced the retirement age by 0.17 years (2 months) and raised the likelihood of retirement at ages 62 and 65 by 2%.
Tompa (1999)	Canadian LAD (1987-1994)	Estimates the effect of CPP/QPP benefits on CPP/QPP take-up using duration models.	• For women, higher levels of CPP income actually reduce the likelihood of taking up CPP. • For men, the level of CPP income has no effect on the CPP/QPP take-up decision
Compton (2001)	Canadian SLID (1993-1996)	Estimates the effect of CPP/QPP benefits on entry to retirement using hazard and ordered probit models	• Finds income security programs have no effect on retirement
Blondal and Scarpetta (1998)	Various sources	Estimate labour force participation rates across countries to determine the effects of income security program incentives on retirement behaviour	• Increasing the pension accrual rate by 10 percentage points would increase labour force participation rates of men 55-64 by1.3-2.5 percentage points.

Table 2.7 – Continued

Paper	Primary Data Source	Analysis	Key Results
Börsch-Supan (2000)	Germany GSOEP (1984-1996)	Estimate retirement probit models to determine the effect of incentives to continue work based on income security programs, controls for random effect.	• An increase in incentives is associated with a decrease in the retirement rate. • Introducing an actuarially fair benefit formula to Germanys pension system would cause retirement at ages 59 and below to drop from 28.6% to 18.5%.
Coile and Gruber (2000)	US HRS (1992-1998)	Estimate retirement probit models to determine the effects of Social Security wealth and incentives to continue work based on Social Security and private pensions.	• A US$1000 increase in incentives is associated with a 0.00025-0.00044 percentage point decrease in the retirement rate among men when pensions are included in the incentives measures and a 0.00065 to -0.00047 percentage point change when pensions are not included. • A US$10000 increase in Social Security wealth is associated with a 0.025-0.057 percentage point increase in retirement rates among men when pensions are included in the incentives measures and a 0.32-0.41 percentage point increase when pensions are not included.
Baker, Gruber and Milligan (2003)	Canadian LWF (1978-1996)	Estimate retirement probit models to determine the effects of income security wealth and associated incentives to continue work.	• A $1000 increase in income security wealth accrual is associated with a 0.19-2.43 percentage point decrease in the retirement rate among men and a 0.01-3.48 percentage point decrease among women. • A $10000 increase in income security wealth is associated with a -0.32 to 0.69 percentage point change in the retirement rate among men and a -0.12 to 0.83 percentage point change among women.

Table 2.7 – Continued

Paper	Primary Data Source	Analysis	Key Results
Coile and Gruber (2004)	US HRS (1992-1998)	Estimate retirement probit models to determine the effects of Social Security wealth and associated incentives to continue work.	• A US$1000 increase in Social Security wealth accrual is associated with a -0.0005 to 0.0015 percentage point change in the retirement rate among men and a -0.00005 to 0.0006 percentage point change among women. • A US$10000 increase in Social Security wealth is associated with a 0.11 to 0.35 percentage point increase in the retirement rate among men and a 0.18 to 0.26 percentage point increase among women.
Baker, Gruber and Milligan (2004)	Canadian LWF (1978-1996)	Estimate retirement probit models to determine the effects of income security wealth and associated incentives to continue work.	• A US$1000 increase in income security wealth accrual is associated with a 0.67 2.21 percentage point decrease in the retirement rate among men and a 0.24-2.06 percentage point decrease among women. • A US$10000 increase in income security wealth is associated with a 0.01-0.09 percentage point increase in the retirement rate among men and a 0.02-0.09 percentage point increase among women.
Krueger and Pischke (1992)	U.S. March CPS (1976-1988), cohort level data	Estimate effect of ISW and one year accrual for delayed retirement on retirement indicators using a logit model. Identification from Notch generation.	• Growth in U.S. Social Security benefits in the 1970s could explain less than 1/6 of the observed decline in male labour force participation rates (based on the largest estimates).

Table 2.7 – Continued

Paper	Primary Data Source	Analysis	Key Results
Baker and Benjamin (1999a)	Canadian SCF Individual files, (1982-83 and 1985-1990)	D-D analysis, estimate effect of introducing early retirement provisions to CPP/QPP on labour force participation of older men.	• Introduction of early retirement provisions led to a significant increase in benefit take-up among men age 60-64, but did not increase the incidence of early retirement.
Baker and Benjamin (1999b)	Canadian SCF Census family files, (1972, 74, 76, 78 and 80).	D-D analysis, estimate effect of eliminating retirement test (tax-back of earnings) from CPP/QPP on labour supply of older men.	• Eliminating the retirement test led to large shifts from part year full time work to full year full time work among older men.
Baker (2002)	Canadian SCF Census family files, (1972, 74, 76, 78 and 80), excludes Quebec.	D-D analysis, estimate effect of introducing SPA on labour market attachment of older individuals	• The participation rates of SPA eligible men fell 7-11 percentage points relative to other men between 1972 and 1980. 6-7 percentage points of this decrease are attributable to the introduction of the SPA. • The participation rates of SPA eligible women remained fairly constant from 1972 to 1980 while the participation rates of other women rose. 4-9 percentage points of the 5-10 percentage point divergence in participation rates may be attributed to the introduction of the SPA.

Note – Data set acronyms used include: CPS Current Population Survey; HRS Health and Retirement Survey; LWF Longitudinal Worker File; NLS National Longitudinal Study; PSID Panel Study of Income Dynamics; RHS Retirement History Survey; SCF Survey of Consumer Finances; SLID Survey of Labour and Income Dynamics.

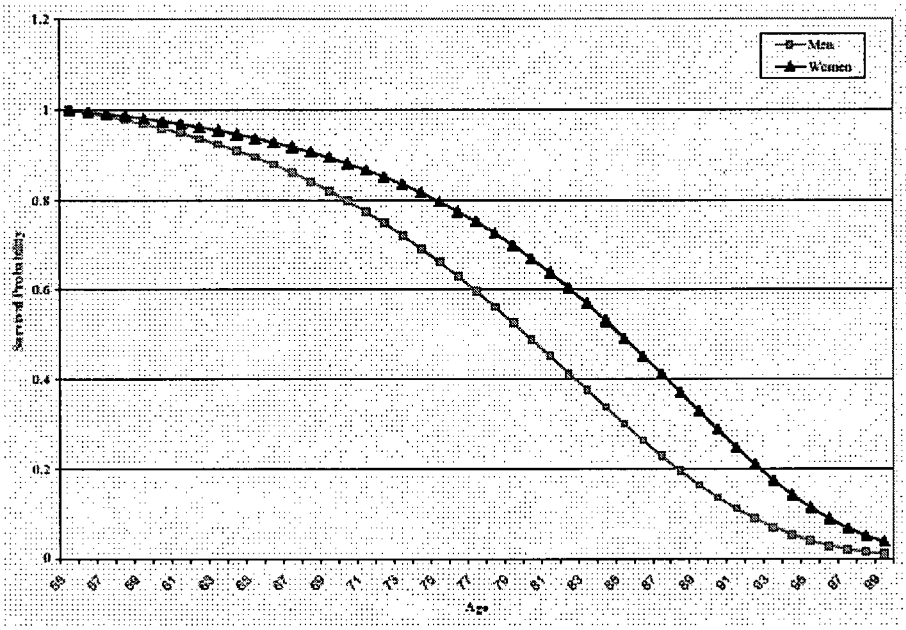

Figure 2.1 Male and Female Survival Probabilities
Source: Statistics Canada (2002)

Chapter 3

The Effects of Health and Financial Incentives on Retirement Decisions in Canada

3.1 Introduction

Concerns about the social and economic consequences of population aging have sparked an interest in the labour force behaviour of older workers. Currently, nearly one third of Canada's adult population is at least 55 years old and this proportion is expected to increase to 40% by 2026 (Habtu, 2002) as individuals are living longer and the baby boom generation is entering their sixties.[1] Population aging is likely to lead to higher expenditures on health care, income security programs, and other publicly funded programs used by our seniors.[2] The long-term viability of these programs, however, is being called into question as most programs continue to be financed on a 'pay as you go' basis and there will be relatively fewer young people available to finance these programs. Furthermore, labour force participation rates of older workers reached record lows in the mid-1990s. Between 1976 and 1996 participation rates of older workers over age 55 fell by 25% and have only recently begun to increase.[3] Given these long-term trends there are concerns that skill

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

[1]I refer to the 'baby boom' generation as individuals born 1946-1959. The 'baby bust' refers to those born 1960-1973 and the 'echo of the baby boom' refers to individuals born after 1973. These definitions follow Beaudry and Parent (2000).

[2]To note, older individuals' health care is much more costly than health care for younger individuals. See Figure 3.1 for some details.

[3]Calculated using CANSIM II series V2461251. The decline in participation rates is attributed to older men, as in Figure 3.2. The participation rates of older women increased over time, most recently for women age 60-64 as in Figure 3.3

shortages may occur as the baby boomers leave the labour force.

These various concerns have spurred interest in finding ways to ensure that the potential supply of labour by older workers is efficiently utilized. Baker et al. (2003, 2004a) demonstrate that Canada's Income Security programs contain provisions that may distort the labour market decisions of older individuals, by providing incentives to enter early retirement. Morissette et al. (2004) find that over one quarter of retirees might have changed their decision to retire if they had been able to reduce their work schedule without their employer-provided pension being affected. Furthermore, Morissette et al. (2004) find that one-third of recent retirees retired for health reasons. Ensuring that the labour market for older workers runs as efficiently as possible, through changes to public policy or other means, first requires a solid understanding of these factors that influence retirement decisions.[4]

In this paper I investigate how several factors may influence the retirement decision with a focus on an individual's health and their financial incentives to retire associated with income security programs, employer-provided pensions, and other sources of income. While the effects of income security programs on retirement decisions have been examined in the Canadian literature, limited attention has been paid to the role of health and employer-provided pensions. This paper contributes to the literature on retirement decisions by providing a more comprehensive examination of how these various factors affect retirement decisions. Also, I address several problems associated with identifying the effects of each factor by exploiting the panel aspect of the Survey of Labour and Income Dynamics, the primary source of data used in this study. I find that the structure of Canada's income security programs have importance incentive effects for retirement. I also find that employer-provided pensions significantly contribute to individual decisions to retire. Furthermore, I find that health has a clear and strong influence on retirement decisions.

In section 3.2 I begin by providing some context for this study with a brief review of the literature related to retirement incentives. This is followed by an overview of the environment in which older workers' decisions are made (in section 3.3). In section 3.4 I provide a theoretical framework for understanding the retirement decision. In section 3.5 I describe the econometric model that is estimated in this paper, the data used, and measurement of key variables. In section 3.6 I present the results of the statistical analysis. Finally, I offer some conclusions.

3.2 Previous Literature

In recent years the literature on retirement behaviour has mushroomed, examining the impacts of income security programs, health, employer-provided pensions, family charac-

[4]Older workers who retire for health reasons may or may not be considered a potential source of labour supply depending on how or whether their health interferes with their ability to work or receive training for employment suited to their health.

teristics, and several other factors on the labour supply of older workers. Despite the large international literature, however, there remains only a handful of Canadian studies examining retirement behaviour, and this literature has focussed almost exclusively on the role of income security programs. As several papers have reviewed different aspects of this literature in detail, in this section I provide a brief review of some key studies with a focus on the Canadian literature.[5]

In Chapter 2 I provided a thorough survey of the international evidence on public pensions and retirement, the largest branch of research on retirement behaviour. Recent Canadian studies have provided conflicting evidence on the effects of Canada's income security programs on retirement. On one hand, Baker et al. (2003, 2004a) use Canadian panel data (1985-1995) and an option value framework (described later in this paper) to show that wealth from income security benefits have a positive and significant effect on entry to retirement and that the incentives to continue working in income security programs have a negative and significant effect on retirement. Baker (2002) finds that the introduction of the SPA in 1975 had a negative effect on the labour force participation of men eligible for the program. On the other hand, Baker (2002) also finds that the SPA did not have a clear effect on the labour supply of eligible women. Furthermore, Baker and Benjamin (1999a) find that while the introduction of early retirement provisions to CPP/QPP significantly increased the rate of CPP/QPP take-up, it did not have a significant impact on labour force participation. Their results indicate that those taking up the early pension benefits were only marginally attached to the labour force anyway. Baker and Benjamin (1999b) consider the effect of the elimination of the earnings test in CPP (1975) and QPP (1977), potentially making work more attractive. They find that elimination of the earnings test had no significant effect on retirement, employment or participation rates. Removal of the test, however, is associated with shifts from part year full time work to full year full time work among older men. Despite the mixed evidence in Canada, the bulk of the international evidence suggests the structure of public pensions contributes to the retirement decision.

A second branch of research has examined the role of health in the retirement decision. Several U.S. studies have incorporated health into their analysis (including Coile and Gruber (2000) and Dwyer and Mitchell (1999)), however recent research in the U.S. finds that the availability of employer-provided retiree health insurance is an important factor that may act as a constraint for the retirement decision.[6] In Canada, the availability of retiree health

[5]In Chapter 2, we reviewed the empirical evidence on public pensions and retirement. Feldstein and Liebman (2002) provide a broad survey of public pensions while Krueger and Meyer (2002) focus on the labour market impacts of social insurance programs. Lumsdaine and Mitchell (1999) provide an overview of the theoretical issues involved in analysing retirement behaviour and the empirical evidence on the labour supply effects of public and private pensions. Lazear (1986) provides an earlier review of the retirement literature with a focus on private pensions. Currie and Madrian (1999) provide an overview of the literature linking health and labour market behaviour.

[6]A U.S. study by Gruber and Madrian (1995) suggest that one year of continued employer-provided post-retirement health insurance increases the retirement rate by 30%. Blau and Gilleskie (2001) and Blau and

insurance is not expected to be an important constraint for the retirement decision given Canada's universal health care system. Using Canadian data from the Survey of Labour and Income Dynamics, Magee (2002) finds that poor health and work-related disability do not have a significant effect on the probability of job separation due to retirement. These results may not tell us much about retirement, however, since job separation due to illness and disability is also a possible response to the job separation question in SLID, and those who separate from a job due to illness and simultaneously retire may not be associated with retirement in this study. Using Canadian data from the NPHS, Campolieti (2002) estimates probit models for the participation of older men as it depends on an indicator of disability status, and finds that disability has a large negative effect on labour force participation. Campolieti, however, does not control for public pensions or any other form of income in the models.

In the literature on health and retirement behaviour, there are concerns that the estimated effect of health on retirement behaviour may be biased. One potential source of bias is referred to as justification bias which arises if individuals are likely to rationalize their retirement by reporting poor health. Dwyer and Mitchell (1999) test self-ratings of poor health against more objective measures and find that there is no evidence in support of the justification hypothesis. Another related source of bias is measurement error in self-reported measures of health, which may be more problematic when using self-assessed measures of general health. Baker et al. (2004b) use NPHS data in conjunction with Ontario diagnostic/treatment records to examine the extent of this problem and find significantly high measurement error in objective measures of health, including false (positive and negative) reports of cancer. Furthermore, they find that for several conditions the misreporting of a health condition (false positive reporting) is negatively correlated with work (as opposed to not working).[7] As a third potential source of bias, there is some evidence that health improves with retirement, particularly among blue collar workers (Marshall and Clarke, 1998). If this is the case, the endogeneity of health would lead to a downward bias in the estimated effect of health if health is reported after entry to retirement.

In a third branch of retirement research, a handful of Canadian studies have examined how employer-provided pension plans may affect an individual's retirement decision. Pesando and Gunderson (1988, 1991) map out pension wealth profiles for common employer-provided pensions in Canada (including flat benefit and final earnings plans) with the goal of identifying the incentives to work created by the structure of pension plans. Unlike Lazear (1983), who finds that pension wealth peaks at the date that an individual first qualifies for early retirement, Pesando and Gunderson (1991) find that there is no clear peak age

Gilleskie (2003) also find that the availability of retiree health insurance has an impact on the employment behaviour of older men in the U.S..

[7]This result is only significant for conditions with higher potential for personal subjective assessment (eg. back problems).

for pension wealth, and in fact the pension wealth profiles exhibit discontinuities. Pesando and Gunderson, however, do not attempt to estimate the effects that the incentives created by pension plans have on observed retirement behaviour. Whether pension plans will have an effect is not obvious, as Morissette and Zhang (2004) have recently shown that many individuals are not aware of whether a pension plan is provided by their employer.

3.3 Canada's Retirement Income System

Canada's retirement income system consists of several parts. First, Canada has a set of income security programs that provide retirement income to the elderly including the Canada Pension Plan and Quebec Pension Plan (CPP/QPP), Old Age Security (OAS), the Guaranteed Income Supplement (GIS) and the (Spousal) Allowance (SPA). Second, the government provides tax assistance for savings through employer-provided pension plans (or Registered Pension Plans) and Registered Retirement Savings Plans. Many individuals also rely on other forms of private savings for their retirement.

3.3.1 Income Security Programs

The various components of Canada's income security programs and the financial incentives they create to enter retirement were thoroughly examined in Chapter 2 and are only briefly outlined here.[8] The largest component of the system is the CPP/QPP, through which individuals over the age of 60 are eligible for an earnings-related pension upon retirement. Any individual over the age of 65 (who meets residency requirements) is also eligible for the OAS pension (a cash transfer that is clawed back from high income individuals). The GIS is an income-tested benefit also available to individuals over 65, with benefit amounts depending on marital status and family income. Finally, the Allowance (SPA) is another income-tested benefit available to 60-64 year old spouses of OAS recipients and widows/widowers.

Canada's income security programs appear to be an important source of income for retirees. More than three quarters of Canadians age 60-68 who are not in the labour force receive CPP/QPP benefits (see Table 3.1). One quarter of these individuals receive GIS benefits and half receive OAS. Roughly half of individuals age 60-68 out of the labour force receive the majority of their income from income security programs. Given their importance as a source of retirement income and the retirement incentives built into the structure of these programs (demonstrated in Chapter 2) we would expect Canada's income security programs to affect retirement decisions.

[8]The financial incentives found in Canada's income security programs are further discussed in Appendix A.

3.3.2 Employer-Provided Pension Plans

In Canada, less than half of paid workers are covered by a registered pension plan (RPP). The proportion of female paid workers covered by pension plans remained fairly constant during the 1990s around 40%. For men however, the proportion covered by pension plans dropped from 49% in 1991 to 41% in 2001.[9] The vast majority of employer-provided pension plans in Canada take the form of defined benefit plans which provide a monthly benefit that typically depends on the years a person has spent with the employer, the wages they earn and the individual's age of retirement. In 1996, 88% of pension plans were defined benefit plans while 10% were defined contribution plans. Over recent years a larger proportion of plans have taken the form of defined contribution plans, for which pension benefits vary depending on the contributions accumulated for each individual and the return on investment. In 2001, 14% of pension plans were defined contribution plans.

Pension benefits are an important source of income for retirees. 44% of older individuals out of the labour force have income from employer provided pension plans and this is the major source of income for 29% of these individuals (see Table 3.1).

3.3.3 Other Sources of Income

Private savings may also be held in the form of Registered Retirement Savings Plans which are not accounted for in this study. Although RRSPs have become much more commonly used by Canadians, it does not appear to be the case that RRSPs will account for a large portion of current retirees' incomes. Using a sample of economic families with at least one member between the ages of 45 and 64 from the 1999 Survey of Financial Security, while 74% of these families reported that they have ever had an RRSP, only 64% of families held positive RRSP investments. The median RRSP holding was only $11,500. When RRIFs are included with RRSP holdings, the median for these economic families rises to $13,000. The median value of RRIF and RRSP holding for economic families with at least one member over 65 was zero as only 27% of these families have positive RRSP holdings.

Aside from the resources already discussed here, some retirees may rely on investment income, provincial social assistance, disability benefits, or other transfers to fund their retirement. While a large portion of older individuals receive some form of investment income, very few rely on this as their main source of income. Only 9% of individuals age 60-68 who are not in the labour force report investment income as their major source of income (see Table 3.1). Those age 50-59 who are not in the labour force rely more heavily on investment income. Of these individuals, 15% report investment income as their major source of income, although only 32% have any investment income. Reliance on other forms of income such as disability benefits or provincial social assistance is much more common

[9] Pension coverage from Statistics Canada (2002a)

among younger retirees.

3.4 Modelling the Retirement Decision

There are several ways to model the retirement decision.[10] In the simplest model, individuals choose a path of lifetime consumption and labour supply to maximize utility subject to the constraint that the discounted present value of lifetime income equals the discounted present value of lifetime consumption. Changes in total lifetime income are expected to have wealth effects that allow the individual to enjoy more leisure. Given hours constraints faced by many individuals, it is expected that such wealth effects will reduce the number of years that an individual works.[11]

More recent modelling of lifetime labour supply recognizes that many forms of income depend on the age at which an individual retires in that additional years of work may raise remaining lifetime income. To capture the effect that the accrual of lifetime income could have on the retirement decision, and following the work of Stock and Wise (1990), the retirement decision is viewed as one in which individuals will choose to retire in the current period if the expected present value of retiring immediately is greater than the expected present value of continuing to work and holding the option of retiring in the future. Each period, if the individual continues to work, this decision is re-evaluated.

At age t, individuals will choose a retirement age (r) to maximize the expected present value of lifetime (indirect) utility $V_t(r)$ given by

$$E_t V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} \pi(s|t) U_w(y_s, w_s, X_s) + \sum_{s=r}^{T} \beta^{s-t} \pi(s|t) U_r(y_s, B_s(r), X_s) \qquad (3.1)$$

where U_w and U_r represent the indirect utility of future income while working and while retired respectively, w_s is the wage earned at age s, $B_s(r)$ are retirement benefits at age s that depend on the age of retirement, y_s is non-labour income at age s, and X_s represents individual characteristics. Future utility is discounted for the probability of survival to age s given survival to age t ($\pi(s|t)$) and discounted for preferences at $\beta = 1/(1+\delta)$.

Assuming individual characteristics act as preference shifters that are additively separable from the utility gained from income sources and separating health status from other preference shifters, (3.1) becomes

$$E_t V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} \pi(s|t) [U_w(y_s, w_s) + \gamma_w H_s + v_s]$$

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

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

$$+\sum_{s=r}^{T}\beta^{s-t}\pi(s|t)[U_r(y_s,B_s(r))+\gamma_r H_s+\xi_s] \tag{3.2}$$

where the preference shifter H_s represents the health status of an individual at time s, and υ_s and ξ_s are other preference shifters.

The decision to retire is based on comparing the utility of entering retirement at a future optimal age to the utility of retiring immediately, represented by

$$G_t(r^*) = E_tV_t(r^*) - E_tV_t(t) \tag{3.3}$$

where

$$r^* = \arg\max_{r\in t+1,t+2,\ldots,T} E_tV_t(r). \tag{3.4}$$

The retirement decision is made such that if $G_t(r^*) \leq 0$ the individual will enter retirement immediately. If $G_t(r^*) > 0$ the individual will delay retirement, hold the option of retiring in the future, and re-evaluate this decision in the next period.

Assuming the individual specific preference shifters follow a first order autoregressive process ($\upsilon_s = \rho\upsilon_{s-1} + \epsilon_{\upsilon s}$ and $\xi_s = \rho\xi_{s-1} + \epsilon_{\xi s}$ and $H_s = \rho_H H_{s-1} + \epsilon_{Hs}$), equation (3.3) may be written as

$$\begin{aligned} G_t(r^*) &= \left(\sum_{s=t}^{r^*-1}\beta^{s-t}\pi(s|t)U_w(y_s,w_s) + \sum_{s=r^*}^{T}\beta^{s-t}\pi(s|t)U_r(y_s,B_s(r^*))\right) \\ &\quad -\sum_{s=t}^{T}\beta^{s-t}\pi(s|t)U_r(y_s,B_s(t)) \\ &\quad +\sum_{s=t}^{r^*-1}\pi(s|t)(\beta\rho_H)^{s-t}[(\gamma_w-\gamma_r)H_t] + \sum_{s=t}^{r^*-1}\pi(s|t)(\beta\rho)^{s-t}[\upsilon_t-\xi_t] \quad (3.5) \\ G_t(r^*) &= g_t(r^*) + \gamma H_t + \lambda\eta_t \quad (3.6) \end{aligned}$$

Here, $g_t(r^*)$ represents the financial incentives that an individual has to delay retirement and hold the option of retiring at a future optimal date, H_t represents the individual's current health status, and η_t represents other current preference shifters.

The theory underlying retirement behaviour therefore implies that wealth, the accrual of wealth, and individual characteristics will matter for the retirement decision. Capturing wealth and accrual in practice will require choosing a functional form for the indirect utility function in (3.5). The general forms used for wealth and accrual variables, respectively, are

$$W_{it} = \sum_{s=t}^{T}\beta^{s-t}\pi(s|t)(y_s+B_s(t)) \tag{3.7}$$

$$g_{it} = \left(\sum_{s=t}^{r^*-1} \beta^{s-t}\pi(s|t)U_w(y_s, w_s) + \sum_{s=r^*}^{T} \beta^{s-t}\pi(s|t)U_r(y_s, B_s(r^*))\right) - \sum_{s=t}^{T} \beta^{s-t}\pi(s|t)U_r(y_s + B_s(t)) \quad (3.8)$$

The wealth variable W_{it} captures the present value of remaining lifetime income given that the individual retires in the current period. The accrual variables is typically defined in one of three ways. First, a one-year accrual variable is defined by placing a linear utility function over income and setting $r^* = t+1$, capturing the gains in expected lifetime income by delaying retirement for one year. More appropriate given the underlying theory is a peak value accrual variable, which also places a linear utility function over income but chooses r^* as the retirement age that maximizes the present value of future income. Stock and Wise (1990) parameterize the utility function as

$$U_w = (y_s + w_s)^\gamma \quad (3.9)$$

$$U_r = (ky_s + kB_s(r))^\gamma. \quad (3.10)$$

and then estimate the parameters. While several papers have used their estimates of k and γ in application of this theory, these parameters may only reflect the preferences of the individuals represented in their sample and are therefore not used in this paper.[12]

3.5 Estimating the Effects of Health and Financial Incentives

The preceding sections have suggested that Canada's retirement income system creates several incentives to enter retirement. The econometric model used to estimate the effect of these incentives as well as the effects of health and other characteristics is stated as

$$R^*_{it} = \beta_0 + \beta_1 W_{it} + \beta_2 g_{it} + \beta_3 H_{it} + \beta_4 X_{it} + \epsilon_{it} \quad (3.11)$$

where

- $R_{it} = 1$ if i enters retirement $(R^*_{it} > 0)$, and
- $R_{it} = 0$, if i continues to work $(R^*_{it} \leq 0)$.

R^*_{it} is a latent variable representing the gains in lifetime utility if the person retires in the current period relative to some future period. Although the difference in utility is unobserved, I observe individuals make the decision to either enter retirement or continue

[12] Stock and Wise (1990) use a sample of 1500 salesmen, 50 years of age or older in 1980, within a large firm and measure retirement benefits as the benefits these individuals would receive from a defined benefit pension plan. Income from public pensions is not considered in their procedure.

to work. As such, estimating equation (3.11) using a probit model is most appropriate. W_{it} is a measure of wealth, g_{it} is an accrual measure of the financial incentives to enter retirement, H_{it} represents the individuals current health, and X_{it} represents other factors we want to control for that would influence retirement decisions.

3.5.1 Data

The primary source of data used to estimate equation (3.11) is the Survey of Labour and Income Dynamics (SLID). SLID is a longitudinal survey following individuals over the course of 6 years, with three panels currently available (1993-1998, 1996-2001, and 1999-2002). From each year 1996-2001, I take a sample of individuals who spent at least part of that year in the labour force, are age 50-68, and are flagged as paid workers during the year.[13] I further exclude individuals whose labour force status or health information is missing. Since questions regarding health status were not asked until 1996, earlier years of the survey cannot be used here. Given the panel aspect of this survey, I am often able to use individuals' future and past information when defining variables.[14]

Two other sources of data are used in the construction of variables. First, I use estimates from the public use Survey of Consumer Finances Census Family files (1973, 1975, 1977, and 1979) and Individuals files (1981-82, and 1984-1997) to create the wage profiles discussed below. Second, I use the public use Census 1996 to match investment income to individuals in my sample, also discussed in more detail below. Third, survival probabilities are calculated using Statistics Canada's complete life tables (1995-1997).

3.5.2 Measurement of Key Variables

Retirement R_{it}

The definition of retirement used in this study is meant to capture individuals who depart from and remain out of the labour force for an extended period of time. A person is defined as entering retirement during the observation year if they report being in the labour force for at least part of the observation year and not at all in the labour force in the following year. A person is defined as not entering retirement if they continued in the labour force in the following year.

[13]To note, a self-employed worker will still be included in the sample if they also held a paid-worker job during the year. Using this flag rather than dropping all workers who were self-employed in the year allows me to keep individuals for whom self-employment is a secondary activity. Robustness checks discussed in the next section demonstrate that dropping all self-employed individuals will not change the final results.

[14]I do not have access to past (future) information when the individual is observed at the beginning (end) of the panel. As such, individuals observed at the end of each panel have to be dropped from the sample because I rely on future information to define their retirement status (see below). Similarly, when I rely on past health information to define my health variables (see below) I have to drop observations at the beginning of the panel. Furthermore, I am not able to observe past self-reported health status for years prior to 1996, so when relying on this information to define the health variable I have to drop all observations in 1996.

This definition of retirement results in an expected retirement hazard, presented in Figure 3.4. The retirement hazard represents the probability of entering retirement at each age given that the individual was in the labour force at that age. Small spikes in the probability of entering retirement occur at age 55 (when many employer-provided pension plans allow early retirement) and at age 60 (when individuals are first eligible for CPP/QPP). A large spike occurs at age 65 which is when individuals become eligible for several income security benefits and may be subject to mandatory retirement.

Individuals who enter retirement (by this definition) are also observed to have the expected income and labour market outcomes. There are few individuals who return to the labour force after entering retirement by this definition. Less than 10% of individuals aged 60-64 who would have been defined as retired would re-enter the labour force within four years of retiring (see Table 3.2). Many of these individuals may have spent only a short time unemployed within the four years. Individuals who have entered retirement also become much more likely to report pensions or government transfers as their major source of income, while those defined as continuing to work continue to report wages as their main source of income (see Table 3.3).

Health H_{it}

The health measure is intended to capture how a person's general health affects their decision to retire, expecting that poor health increases the disutility of work and therefore increases the likelihood of entering retirement. To measure health, I use individuals' self-reported current health status which may be rated excellent, very good, good, fair, or poor. Dummy variables are used to indicate reported health.

Using current health status, however, has its problems. First, respondents are asked in January following the survey year about their current health. As such, the current health variable is actually describing the individual's health at the end of the year rather than describing their health throughout the year. This could contribute to some identification issues since this health measure may be reported 'post-retirement'. As discussed earlier, the estimated effect of health may be biased upward if justification bias is a problem, or downward if health tends to improve after retirement.

To address these concerns, I have included specifications that use the individual's 'previous year' or past reports of health instead of the current health report. Effectively, this will be the individual's reported health at the beginning of the observation year rather than their health at the end of the year, hopefully picking up the health status that affected their decision to retire.

Health reported at the beginning of the year, however, will miss events that happen during the year to worsen the person's health and therefore push them into retirement. For example, this could be a general worsening of health or the onset of a disability. To address this I will also provide specifications that use health measures reflecting a change in health status. For example, I can measure whether the person reports not having a disability at the beginning of the year, but reports having a disability at the end of the year (using a disability status variable in SLID, I will later refer to this variable as 'New Disability'). I can also measure whether the person reports a worsening of health by comparing their reported health at the beginning of the year to their reported health at the end of the year (I refer to a 'small shock ' as measuring any worsening of health, and 'large shock' as measuring a worsening of health from excellent, very good or good to fair or poor). The various measures that I use are summarized in Table 3.4.

Financial Incentives g_{it} and W_{it}

Financial incentives are measured by including an accrual variable and a wealth variable in the econometric model, as described in section 3.4. This requires estimating expected future incomes from each source of income, contingent on all possible dates of retirement. When constructing the income profiles, I allow an individual to live up to the age of 102 and retire up to the age of 69.

With respect to income security program benefits, I determine the amount of benefits that a person will be eligible for upon retirement at each possible age. The calculation of CPP/QPP benefits requires a full wage history. I construct a wage history for each individual in several steps. First, I use the SCF and SLID to estimate annual wage regressions for men and women separately, with experience, education, province, and marital status as explanatory variables and then use these estimates to impute a wage history.[15] For years prior to 1973, I use the 1973 estimates and adjust the earnings for inflation. I have a full marital history for individuals and use this when imputing wages.[16] In the second step, I use the individuals' years of full time full year equivalent experience (provided in SLID) to determine how many years of this history should be filled with zeros. I then fill the appropriate number of years at the beginning of the wage history with zeros. Finally, to determine benefits when a person does not immediately enter retirement, I assume that wage earnings will grow with expected inflation with no real wage growth. Given this wage history, I use the policy parameters in place in the observation year to calculate the CPP/QPP benefits the individual is eligible for.[17]

[15]The highest level of education report in SLID is recoded into 6 categories (grade 8 or less, grade 9-10, high school (not making a distinction for graduation), some post-secondary education, post-secondary degree (less than Bachelor's degree), and university degree (Bachelor's degree or higher) to match the coding of education in the SCF. I also add a random component to their annual earnings based on the variance in unexplained earnings in each year. Adding the random component adds variation to the wage distribution but does not affect results.

[16]There are a handful of observations with no marital history. For these individuals I use their current marital status and date of first marriage to create a marital history.

[17]I am not able to account for the drop-out provisions related to child care and disability.

Calculation of OAS, GIS, and SPA is much simpler. OAS is adjusted for the residency requirements when the individual is an immigrant according to the year the person immigrated. All amounts take into consideration the expected income from other sources when calculating the amount the person is eligible for.

For employer-provided pension benefits, I am able to observe whether a person is covered by a pension plan with their employer, whether they contribute to a pension plan, and any income from registered pension plans. Unfortunately, I am not able to observe specific provisions of individuals' pension plans. I assume that if a person reports they are not covered by a pension plan, report zero contributions to an RPP, and report zero pension income in the case that they do retire, that they will not have access to a pension plan when they retire. For these individuals I assume that the entire future stream of income from pension benefits is zero.

For individuals who appear to be covered by a pension plan with their employer, I impute a future pension for their stream of future income from pensions contingent on retirement age. To do this I estimate a heckman selection model for pension income (using maximum likelihood), which can be represented by

$$p^* = X\beta + u \tag{3.12}$$

$$R^* = Z\gamma + v \tag{3.13}$$

where p^* is the pension amount they would receive if they retired in year t and is only observed among individuals who retire ($R = 1$).[18] X includes the number of years an individual is with their employer, age indicators, union status, public or private sector, occupation indicators (10 groups), hourly wage, and size of the employer. Z includes X plus indicators for health, marital status, whether a spouse is in the labour force, number of children in the census family, and non-linear combinations of years with the employer and wages.

When imputing the pension amount for future retirement ages, I assume that the individual stays with their employer, thereby increasing the number of years with the employer, and that other job characteristics remain the same. I allow wages to increase with inflation with zero real wage growth.

Investment income is an important source of retirement income for some individuals, however estimating expected investment income is difficult. To impute future investment incomes, I match individuals in my sample to individuals in the Census and as-

[18] If the potential pension benefits of all individuals covered by a pension plan were observable, OLS would be sufficient for estimating the parameters used to impute potential pension benefits. However, I am only able to observe pension benefits if the individual enters retirement and therefore a sample selection problem arises if there are unobservable characteristics determining the pension that are related to whether a person enters retirement. The Heckman selection model accounts for this. If sample selection is not a problem, the estimates will be equivalent to those obtained using OLS.

sign investment income as the cell-specific expected median investment income $(Prob(I > 0)_c * (MedianI|I > 0)_c)$.[19]

I calculate the spouse's income as I do for the individuals I observe, except that some assumptions are made to simplify calculations. First, I assume that if a spouse is not currently in the labour force, they will remain out of the labour force for the rest of their lives. For spouses who are in the labour force, I assume they will stay in the labour force and then retire at age 60 or immediately if they are already over the age of 60. Survivor benefits under CPP/QPP are also calculated using this assumption

Finally, tax payable is calculated given each source of expected income and spouse's income, contingent on the date of retirement considered.

The projections of future income that I create approximate incomes actually observed fairly well. In Table 3.5, comparisons of the distributions of imputed and actual incomes are presented. The distribution of imputed wages, CPP/QPP, and OAS match the actual distributions very well. The amount of GIS a person is eligible for is typically underestimated, however, given overestimation of investment income. For pension income, a few individuals have been assigned a pension income although I don't see them collecting a pension when they retire.[20] This occurs because some individuals may not have been vested in the employer-provided pension plan upon retirement.

When constructing the wealth and accrual measures, incomes are discounted at a discount rate of 3% and for the probability of survival for the individual and their spouse. Finally, all financial incentives measures are stated in real terms.

Other Explanatory Variables X_{it}

In all specifications of equation (3.11), I include a full set of age indicators, province indicators, indicators for sex, marital status, whether a spouse enters retirement, whether a spouse has poor health, as well and the number of children under the age of 18 in the census family.

In some specifications, controls for lifetime earnings, experience, and current wages are included. Lifetime earnings represents the total imputed earnings of the individual since 1966 in real terms. This set of controls includes a cubic in lifetime earnings of the individual as well as a cubic in lifetime earnings of the spouse. Similarly, wage controls include a cubic

[19]Individuals are place in the following cells:

1. Not in the Labour Force: (a) 3 regions (East, Ontario, West), (b) 5 age groups (50-54, 55-59, 60-64, 65-75, 75+), (c) 2 marital status (married, not), (d) sex
2. In the Labour Force: (a) 3 regions (East, Ontario, West), (b) 4 age groups (50-54, 55-59, 60-64, 65-68), (c) 2 marital status (married, not), (d) sex, (e) 4 occupation groups (i. SOC91 (A-C) managers, professional, clerical, sciences; ii. SOC91 (D-F) health, government, teachers, art; iii. SOC91 (G) services; iv. SOC91 (H-J) trades, transport, manufacturing)

[20]Imputed pensions are zero below the 40th percentile among those who retired.

in the individuals' current wage and a cubic in the spouses' wage. Experience controls include a linear term for the years of full time full year equivalent experience of the individual and their spouse. These variables are included to control for individual heterogeneity that reflects differences in tastes for leisure. For example, we can expect that individuals with a higher preference for work will also have longer work histories and hence potentially higher wealth and accrual measures. If this heterogeneity is not controlled for, the estimated effects of wealth and accruals may be biased downward.

3.5.3 Identification of Wealth and Accrual Effects

A crucial issue in the analysis of the financial incentives in income security programs and employer-provided pensions is identification. The main concern here is that several individual attributes that we expect to influence the decision to retire - such as age or preferences for leisure (which may be proxied for with wages) - also determine in part the value of the incentives measures.[21] In this section, I exemplify the variation that is used to identify the incentive effects of income security programs and employer-provided pensions. As demonstrated in the following examples, there is very little exogenous variation in the income security wealth and accrual measures and this limitation of the data should be kept in mind when evaluating the results in subsequent sections. In contrast, measures of wealth and accrual that include employer-provided pension benefits have more exogenous variation available to identify their effects.

The distribution of the wealth and accrual measures are summarized in Tables 3.6-3.8. Three variations of the measure are used – the first only includes income from income security benefits, the second adds employer-provided pension income and the third includes all forms of income in the construction of the variable. From these tables, we can see that within each age group there is a considerable amount of variation in the wealth and accrual measures. Furthermore, we can see there is a great deal more variation in the wealth and accrual measures that include employer-provided pensions than those that only include income security benefits.

Within each age group at one point in time, the main source of variation in the income security wealth measures reflects differences in individuals' wage histories. The identifying variation for income security wealth and accruals largely relies on changes in wealth and accruals over time - both across individuals and for individuals that are repeated in the sample. For example, between 1997 and 1999, the CPP/QPP benefit formula changed so that the pension adjustment factor (see section 2.2.1) was reduced.[22] For an individual who

[21] See Gruber and Wise (2004, p.12-13) for more discussion of this issue in the context of analyzing the incentives in income security programs.

[22] Until 1997, the pension adjustment factor was based on a 3 year moving average of the year's maximum pensionable earnings. In 1998, this was based on a 4 year moving average and beginning in 1999 this was based on a 5 year moving average.

did not retire in 1997, subsequent values of income security wealth would be lower given the new policy and his revised expectations (holding all else constant).

A look at the median wealth and accrual by age in each of Tables 3.6-3.8 indicates that the individuals' age-wealth profiles that include employer-provided pensions are also more non-linear than the income security wealth profiles, and may include several local maxima in the profile (unlike the income security wealth profiles that appear likely to have a global maximum that is also the only local maximum in the profile). These non-linearities relate to the early and special retirement provisions of employer-provided pensions whereby employees are commonly offered bonuses for retirement at specific ages.[23] Effectively, these provisions will create some variation across age groups that does not merely reflect changes in an individuals' preferences for retirement over work but rather truly reflects differences in financial incentives. Within an age group, variation in the employer-provided pension benefits will reflect differences in union status, public or private sector employment, and job tenure. For an individual that is repeated in the sample, variation in their employer-provided wealth and peak accrual measures may have several sources. Primarily, the profiles will change for each year of delayed retirement given that the employee will observe a new average pension offer and this gets built into the employee's expected future pension benefits.[24] The individual will also see an increase in their pension offer relating to increases in their seniority and wages. For a few individuals in the sample, the choice not to retire may involve a change in employment that may entirely change the pension benefits they are eligible for.

Finally, suppose we held an individual's age-wealth profile constant over time. In this case, we will still see variation in the individual's peak accrual values if he or she remains in the sample. The nature of that variation depends on the shape of each individual's profile and the age they are first seen in the sample. For example, consider an individual with a fairly simple concave wealth profile with only one maximum. If the individual's peak wealth remains to be seen at a future age, delaying retirement will imply a smaller peak accrual value when the individual reconsiders their retirement decision the next period. As another example, consider an individual with a more complex age-wealth profile that involves several local maxima and the individual's preferences are such that he has already passed the age where the global maximum occurred (without retiring).[25] At an age where the individual is at or has just passed the global maximum, it is likely that peak accruals will be negative, reflecting the smallest amount a person has to lose by delaying retirement.

[23]Pescarus and Rivard (2005) indicate that such provisions are most common at ages 55 and 60 in Canadian pension plans, which corresponds to the median peak accrual values in Table 3.7. Such non-linearities are reflected in the coefficients on age when predicting an individual's pension benefits.

[24]This is accounted for by the inclusion of a set of year indicators when estimating the employee's pension offer.

[25]To note, we have to consider that the financial incentives discussed here are not the only factor affecting retirement decisions and might be balanced by the effects of other retirement determinants.

We would expect that a larger negative amount would lead to a higher likelihood of entering retirement. At another later age, the individual's peak accrual could turn positive again as they approach a local maximum.

To summarize, after age and individuals' wage histories (proxying for individuals' leisure preferences) are controlled for, there is little variation left in the measures of income security wealth and accrual. As such, any estimated incentive effects of income security programs may not be well-identified. In contrast, there is more identifying variation found in the incentive measures for employer provided pension plans.

3.6 Results

Results for various specifications of the retirement probit are presented in Tables 3.9 - 3.14. In each table, the wealth and accrual variables used in each specification vary according the income included in the calculation of these measures. In Table 3.9, the first set of specifications include only income from income security programs in the calculation of wealth and peak accrual. The second set adds pension income to income from income security programs and the third set adds investment income, wages, and taxes to the calculation of wealth and peak accrual variables. Within each block of the table, different specifications of the retirement probit are provided.

3.6.1 The Effects of Income Security Programs

Beginning with the impact that income security programs have on the decision to retire, results presented in the first column of Table 3.9 indicate that wealth from income security does not have a significant effect. As discussed in the previous section, however, the lack of significance here may in part be due to a lack of variation in income security wealth.[26] As Baker et al. (2003) also point out, there is a need to control for unobserved heterogeneity in work preferences. Here, individuals with higher incomes and longer work histories are likely to have higher income security wealth as well as higher preferences for work and a lower likelihood of entering retirement, resulting in a downward bias in the estimated effect of income security wealth. To control for this heterogeneity, I add the controls described earlier for lifetime earnings, current wages, and years of full time full year experience. As a result, the coefficient on income security wealth does increase substantially but is still not significant. To check whether these extra controls are sufficient, I use a fixed effects probit estimator, the results of which are presented in Table 3.10.[27] The fixed effects estimates

[26]The size of the effects are just as large as the effects of employer-provided pensions.

[27]The fixed effects probit involves an incidental parameters problem due to the connection between sample size and parameter space. As such, the fixed effects probit estimates are not consistent. Wooldridge (2002) conjectures that the estimators of the marginal effects have reasonable properties. Fernandez-Val (2005) finds the bias in estimators of marginal effects to be negligible. Note that the marginal effects presented in

are not substantially different from the estimates obtained with the retirement probits.

The accrual of income security wealth, measured using the peak accrual, is significant across specifications, even after we control for individual specific fixed effects. This would indicate that individuals pay attention to the amounts they can gain from income security programs by delaying retirement.

Considering the results presented in Table 3.11, where past health reports are used to measure poor health rather than current reported health, it appears that the endogeneity of health may be an issue when identifying the effects of income security programs. When using past health reports, the magnitude of the coefficients on income security wealth and accrual increase substantially, and the effect of income security wealth becomes marginally significant. However, when using other measures of health, as presented in Table 3.12, the income security wealth measure is not significant. The endogeneity and identification of the effects of health are discussed in more detail below.

Similar specifications using the one year accrual of income security wealth are presented in Table 3.13. Once the appropriate controls are included in the specifications, the effects of income security wealth are insignificant and the estimated effect of the one year accrual is insignificant and of the wrong sign. This is not surprising given the expectation that individuals are forward looking when making retirement decisions and wealth profiles may be non-linear, making the peak accrual measure more appropriate.

Finally, in Table 3.14 I check the robustness of these estimates to different sampling choices. In the first block of estimates in the table, I have additionally excluded any individuals who had no wage income in the observation year, despite reporting having been in the labour force. Effectively this excludes individuals who were unemployed during the observation year, but not employed, implying a slightly different measure of retirement. There are no substantial changes to the estimated effect of income security programs when compared to the estimates previously discussed. In the third block of the table, I further address the concern that the self-employed act very differently than paid workers by excluding individuals who spent any time self-employed in the observation year.[28] Again, the results are nearly identical to those presented in Table 3.9.

The collection of estimates imply that income security programs have important accrual effects, but may not have the significant wealth effects suggested by earlier studies. There are several potential explanations for the discrepancy in results. On one hand, early studies used data covering a time period in which benefit generosity was generally increasing while retirement age and labour force participation of older workers were falling and did not

Table 3.10, which are evaluated at the mean, are not directly comparable to the marginal effects presented in Table 3.9 as those are evaluated for a particular type of person.

[28]That is, the original sample used for the retirement probits kept any individual who was a paid worker at some point during the observation year. They may have also been self-employed at some point during the observation year.

always control for time effects. As such, these studies may have been picking up a spurious correlation between wealth from income security and the likelihood of entering retirement.[29] The time period used in this study, however, captures a period in which the labour force participation rates of older workers had levelled off and actually increased. Furthermore, in comparison to Baker et al. (2003) (who control for time effects), when constructing income and benefit measures I have more complete information regarding the length of time individuals have spent employed in their lifetime, improving my estimates of income security wealth and capturing the non-linear nature of wealth profiles. On the other hand, Baker et al. (2003) have access to more wage history information for the period they can observe and do not have to rely entirely on imputed wage histories as I do to create their measures of income security benefits. More importantly, as discussed in section 3.5.3 it may be the case that there is simply not enough exogenous variation in income security benefits formulas over the time period I study to identify any wealth effects.[30]

3.6.2 The Effects of Employer-Provided Pensions and Other Income

To see how employer provided pensions may affect retirement decisions differently than income security programs, I repeat the specifications used to test for the effects of income security program, but add pension income to the measures of wealth and accrual. In Table 3.9 these results are presented in the second block of the table. In each specification the wealth effects are positive and significant and accrual effects are negative and significant as expected. A large portion of the variation identifying these effects comes from differences across individuals' access to pension plans.[31] Concerns that there may be something specific about individuals that leads them into jobs with or without pensions and that this characteristics is also related to their preferences for work and therefore retirement would be addressed with the use of a fixed effects estimator. When the fixed effects estimator is used, results do not change substantially, as presented in Table 3.10.

The last set of retirement probits in Table 3.9 use wealth and accrual measures that include not only income security benefits and pension income, but wage income, investment income, and taxes as well. The estimated wealth and accrual effects differ only slightly from the wealth effects of employer-provided pensions.

[29] I have estimated models that include year effects. The size and significance of the coefficient on income security wealth diminishes when year indicators are included, but other results do not change significantly.

[30] Baker et al. (2003) were able to use more substantial policy changes, specifically the introduction of early retirement provisions in the mid-1980s, as a source of exogenous variation in their study.

[31] To note, one possible reason for the insignificance of income security wealth effects relative to the significance of wealth effects associated with employer-provided pensions is that there exists less variation in income security wealth (which can be accessed by virtually all retirees).

3.6.3 The Effects of Health

The estimates provided in Tables 3.9-3.14 consistently demonstrate that health status has a significant effect on the likelihood of entering retirement. The effect is substantial, as demonstrated in Table 3.9 where estimates imply that having poor health raises the likelihood of entering retirement by more than twenty percentage points.[32] Given the subjective nature of this health measure and the potential identification issues discussed earlier in this paper, it is useful to consider variety of measures to check the robustness of this result.

One concern was that individuals will mis-report their health in order to justify their retirement, creating an upward bias in the estimated effect of poor health. Using the past reports of poor health to create the health measure indicates this may be a concern. Comparing results in Tables 3.9 and 3.11, the magnitudes of the probit coefficients on health drop slightly when past health reports are used.[33] Similarly, estimates in the first block of Table 3.12 in which a complete set of current health indicators are used suggest poor health has a higher impact on retirement than when the past health reports are used as in the second block of Table 3.12. These estimates also suggests that any justification bias is greater than any bias associated with improved health with retirement.

While use of past health reports may correct for justification bias, estimates of the effect of health using past health reports may be biased downward if health shocks contribute significantly to retirement rates. As was demonstrated in Table 3.4, several individuals experience a worsening of their health over the year and this could push them into retirement. In the third, fourth and fifth blocks of Table 3.12 I have used indicators for the worsening of health and demonstrate that any worsening of health will raise the probability of entering retirement. The onset of a new disability will raise the likelihood of entering retirement by nine percentage points while experiencing a relatively large shock to health (such that you change your reported health from excellent, very good or good to fair or poor) raises the likelihood of entering retirement by roughly eight percentage points.[34]

To note, specifications of the probit that included indicators for access to health insurance and access to life and disability insurance through an employer, as well as interaction terms for poor health and access to insurance, were also estimated to check whether access to health insurance might act as a constraint as it appears to in the United States. Although the results are not presented here, the effect of insurance on the likelihood of retirement was completely insignificant. Furthermore, the effect of poor health did not differ between individuals with and without health or disability insurance.

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[32]The marginal effect is slightly lower for individuals under the age of 60 and slightly higher for individuals over age 60.

[33]Note that the coefficients on wealth and accrual also increase.

[34]Effects of health shocks are slightly higher (lower) for older (younger) individuals.

3.7 Conclusions

This study provides estimates of the effects of health, Canada's income security programs, and employer-provided pensions on individuals' decisions to enter retirement. The results indicate that individual health has a significant and strong influence on retirement behaviour. Identification issues associated with using self-assessed health measures have been addressed in this study, suggesting that justification bias may be an important problem that should be taken into consideration.

Examining the effects of income security programs on retirement behaviour, while the results suggest that income security programs do not have significant wealth effects, the accrual of income security wealth that can be achieved with delayed retirement appears significant. The estimated effects of income security wealth do not correspond to those found in several earlier studies that also estimate reduced form models of the decision to enter retirement. The insignificance of wealth effects, however, correspond to the results found in several studies using natural experiments to identify the effects of income security programs. It is likely the discrepancy between earlier studies and this study is due to a relative lack of exogenous variation available to identify the effect of income security wealth over the time period studied here.

The estimates provided in this paper suggest that employer-provided pensions have significant wealth and accrual effects on the decision to enter retirement. Wealth effects appear to be stronger than accrual effects, which in part captures the differences in wealth between those with and without pension plans. The addition of other forms of income to the measures of wealth and accrual do not significantly change the results, except that the accrual of wealth becomes more significant suggesting that individuals consider their entire financial picture when making the decision to retire.

These results potentially have important implications for policies affecting retirement income. Primarily, changes to the structure of benefit formulas that affect accruals in wealth may influence the timing of retirement. Furthermore, the interaction of different policies (such as the interaction between CPP/QPP and GIS) should be an important consideration. Finally, it is important to consider that the importance of health and other forms of income may trump the effects of financial incentives found in any income security program.

Table 3.1. Importance of Various Income Sources

	In the Labour Force		Not in Labour Force	
	50-59	60-68	50-59	60-68
Proportion Reporting Positive Income				
Wage	.93	.86	.13	.09
CPP/QPP	.03	.46	.2	.76
GIS	.	.07	.	.27
OAS	.	.2	.	.49
Investment	.4	.45	.32	.46
Pension	.06	.26	.21	.44
Proportion Reporting Majority of Income From Each Source				
Wage	.91	.71	.08	.02
CPP/QPP	.01	.09	.15	.26
OAS+GIS	.	.04	.	.25
Investment	.02	.04	.15	.09
Pension	.02	.1	.18	.29
No Income	.05	.02	.45	.09

Note. — SLID sample of individuals 1996-2001, age 50-68, who are not self-employed. The top panel describes the proportion of individuals in this sample reporting positive income from each source. The bottom panel describes the proportion of individuals for whom the given income source is the major source of income out of the sources listed here. The proportion with 'No Income' are those not reporting any income from wages, CPP/QPP, OAS, GIS, investments or pensions.

Table 3.2. Rate of Exit From Retirement

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

Note. — Using annual labour force status to define entry to retirement. Exit from retirement refers to re-entry to the labour force in the first, second, third, or fourth year after entry to retirement. This sample uses individuals defined as retiring in 1994 (first panel of SLID) or in 1997 (second panel of SLID), age 50-64 in 1994 or 1997

Table 3.3. Characteristics of Retirees and Non-Retirees

	$t-1$	t	$t+1$
Annual Labour Force Participation Rate			
$R=1$	.91	1	0
$R=0$	.99	1	1
Major Source of Income			
Wages, $R=1$	.76	.60	.09
Wages, $R=0$	.89	.90	.85
Pension, $R=1$	.06	.11	.35
Pension, $R=0$	.02	.02	.03
Transfers, $R=1$	.13	.19	.41
Transfers, $R=0$	.05	.04	.06
Average Wages and Salaries			
$R=1$	27780	19219	3320
$R=0$	33631	34729	33577

Note. — $R=1$ when the individual enters retirement in year t, $R=0$ otherwise. Annual labour force status is used to define entry to retirement, as described in the text. SLID sample of panel 1 individuals age 50-68 in 1994 and panel 2 individuals age 50-68 in 1997.

Table 3.4. Health Measures by Age

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

Note. — Using full sample of 25810 observations described in section 3.5. For past health information, only 17618 observations available. See text for definitions.

Table 3.5. The Distribution of Imputed and Actual Incomes

	Mean	Median	1st Dec.	9th Dec.	Std. Dev
$\widehat{Wage}_t$, $(R_t = 0)$	32284	25313	8890	65431	24292
$Wage_t$, $(R_t = 0)$	37331	32215	7000	68350	39121
$\widehat{Wage}_{t-1}$	33509	25552	8452	69988	26538
$Wage_{t-1}$	35778	31453	4834	66781	30860
$\widehat{CPP}_{t+1}$, $(R_t = 1)$	2935	199	0	7963	3399
CPP_{t+1}, $(R_t = 1)$	2944	0	0	8059	3636
$\widehat{CPP}_{t+1}$, $(R_t = 1, Age_{t+1} \geq 60)$	5568	6060	1443	8876	2693
CPP_{t+1}, $(R_t = 1, Age_{t+1} \geq 60)$	4809	5238	0	8637	3234
$\widehat{OAS}_{t+1}$, $(R_t = 1)$	1023	0	0	5049	1998
OAS_{t+1}, $(R_t = 1)$	901	0	0	4901	1877
$\widehat{OAS}_{t+1}$, $(R_t = 1, Age_{t+1} \geq 65)$	4776	5049	3660	5232	839
OAS_{t+1}, $(R_t = 1, Age_{t+1} \geq 65)$	4209	4901	1286	5232	1588
$\widehat{GIS}_{t+1}$, $(R_t = 1)$	97	0	0	0	558
GIS_{t+1}, $(R_t = 1)$	240	0	0	15	940
$\widehat{GIS}_{t+1}$, $(R_t = 1, Age_{t+1} \geq 65)$	451	0	0	0	1138
GIS_{t+1}, $(R_t = 1, Age_{t+1} \geq 65)$	878	0	0	3504	1618
$\widehat{Pension}_{t+1}$, $(R_t = 1)$	9533	6870	0	24898	10189
$Pension_{t+1}$, $(R_t = 1)$	9982	0	0	33956	14551
$\widehat{Pension}_{t+1}$, $(R_t = 1, Age_{t+1} \geq 60)$	8880	6870	0	22501	9318
$Pension_{t+1}$, $(R_t = 1, Age_{t+1} \geq 60)$	9266	2374	0	31212	12956
$\widehat{Investment}_t$, $(R_t = 1)$	909	920	467	1370	338
$Investment_t$, $(R_t = 1)$	1494	8	0	3848	7064
$\widehat{Investment}_t$, $(R_t = 0)$	523	437	229	886	322
$Investment_t$, $(R_t = 0)$	802	0	0	2041	3499

Note. — The sample used is the same as that described in section 3.5. Imputed incomes are denoted with $\widehat{\ }$. $R_t = 1$ indicates the individual entered retirement during the observation year t.

Table 3.6. The Distribution of Income Security Measures

		Wealth				One Year Accrual				Peak Accrual			
Age	N	Median	1st Dec.	9th Dec.	Std.Dev.	Median	1st Dec.	9th Dec.	Std.Dev.	Median	1st Dec.	9th Dec.	Std.Dev.
50	3,131	110147	80330	154600	29857	1775	588	6511	2665	12225	2961	23646	8121
51	2,870	114943	85363	160127	30417	897	-9625	1931	5934	9948	0	21219	9349
52	2,667	118252	85022	163287	32366	1865	599	4542	2152	10179	2542	22195	7847
53	2,483	123718	92480	172575	32565	1367	-3963	2235	3515	8608	493	20141	8474
54	2,288	128154	94965	177454	33533	1126	-1237	2219	3758	6956	828	19960	7651
55	1,986	134940	96968	183699	35556	1140	92	2737	1017	6794	852	20237	7812
56	1,726	136859	101748	189949	36073	1091	87	2527	914	5738	757	17586	7320
57	1,525	140724	105190	199882	37578	856	0	2330	1111	4200	346	14920	6371
58	1,333	147949	112786	209772	38981	976	12	2996	1779	2629	51	12340	6184
59	1,184	153417	119760	215285	39274	662	0	2224	1589	1066	0	8913	4442
60	1,045	159617	122410	225085	40926	-184	-2039	1446	1420	-88	-2036	7066	4689
61	866	165749	129239	234392	41521	-1039	-2739	1500	2154	-1039	-2739	5972	4344
62	726	171261	133587	245980	42464	-1876	-3938	117	2880	-1759	-3644	2608	3595
63	597	174123	137878	240763	40287	-2504	-4101	491	3232	-2504	-4101	3557	5335
64	461	178320	136963	250170	42932	-3177	-4625	803	2816	-3177	-4625	2988	3750
65	394	185119	135861	254223	43499	-3061	-5376	275	2352	-3061	-5376	1095	3183
66	231	186514	148680	249314	40753	-4415	-8158	-734	6546	-4165	-6238	177	3254
67	167	183368	129779	244861	43328	-4830	-7102	401	9558	-4830	-7102	401	9681
68	130	191543	146445	255467	45092	-5014	-7381	-934	2747	-5014	-7381	-934	2747

Note. — Description of sample and definitions of variables in section 3.5.

Table 3.7. The Distribution of Income Security + Pension Measures

		Wealth				One Year Accrual				Peak Accrual			
Age	N	Median	1st Dec.	9th Dec.	Std.Dev.	Median	1st Dec.	9th Dec.	Std.Dev.	Median	1st Dec.	9th Dec.	Std.Dev.
50	3,131	204072	96346	448996	147318	-9187	-65267	1732	29955	107896	5506	149898	59563
51	2,870	174181	100609	405799	129435	79562	715	132084	59179	155502	5075	205586	86032
52	2,667	266419	108314	507459	166529	-41754	-54436	1747	24828	59395	3890	89134	34098
53	2,483	225413	111290	472029	154192	46883	733	58369	25608	112735	3118	136583	57288
54	2,288	273574	118562	518201	164770	67073	631	81835	35733	68328	2603	83652	34314
55	1,986	344029	124555	590725	184606	-23148	-32707	1499	14378	-18907	-32707	12558	19159
56	1,726	305070	126361	546680	169383	-12853	-23696	1632	10440	439	-23696	17257	17615
57	1,525	284707	131189	536750	163862	1452	-2011	8625	4277	3114	-2011	25486	14816
58	1,333	274819	137719	543600	163252	-30311	-43267	1527	19815	137	-37957	15834	22819
59	1,184	254931	144166	506597	151043	2821	25	13954	5596	4708	79	48252	20946
60	1,045	257537	147919	504418	149748	-8486	-20787	334	8668	-857	-20787	36154	21088
61	866	255119	153223	479915	139655	-21232	-39290	-252	17017	-551	-13865	50751	24665
62	726	255196	155808	439787	120979	16828	-3325	30847	14507	17351	-3325	77402	33570
63	597	261815	156082	474867	137022	-34308	-50525	-1223	22059	1314	-4511	51211	25007
64	461	244065	154429	404648	100542	-21150	-35532	-528	14742	57558	-4198	99085	42637
65	394	233722	166686	402048	104203	-4221	-12131	101	5078	91029	-4692	128191	56882
66	231	233819	166382	413200	101780	110729	-5073	141875	61747	110729	-5073	141875	61721
67	167	279393	162572	547821	147559	-111457	-164307	-3297	74175	-111457	-164307	-3297	74199
68	130	242735	163157	387834	85649	-7041	-20889	-2354	6963	-7041	-20889	-2354	6963

Note. — Description of sample and definitions of variables in section 3.5.

Table 3.8. The Distribution of Total Income Measures

	Wealth				One Year Accrual				Peak Accrual			
Age	Median	1st Dec.	9th Dec.	Std.Dev.	Median	1st Dec.	9th Dec.	Std.Dev.	Median	1st Dec.	9th Dec.	Std.Dev.
50	345756	117000	648103	213159	6463	-31334	30802	23824	246840	106091	530620	172074
51	310689	116820	590137	190069	79578	10406	124609	46028	268327	122890	546207	175369
52	348481	132017	660388	204002	2891	-24252	27242	20207	200291	64552	452717	153966
53	315852	130935	601562	190263	45136	10245	74013	24009	213006	87386	452537	147400
54	332711	162186	605065	178136	55489	10382	82301	26909	167131	55744	399394	142256
55	357393	174242	619612	189181	7195	-11606	28875	16158	121748	3929	329215	133265
56	332781	151671	569456	162844	10081	-4967	33097	14973	122161	21955	335245	125708
57	305566	157194	540584	156123	17667	6397	38940	13428	119338	27653	291594	113036
58	294550	157220	542708	153544	6112	-17325	27218	16780	105526	20646	262407	97173
59	273454	158444	496643	138511	17593	7988	39783	12976	95066	30554	239281	86375
60	269954	162061	462364	124681	7879	-4025	28477	13100	77591	19892	210320	80823
61	262551	164402	453921	115145	3559	-16846	23987	15727	66291	17007	185457	69782
62	257069	171184	406569	98030	23674	5029	41377	14498	78254	26880	158540	56428
63	263139	172500	410151	107960	1057	-25248	21127	17768	53477	15068	132156	48625
64	246642	173820	373170	77955	1462	-15708	19693	14064	66869	14221	111811	41281
65	238145	178931	359654	78668	6792	278	22735	9246	74276	17054	111485	35382
66	238218	171175	353347	73025	74424	3501	100336	38583	78904	9386	100367	34423
67	277250	162724	419173	99197	-59606	-95549	19483	47640	-36549	-89995	37467	52174
68	241141	172003	344467	64019	5395	-2626	22676	9613	5395	-2626	22676	9613

Note. — Description of sample and definitions of variables in section 3.5.

Table 3.9. Retirement Probit Results I

	Income Security			IS + Pensions			All Income		
Poor Health	0.216	0.238	0.239	0.230	0.239	0.248	0.249	0.245	0.252
	(.036)	(.039)	(.039)	(.037)	(.04)	(.039)	(.038)	(.04)	(.04)
	[.864]	[.865]	[.861]	[.901]	[.896]	[.897]	[.900]	[.895]	[.895]
Wealth	0.003	0.012	0.014	0.014	0.018	0.017	0.014	0.016	0.015
	(.010)	(.018)	(.018)	(.002)	(.003)	(.003)	(.003)	(.004)	(.004)
	[.018]	[.070]	[.077]	[.090]	[.109]	[.097]	[.082]	[.094]	[.085]
Peak Accrual	-0.100	-0.140	-0.155	-0.017	-0.017	-0.018	-0.011	-0.016	-0.017
	(.040)	(.064)	(.062)	(.007)	(.007)	(.008)	(.003)	(.006)	(.006)
	[-.666]	[-.798]	[-.872]	[-.111]	[-.107]	[-.107]	[-.063]	[-.091]	[-.094]
Lifetime earnings Controls	no	yes	no	no	yes	no	no	yes	no
Experience Controls	no	no	yes	no	no	yes	no	no	yes
Wage Controls	no	yes	yes	no	yes	yes	no	yes	yes

Note. — 25810 observations. Marginal effects are presented representing a 60 year old single male in Ontario, standard errors of the marginal effect in parentheses, probit coefficients are in square brackets. All specifications include the basic set of controls described in the text.

Table 3.10. Retirement (Fixed Effects) Probit Results II

	Income Security	IS + Pensions	All Income
Poor Health	0.165	0.148	0.166
	(.097)	(.100)	(.098)
	[.565]	[.523]	[.571]
Wealth	0.049	0.081	0.056
	(.110)	(.020)	(.015)
	[.213]	[.360]	[.245]
Peak Accrual	-0.489	-0.101	-0.021
	(.244)	(.056)	(.012)
	[-2.109]	[-.449]	[-.092]

Note. — 3195 observations, 1131 individuals. Marginal effects evaluated at the mean are presented, standard errors of the marginal effect are in parentheses, probit coefficients are in square brackets. All specifications include controls for age, whether the spouse works, spouse's health, and number of children under 18.

Table 3.11. Retirement Probit Results III

	Income Security			IS + Pensions			All Income		
Past Poor Health	0.201	0.226	0.231	0.213	0.233	0.241	0.232	0.240	0.245
	(.050)	(.055)	(.055)	(.051)	(.055)	(.055)	(.053)	(.056)	(.056)
	[.794]	[.804]	[.799]	[.830]	[.824]	[.820]	[.834]	[.833]	[.824]
Wealth	0.023	0.041	0.037	0.015	0.020	0.019	0.015	0.017	0.016
	(.013)	(.022)	(.024)	(.003)	(.004)	(.004)	(.003)	(.005)	(.005)
	[.143]	[.220]	[.190]	[.093]	[.108]	[.097]	[.081]	[.087]	[.080]
Peak Accrual	-0.123	-0.179	-0.223	-0.015	-0.017	-0.018	-0.010	-0.018	-0.020
	(.045)	(.073)	(.076)	(.008)	(.010)	(.010)	(.004)	(.008)	(.008)
	[-.761]	[-.956]	[-1.135]	[-.096]	[-.091]	[-.091]	[-.056]	[-.092]	[-.096]
Lifetime earnings Controls	no	yes	no	no	yes	no	no	yes	no
Experience Controls	no	no	yes	no	no	yes	no	no	yes
Wage Controls	no	yes	yes	no	yes	yes	no	yes	yes

Note. — 17618 observations. Marginal effects are presented representing a 60 year old single male in Ontario, standard errors of the marginal effect are in parentheses, probit coefficients are in square brackets. All specifications include the basic set of controls.

Table 3.12. Retirement Probit Results IV

	(1)		(2)		(3)		(4)		(5)	
	IS	IS+Pension	IS	IS+Pension	IS	IS+Pension	IS	IS+Pension	IS	IS+Pension
Poor	0.258	0.271	0.248	0.262	-	-	-	-	-	-
	(.04)	(.041)	(.056)	(.056)						
Fair	0.082	0.091	0.050	0.058	-	-	-	-	-	-
	(.017)	(.017)	(.017)	(.018)						
Good	0.019	0.023	0.039	0.045	-	-	-	-	-	-
	(.009)	(.009)	(.013)	(.013)						
Very Good	0.010	0.012	0.007	0.008	-	-	-	-	-	-
	(.008)	(.007)	(.009)	(.01)						
New Disability	-	-	-	-	0.091	0.093	-	-	-	-
					(.016)	(.016)				
Small Shock	-	-	-	-	-	-	0.017	0.020	-	-
							(.009)	(.01)		
Large Shock	-	-	-	-	-	-	-	-	0.071	0.080
									(.021)	(.022)
Wealth	0.014	0.016	0.035	0.018	0.015	0.016	0.035	0.019	0.035	0.020
	(.016)	(.003)	(.021)	(.004)	(.017)	(.003)	(.024)	(.004)	(.024)	(.004)
Peak Accrual	-0.135	-0.016	-0.195	-0.016	-0.150	-0.021	-0.216	-0.019	-0.216	-0.019
	(.055)	(.007)	(.069)	(.009)	(.06)	(.008)	(.076)	(.011)	(.076)	(.011)
N	25810	25810	17618	17618	25810	25810	17618	17618	17618	17618

Note. — (2) uses past health variables. Marginal effects are presented, standard errors in parentheses. All specifications include basic set of controls plus controls for experience and current wages.

Table 3.13. Retirement Probit Results V

	Income Security				IS + Pension			
Wealth	0.098	0.010	0.032	0.034	0.010	0.014	0.019	0.018
	(.012)	(.01)	(.016)	(.018)	(.002)	(.003)	(.003)	(.003)
One Year	-0.204	-0.005	0.005	0.004	-0.011	0.004	0.005	0.005
Accrual	(.069)	(.09)	(.104)	(.106)	(.004)	(.012)	(.013)	(.013)
Age Controls	no	yes	yes	yes	no	yes	yes	yes
Lifetime Earnings Controls	no	no	yes	no	no	no	yes	no
Experience Controls	no	no	no	yes	no	no	no	yes
Wage Controls	no	no	yes	yes	no	no	yes	yes

Note. — Marginal effects are presented, standard errors in parentheses. All specifications include basic set of controls and an indicator for poor health unless otherwise indicated.

Table 3.14. Retirement Probit Results VI

	IS		IS + Pension		IS		IS + Pension	
Poor Health	0.204	0.212	0.206	0.220	0.243	0.244	0.245	0.253
	(.04)	(.04)	(.04)	(.041)	(.04)	(.039)	(.041)	(.04)
Wealth	0.023	0.017	0.018	0.017	0.014	0.018	0.018	0.017
	(.017)	(.019)	(.003)	(.003)	(.018)	(.018)	(.003)	(.003)
Peak Accrual	-0.093	-0.126	-0.013	-0.014	-0.148	-0.163	-0.018	-0.019
	(.061)	(.063)	(.007)	(.008)	(.065)	(.064)	(.007)	(.008)
Lifetime Earnings Controls	yes	no	yes	no	yes	no	yes	no
Experience Controls	no	yes	no	yes	no	yes	no	yes
Wage Controls	yes	yes	yes	yes	yes	yes	yes	yes
N	25265	25265	25265	25265	24601	24601	24601	24601

Note. — Marginal effects are presented, standard errors in parentheses. All specifications include basic set of controls.

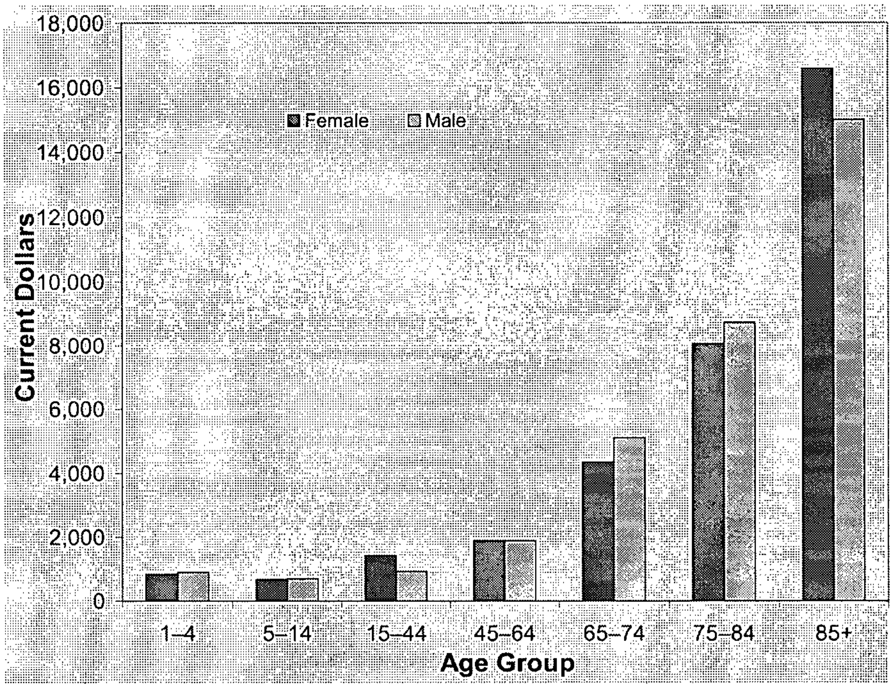


Figure 3.1 Provincial Health Care Expenditures per Person by Age and Sex, 2000
Source: The Canadian Institute for Health Information (2002). (Table E.1.3)

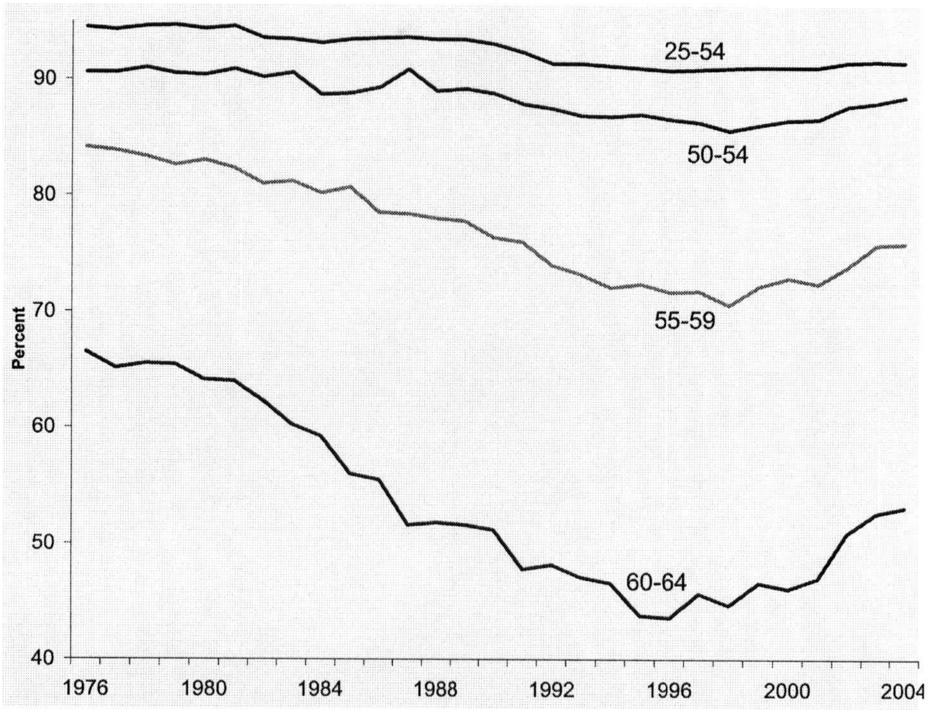


Figure 3.2 Male Participation Rates by Age Group, 1976-2004
Source: Statistics Canada, CANSIM II Series V2461460, V2461470, V2461471, V2461472

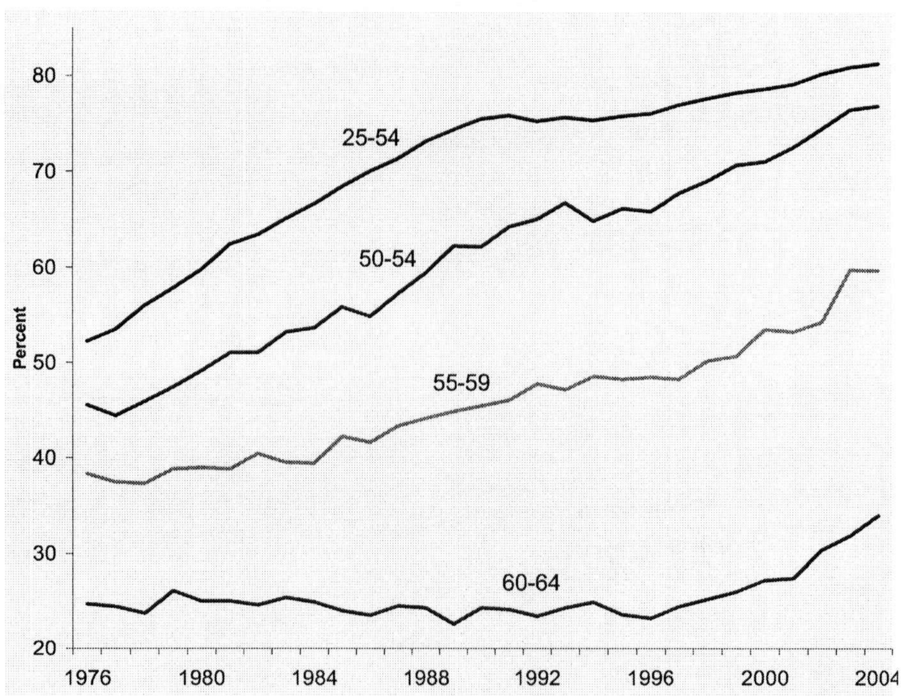


Figure 3.3 Female Participation Rates by Age Group, 1976-2004
Source: Statistics Canada, CANSIM II Series V2461670, V2461680, V2461681, V2461682

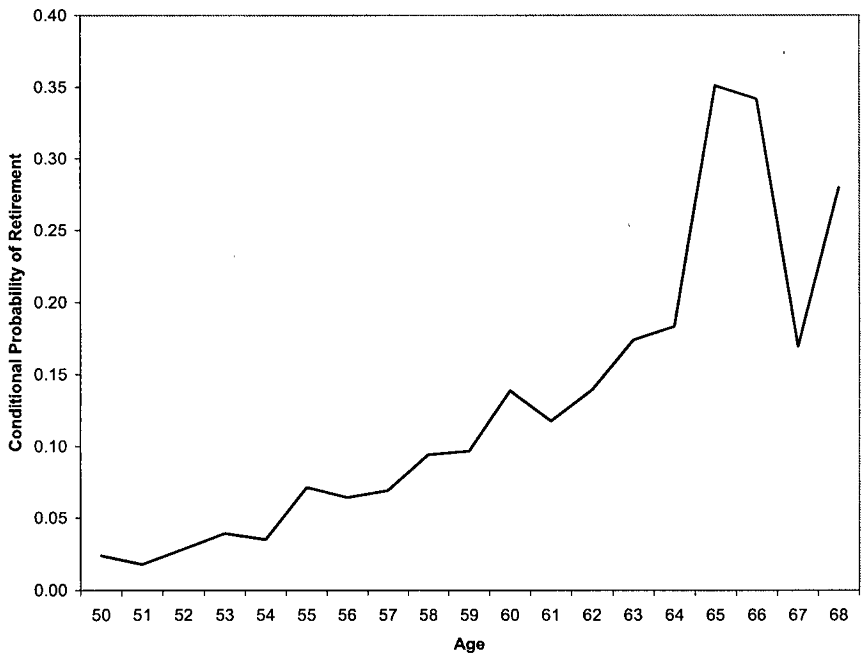


Figure 3.4 Conditional Probability of Retirement at Different Ages

Chapter 4

Why Have the Labour Force Participation Rates of Older Men Increased Since the Mid-1990s?

4.1 Introduction

Since the mid-1990s there has been a clear reversal in the decline in labour force participation rates of older men in Canada, the United States, the United Kingdom, and several other European countries. Through most of the 20th century the participation rates of men age 55-64 had fallen steadily, elevating concerns that population aging will place pressure on public pensions and many other publicly funded programs. Over the past decade, however, there has been a remarkable increase in the participation rates of older men, potentially alleviating many of these concerns.

What might explain this striking reversal in participation rates? Despite having very different policy environments and macroeconomic performance in recent years, increases in the participation rates of older married men in the U.S., Canada, and the U.K., have coincided with recent increases in older women's participation rates, while single men appear to follow a different trend. This paper exploits the cohort effects driving recent increases in older women's participation rates to identify the extent to which older married men's participation decisions are influenced by their wives' participation decisions. The response of husbands to their wives' participation decisions then has the potential to explain some of the recent increases in older men's participation rates.

There are two main routes through which we can expect wives' participation decisions to affect the participation decisions of husbands. First, we can expect an income effect

[0]Portions of the statistical analysis in this chapter rely on Statistics Canada microdata, made available through the British Columbia Inter-University Research Data Centre. This study reflects the views of the author and does not reflect the opinions of Statistics Canada.

whereby the husband is able to enjoy more leisure given the extra family income earned by a participating wife. This income effect will reduce a husbands' likelihood of participating in the labour force. Second, we can expect that couples have some preferences for shared leisure time, especially at older ages. Husbands may not enjoy their leisure time as much when their spouse is participating in the labour force. This shared leisure effect will result in a higher likelihood of participation among husbands whose wives are participating in the labour force.[1] If shared leisure effects dominate any income effects associated with wives' participation, we would expect to see increases in the participation rates of older men in response to increases in the participation rates of older women.

The existing literature provides considerable evidence that shared leisure effects play an important role in older men's retirement and participation decisions. The notion that a wife's leisure is complementary to her husband's is evidenced by the fact that in the United States 62% of older men report that they look forward to retiring only if their spouse can retire as well (Coile (2004b), Maestas (2001)).[2] In Canada, older couples tend to rate the quality of their relationship higher when both spouses are not in the labour force than when they are both in the labour force or have retired alone (Chalmers and Milan (2005)). The prevalence of joint retirement suggests that this preference for shared leisure is an important determinant of participation and retirement decisions. Gustman and Steinmeier (2000) find that a wife's retirement status significantly affects the retirement preferences of a husband, although the husband's retirement does not appear to affect the retirement preferences of the wife. Coile (2004b) examined how the retirement incentives of husbands and wives are influenced by their own financial incentives to retire and the incentives of their spouse, and finds that husbands are very responsive to their wives' financial incentives to enter retirement. Coile also provides evidence that husbands are even more responsive to wives' incentives when they indicate that they enjoy sharing leisure time with their spouse. Blau (1998) provides further evidence that preferences for shared leisure affect retirement decisions, showing that the high incidence of joint retirements cannot be explained by financial incentives and that the non-employment of one spouse has a positive effect on the labour force exit rates of the other spouse.

In the current analysis I am primarily concerned with the extent to which this preference for shared leisure, in conjunction with increased participation of wives, may help explain recent increases in the participation rates of men age 55-64. I begin by estimating the effect of a wife's participation decision on the participation decision of a husband. Here, I model

[1] A positive response to wives' participation may also reflect husbands' reluctance to abandon their role as the primary 'bread-winner'.

[2] This is based on responses to the question in the Health and Retirement Study: How much do you agree or disagree with the statement: "I look forward to retiring only if my wife can retire at about the same time." Responses include Strongly agree (14%), agree (48%), disagree (35%) and Strongly disagree (3%). Both authors are using samples of married men age 51-61 in 1992, restricted to couples in which neither spouse had retired by 1992.

the participation decisions of husbands and wives as a system of simultaneous equations and rely on a measure of cohort effects as an instrument for the wife's participation decision. To examine the explanatory power of wives' participation, a decomposition of older married men's participation rates is undertaken using the methodology of DiNardo, Fortin and Lemieux (1996) and data from the March Current Population Survey (United States), the master files of the Labour Force Survey (Canada), and the Quarterly Labour Force Survey (United Kingdom). The results demonstrate that a substantial portion of the recent increase in married men's participation can be attributed to shared leisure effects. I also investigate the role played by changes in the age structure and educational attainment of this group of men and show that these factors can explain a substantial portion of the recent increase in participation, especially in the United States. Looking forward to how these factors will affect future trends in older men's participation rates, changes in older wives' participation will continue to place upward pressure on older married men's participation rates. However, the education levels of the upcoming cohort of men do not differ substantially from the current cohort. As such, it appears that the effects of education have been exhausted and cannot be relied upon to further increase older men's participation rates.

The remainder of this paper is organized in the following manner. I begin with a description of recent trends in the participation rates of older individuals, demonstrating the potential explanatory power of changes in wives' participation for recent increases in men's participation rates. In section 4.3, I provide a simple framework to analyze the shared leisure and income effects associated with wives' participation and provide empirical evidence that shared leisure effects dominate income effects in the participation decisions of older men. In this section I also address other factors that may be important for retirement or participation decisions, such as health, macroeconomic effects, and stock market fluctuations. In section 4.4, I describe the methodology used to decompose the changes in participation rates, discuss the results of the decomposition, and provide additional evidence of the importance of wives' participation in the participation decisions of husbands. In section 4.5 I present some evidence suggesting we may expect further increases in participation over the next decade. Finally, I offer some conclusions in section 4.6.

4.2 Data and Recent Trends in Participation

In this section, I begin by introducing the data used in this study. I then document trends in older men's and women's participation rates and demonstrate the potential explanatory power of wives' participation for the recent increases in older men's participation rates.

4.2.1 Data

Several micro data files are used to analyze older men's labour force participation in the U.S., Canada, and the U.K.. U.S. samples are taken from the Current Population Survey Annual Demographic Files (March CPS) while Canadian samples are taken from the master files of the Canadian Labour Force Survey (CLFS) and samples for the U.K. are taken from the U.K.'s Labour Force Survey (UKLFS). Each of these data sources provide information regarding the labour force status, education, and demographic characteristics of individuals and their spouses. The details of sample selection, the construction of key variables, and other data sources used in this paper are described in Appendix B. Generally speaking, the samples exclude individuals whose information is missing, and for the purposes of the decomposition exercise that follows I further exclude from the samples any husband who is more than 15 years younger or 15 years older than his wife.

The analysis in this paper focuses on married men age 55-64 in each country. Descriptions of these samples are provided for years representing low and high points in older men's participation rates in Tables 4.1, 4.2, and 4.3 for the U.S., Canada, and the U.K. respectively. In each of these countries, the observed increase in labour force participation coincides with substantial increases in educational attainment for this group of men.[3] Interestingly, the average age of these men fell slightly over the decade, reflecting a slight change in the age structure of this group.[4] Perhaps surprisingly, the likelihood of having children at home has not increased in recent years.

Notably, the likelihood of wives' participation in these samples increased substantially over the past decade. The increase is most striking for the Canadian wives of men age 55-64, whose participation rates increased by twelve percentage points between 1995 and 2005. Men whose wives are in the labour force are more likely to participate in the labour force. However, these men also tend to be slightly younger and more educated than men whose wives are not in the labour force.

4.2.2 Trends in Participation

The participation rates of older men in Canada, the U.S., and the U.K. had fallen steadily through most of the 20th century.[5] Figure 4.1 shows that the participation rate of men

[3]Note that educational attainment is not directly comparable across the different countries. For example, Canadian men appear to have much higher attainment of post-secondary education than American men in part due to the fact that Canadian surveys include trade certificates as post-secondary education while U.S. surveys do not. Also, U.K. categories of education are defined by an individuals' qualifications, which may differ slightly from the concept of education in the Canadian and U.S. surveys.

[4]There are clear changes across the distribution of age indicating the group became 'younger' over time in each country as the baby boom cohort begins to enter this group.

[5]Ransom and Sutch (1986) find that the participation rates of men age 60 and over in the United States decline after 1930. Johnson (1994) finds there was no clear trend in the participation rates of men age 60-64 in England and Wales up to the 1960s.

age 55-64 in Canada had fallen by nineteen percentage points between 1976 and 1995. The participation rate of these men also declined substantially in the U.S., by ten percentage points between 1976 and 1994. In the U.K., the participation rate of men age 55-64 fell by 23 percentage points between 1977 and 1995.[6]

Since the mid-1990s, however, the participation rates of older men in each of these countries has been increasing. In Canada the participation rate of men age 55-64 increased by 8 points between 1995 and 2005. In the U.S. the participation rate of men age 55-64 rebounded by more than half of the earlier decline, increasing by 6 percentage points between 1994 and 2005. A similar pattern is observed in the U.K. where the participation rate of these men increased by 5 percentage points between 1995 and 2005. Similar trends in the participation rate of men age 55-64 can be found in several other European countries, some of which are shown in Figure 4.2.[7]

The participation rate of older women has also increased substantially in recent years, as shown in Figures 4.1 and 4.2, although earlier trends in their participation rates were often very different from their male counterparts. In Canada, the participation rate of women age 55-64 increased by 13 percentage points between 1995 and 2005 after increasing by less than 5 percentage points over the previous two decades. In the U.S., the participation rate for these women increased by 7 percentage points between 1994 and 2005. In the U.K., their participation rate increased by 8 percentage points between 1995 and 2005. Again, similar trends are found in other European countries.

The recent increases in older women's participation may be largely explained by cohort effects. The age-participation profiles for selected birth cohorts of women in the U.S., Canada, and the U.K. are presented in Figure 4.3. Consider, for example, women born in the U.S. in 1940 - one of the earliest cohorts of women to have legal access to the pill in the 1960s.[8] The large increases in women's participation rates observed in the late 1970s can in part be attributed to this 1940 cohort, and women in this cohort turned 55 in the mid-1990s. The recent increases in older women's participation can be attributed to the entry of this 1940 cohort and later cohorts to this older age group.[9]

In Figure 4.4 the participation rates of men and women age 60-64 by marital status are plotted for the U.S., Canada, and the U.K.. In all three countries, the recent increases in women's participation are common to single and married women. Notably, however, the participation rates of married and single men in this age group have followed different

[6]Note that the definition of unemployment changed over the early years of the survey and is only consistently defined after 1984.

[7]Similar trends are also found in Sweden and Denmark. See Gruber and Wise (2005) for a brief discussion of recent trends in these countries.

[8]Goldin and Katz (2002) find that for college women, access to oral contraception led to a later age at first marriage and greater representation of women in professional occupations. Bailey (2005) shows that legal access to the pill increased the number of women in the paid labour force.

[9]See Beaudry and Lemieux (1999) for a cohort analysis of female labour force participation rates in Canada.

trends. In both the U.S. and the U.K., the participation rate of single men age 60-64 has remained fairly constant since the mid-1980s. Similarly, in Canada the participation rates of older single men remained fairly constant through the 1990s and did not increase until after 2002. As such, the recent increases seen in the participation rates of older men has largely been driven by an increase in the participation of older married men.

The similar trends in married men's and women's participation rates suggest that husbands may be responding to the higher likelihood of participation among wives. The following sections examine the decisions of individuals directly, evaluating how the labour force participation decisions of married men have been affected by the participation decisions of their wives.

4.3 Leisure Complementarity and Participation Decisions

In this section I present a simple static model of married men's labour supply that highlights the competing income and shared leisure effects of a wife's participation decision on her husband's participation decision.[10] I then provide estimates of the effects of wives' participation on husbands' labour force status, demonstrating that shared leisure effects dominate any income effects associated with having a wife in the labour force. I then consider other potentially important determinants of the participation decision.

4.3.1 A Simple Model of Shared Leisure and Income Effects

Consider a model in which the husband and wife maximize utility independently and, unlike the standard traditional family labour supply model, each spouse treats some share of the other's income as non-labour income.[11] The husband's utility is defined over current consumption (C_t) and leisure time (ℓ_t^H) where $0 \leq \ell_t^H \leq 1$. When $\ell^H = 1$, the husband is not participating in the labour force. The wife's leisure time (ℓ^W) is similarly defined. At any point in time then, the husband chooses his leisure time in order to maximize

$$\begin{aligned} U_t^H &= U^H(C_t, \ell_t^H, X_t^H, \ell_t^W) && (4.1) \\ s.t. \quad & C_t = \lambda \left[(1-\ell_t^H)w_t^H + \mathbb{1}(\ell_t^H = 1)B_t^H + Y_t^H\right] \\ & \quad +\kappa\left[(1-\ell_t^W)w_t^W + \mathbb{1}(\ell_t^W = 1)B_t^W + Y_t^W\right] && (4.2) \end{aligned}$$

[10]The model presented here only provides a simple framework for understanding the role of leisure complementarity at one point in time. A dynamic model would be more appropriate in the context of examining retirement transitions which is not the focus of this paper.

[11]The standard traditional model is specified such that the husband's labour supply decisions are independent of his wife's behaviour and income. Lundberg (1988) notes that joint utility models of labour supply may be inappropriate given the revocability of the marriage decision. Lundberg (1988) also notes that bargaining models can be considered a general alternative within which joint utility and traditional models may be nested and "[r]egardless of the particular behavioural model chosen, we can treat the labor supply of husband and wife as being jointly determined, and specify a pair of simultaneous equations".

where w_t^H and w_t^W are the wage rates of the husband and wife respectively, $\mathbb{1}(\ell_t^H = 1)$ is an indicator function equal to one when the husband is not in the labour force and zero otherwise, B_t^H and B_t^W are benefits the husband and wife may receive when they are not participating in the labour force, and Y_t^H and Y_t^W represent the non-labour income of each spouse that does not depend on their labour force status.[12] The parameters λ and κ represent the portion of the husband's and wife's income, respectively, that the husband may use for consumption. If $\lambda = \kappa = 1/2$ the husband and wife share income equally. The husband's characteristics (X_t^H) and the wife's leisure choice (ℓ_t^W) enter the utility function as preference shifters, such that they affect the husband's preferences over leisure and consumption. For example, we can expect that the marginal utility of leisure is increasing with age. Similarly, if there exists some complementarity in leisure then non-participation of a wife should also increase the marginal utility of leisure.[13]

The husband will choose to participate in the labour force as long as

$$U^H(C_t, \ell_t^H, X_t^H, \ell_t^W | \ell_t^H < 1) - U^H(C_t, \ell_t^H, X_t^H, \ell_t^W | \ell_t^H = 1) > 0 \tag{4.3}$$

and the standard solution to the utility maximization problem implies that

$$\begin{aligned} MRS_{\ell c} &= \tfrac{U^{\ell H}}{U^C} = w_t^H \quad \text{if} \quad \ell_t^H < 1 \\ MRS_{\ell c} &= \tfrac{U^{\ell H}}{U^C} \geq w_t^H \quad \text{if} \quad \ell_t^H = 1 \end{aligned} \tag{4.4}$$

where $MRS_{\ell c}$ is the marginal rate of substitution between consumption and leisure. In either of the above cases, if husbands prefer to share leisure time with their wives, then we would expect that for any given value of ℓ_t^H, X_t^H, and C_t, the marginal rate of substitution between leisure and consumption will be larger when the wife is not participating in the labour force relative to when the wife is working. That is,

$$MRS_{\ell c}(\ell_t^W = 1) > MRS_{\ell c}(\ell_t^W < 1) \tag{4.5}$$

The decisions of the husband can easily be depicted graphically, as in Figure 4.5. The equilibrium E_0 represents a situation in which both the husband and wife are in the labour force. As non-labour income, the husband considers the share κ of wage earnings of his wife as well as the benefits he could receive if not in the labour force. When the wife leaves the labour force, the husband's decision is affected in two ways. First, the husband's budget constraint shifts down by the difference between the wife's wage earnings and the retirement benefits she can receive. In isolation, this income effect may reduce the amount of leisure

[12]The indicator functions $\mathbb{1}(\ell_t^H = 1)$and $\mathbb{1}(\ell_t^W = 1)$ are used here so that benefits do not affect the slope of the budget constraint. Alternatively, a 100% negative income tax could be applied to benefits, this would not significantly change the implications of this model.

[13]Alternatively this can be stated as $(\partial U^2 / \partial \ell^H \partial \ell^W) > 0$.

he consumes, leaving him at the equilibrium E_1. Second, the husband's relative preference for leisure may be affected such that the indifference curves are steeper when the wife is not in the labour force, represented by the indifference curve U'^H. This shared leisure effect may result in the equilibrium E'_1 in which both the husband and wife are out of the labour force. Overall the effects of a wife's participation on the husband's participation decision will depend on the relative magnitudes of the income and shared leisure effects.

To further exemplify the role of leisure complementarity, this model can be solved using a functional form for the husband's utility similar to one used in Gustman and Steinmeier (2000),

$$U_t^H = \frac{1}{\alpha}C_t^\alpha + exp(X_t^H\beta^H + \ell_t^W\gamma^H)\ell_t^H \tag{4.6}$$

where the term $exp(X_t^H\beta^H + \ell_t^W\gamma^H)$ determines the relative value of leisure and will depend on the wife's leisure choices. The equilibrium choice of leisure (assuming an interior solution) for the husband may be written as

$$\ell_t^H = \frac{1}{\lambda w_t^H}\Bigg[\lambda(w_t^H + Y_t^H) + \kappa((1-\ell_t^W)w_t^W + Y_t^W) - \left(\frac{\lambda w_t^H}{exp(X_t^H\beta^H + \ell_t^W\gamma^H)}\right)^{\frac{1}{1-\alpha}}\Bigg] \tag{4.7}$$

and

$$\frac{\partial\ell_t^H}{\partial\ell_t^W} = \frac{1}{\lambda w_t^H}\left(\frac{\lambda w_t^H}{exp(X_t^H\beta^H + \ell_t^W\gamma^H)}\right)^{\frac{1}{1-\alpha}}\left(\frac{1}{1-\alpha}\right)\gamma^H - \frac{\kappa w_t^W}{\lambda w_t^H} \tag{4.8}$$

The first term captures the effects of preferences for shared leisure on the husband's leisure choices. That is, as long as $\gamma^H > 0$, indicating the wife's leisure is complementary to the husband's leisure, this term will be positive. The second term can be viewed as capturing the income effects associated with the wife's leisure time. As the wife takes on more leisure, the husband loses some income associated with the wife's earnings, thereby reducing the amount of leisure he will consume. The overall effect of a wife's leisure choices on a husband's leisure decisions will depend on the relative magnitudes of shared leisure and income effects.

The wife's leisure and consumption choices may be similarly described, however there is no reason to assume that the wife faces a utility maximization problem that is perfectly symmetric to the husband's. Current evidence suggests that the structure underlying the participation decision of the wife is significantly different from the decisions of husbands. For example, in their analysis of joint retirement decisions, Gustman and Steinmeier (2000) find that although the wife's retirement status has substantial impact on a husband's retirement preferences, the husband's retirement status does not affect the wife's preferences for leisure. For the functional form presented in equation (4.6), this suggests we would have a parameter $\gamma^W = 0$. Furthermore, Coile (2004b) provides evidence suggesting that wives are not responsive to the financial incentives of their husbands to retire although wives respond to their own financial incentives to enter retirement, suggesting that income effects associated with the husband's labour supply choices are not as significant for the wife's decision. Although women's labour supply has commonly been modelled as depending on the husband's income and the husband's labour supply as not depending on the wife's income, evidence from Blau and Kahn (2005) suggests that this is no longer appropriate as women have become much less responsive to their husbands' wages.[14] As women in this cohort may have only entered career employment in the 1980s and are typically younger than their husbands, women's participation decisions may be relatively independent of their husbands as their primary concern may be the attainment of their own pensions and benefits upon retirement.

To note, within this simple framework we can also see that pensions, stock market returns, and other individual characteristics such as health may be important determinants of the husband's participation decision. The next section focuses on estimating the effects of wives' participation on husbands' participation decisions. This is followed by a discussion of other potential determinants, however these other factors will not be incorporated into the decomposition of older men's participation rates as they are not expected to help explain recent increases in participation.

4.3.2 Estimated Effect of Wives' Participation on Husbands' Decisions

From the simple model of husbands' and wives' labour supply described above, each spouse's participation decisions may described by the latent variables L^{H*} and L^{W*}, where

$$L^{H*} = U^H(C_t, \ell_t^H, X_t^H, \ell_t^W | \ell_t^H < 1) - U^H(C_t, \ell_t^H, X_t^H, \ell_t^W | \ell_t^H = 1) \qquad (4.9)$$

represents the husband's utility associated with participating in the labour force relative to non-participation. Similarly, L^{W*} represents the wife's utility associated with participating in the labour force relative to non-participation. The econometric model representing the couple's participation decision may be stated as

$$\begin{aligned} L_i^{H*} &= \gamma^H L_i^W + X_i^H \beta_1^H + X_i^W \beta_2^H + \epsilon_i^H & (4.10) \\ L_i^{W*} &= \gamma^W L_i^H + X_i^H \beta_1^W + X_i^W \beta_2^W + Z_i^W \delta + \epsilon_i^W & (4.11) \end{aligned}$$

where we observe $L_i^H = 1$ if the husband participates in the labour force ($L_i^{H*} \geq 0$) and $L_i^H = 0$ otherwise. Similarly, $L_i^W = 1$ if the wife participates in the labour force. Here, the

[14] Blau and Kahn (2005) find that married women's cross wage elasticity fell by 38-47 percent between 1980 and 2000. Estimates of women's own wage elasticity fell by 50-56 percent over this period.

husband's participation decision depends on the participation decision of his wife (L_i^W), the husband's own characteristics (X_i^H), and possibly characteristics of his wife (X_i^W). The wife's participation decision may depend on the participation decision of her husband, each spouse's characteristics, as well as characteristics of the wife (Z_i^W) that would not affect the participation decisions of her husband. In this model, if the shared leisure effects associated with a wife's participation dominate any income effects we would expect γ^H to be positive.

Using data from the past decade for each country, I begin by estimating the husband's participation decision in isolation with a simple probit model.[15] For a set of baseline estimates (that are later used in the decompositions), I include the husband's education, age, and the number of own children in the household as characteristics that would affect his participation decision. A full set of year indicators are also included. Education and age will capture the husband's earnings potential. The husband's age will also affect his preferences for leisure, with the expectation that an individual's marginal utility of leisure is increasing in age. Results for the United States, Canada, and the United Kingdom are presented in the first two columns of Tables 4.4, 4.5, and 4.6, respectively.

In each of the countries, the large positive and significant marginal effects of a wife's participation demonstrate that shared leisure effects dominate any income effects associated with the wife's participation in the labour force. In the U.S., the presence of a wife in the labour force is expected to increase a husband's likelihood of participating by 19 percentage points while in Canada the presence of a wife in the labour force increases the husband's likelihood of participating by 23 percentage points. The effect appears to be slightly larger in the U.K., where the presence of a wife in the labour force increases the husband's likelihood of participating by 27 percentage points.[16]

The results also show that in all three countries educational attainment is also an important determinant of the participation decision, as more educated men are more likely to participate in the labour force. As expected, age also has a significant effect as married men are less likely to participate in the labour force as they get older.[17]

I then estimate the simultaneous probit model described by equations (4.10) and (4.11) using a reduced form model, which can be stated as

$$L_i^{H*} = \gamma^H L_i^W + X_i^H \beta_1^H + X_i^W \beta_2^H + \epsilon_i^H \quad (4.12)$$

$$L_i^{W*} = X_i^H \beta_1^W + X_i^W \beta_2^W + Z_i^W \delta' + \epsilon_i^W \quad (4.13)$$

[15]The years 1995-2005 are used in the Canadian and U.K. estimates, the years 1994-2005 are used in the U.S. estimates.

[16]These marginal effects are evaluated for a 60 year old high school graduate (A level or equivalent in the U.K.) in 2005 whose wife is in the labour force and no children are at home.

[17]In the retirement literature it is suggested that a coefficient on age may also be picking up policy effects as many retirement income programs use age as the key variable defining eligibility. For this reason, models estimating retirement hazards will use a more flexible functional form for age (ie. a set of indicator variables). Such spikes do not appear as clearly for the participation decision and a linear function of age in the equation is reasonable.

and thought of as analogous to the reduced form equations used in a two-stage least squares model.[18]

As the instrument (Z^W) for the wife's labour force status, I use the cohort-specific labour force participation rates of women at age forty.[19] Here, cohorts are defined by the wife's year of birth. This instrument is designed to capture the step function observed across cohorts in the age participation profiles of women, indicated in Figure 4.3, with each successive cohort being more likely to participate in the labour force at all ages.[20] As such, there is substantial variation in the participation rates of each cohort of women at age forty and we can expect the cohort's participation rates to be strongly correlated with wives' current participation decisions.

Use of this instrument also requires that the past participation rates of a wife's cohort do not directly affect a husband's current participation decision. Given the joint nature of husbands' and wives' lifetime consumption and leisure choices, we would expect that a 'young' husband's plans for retirement will depend on his expectations of his wife's future labour market activity. These expectations may depend on his wife's labour market activity at the time (or in the past) and her characteristics. However, it is reasonable to assume that the labour market activity of other women (in his wife's cohort) will not play a separate and direct role in forming those expectations or his retirement plans.[21]

The model represented by equations (4.12) and (4.13) is estimated as a bivariate probit model, again using data from the past decade for each country. The results for the U.S., Canada, and the U.K. are presented in the last two columns of Tables 4.4, 4.5, and 4.6, respectively.[22] In Canada and the U.S., the resulting marginal effects of a wife's participation are not significantly different from the probit model estimates. In the U.K., however, the resulting marginal effect is much smaller than the probit estimate, suggesting the probit estimates were biased upward. This could, for example, be a reflection of assortative matching in the marriage market whereby individuals with similar preferences over work and leisure are more likely to match. To note, the estimated marginal effects of other variables are not significantly affected by the use of the bivariate probit model.

[18]The reduced form model is used here because valid instruments are not available for the husband's participation decision within the data sets used in this paper. As such, I am unable to identify the effect of a husband's participation decision on the participation decision of the wife. Furthermore, the simultaneous probit model described by equations (4.10) and (4.11) suffers from logical inconsistency, whereby the relationship between (ϵ^H, ϵ^W) and (L^H, L^W) is not one to one.

[19]See the appendix B for details on the construction of this measure.

[20]Although it would be preferable to measure the intercept in the age-participation profiles (ie. participation rates at age 20 for each cohort), reliable estimates are not available for earlier time periods.

[21]Also note that we do not see similar cohort effects playing a role in the participation decisions of men. Between the ages of 25 and 54, the age-participation profiles of men do not vary substantially by cohort.

[22]Note that a full set of year dummies are also included in these specifications.

4.3.3 Robustness Checks – Other Factors Important For Participation Decisions

The estimates presented thus far have not addressed several important factors that could potentially be important for explaining changes in the participation decisions of older men. For example, the results of the previous chapter demonstrated that health is a significant determinant of retirement decisions.[23] However, it appears that the health status of Canadian men has not changed in recent years. In 1996 and 2003, 7% of Canadian men age 55-64 described their health as poor. The portion of these men reporting good to excellent health had not changed either, remaining stable at 78%.[24] Using data from the March CPS, a variable indicating poor health was added to the baseline specification. While poor health was a significant determinant of husbands' participation, the addition of this variable did not significantly change the estimated effect of a wife's participation (see Table 4.7).

The decline in employer-provided defined-benefit pension plans has been cited as part of the explanation for increased participation of older men in the U.S. (Gruber and Wise, 2005). However, the percentage of workers participating in defined benefit plans was 21% in both 1999 and 2004.[25] Furthermore, between 1999 and 2004 the percentage of private sector employees participating in retirement plans actually increased from 48% to 50%.[26] In Canada, the portion of men in the labour force covered by a registered pension plan fell only slightly since the mid 1990s, from 35% in 1995 to 33% in 2002.[27] As such, it is unlikely that changes in pension coverage could explain the substantial increases in participation.

It has been suggested that the performance of the stock market in the U.S. has had an impact on older individuals' participation decisions. For example, Coronado and Perozek (2003) find that individuals who received unanticipated equity gains during the market boom of the late 1990s retired earlier than they had anticipated. The stock market bust of 2000 seems to be an unlikely explanation for changes in participation rates, however, given that a fair portion of the increase in older men's participation occurred prior to the stock market bust in the fall of 2000. Furthermore, Coile and Levine (2004) demonstrate that the stock market bust could not feasibly explain the recent increases in participation in the U.S. given that very few households have substantial stock holdings. Similarly, only 11% of Canadian households held stocks in 1999 and the median value of stocks (conditional on

[23] Several studies in the United States have found similar results including Coile (2004a), Coile and Gruber (2000) and Dwyer and Mitchell (1999).

[24] Based on responses in the Survey of Labour and Income Dynamics of a sample of men age 55-64.

[25] Bureau of Labour Statistics series EBUDBINC000000AP. Percent of employees participating in defined benefit pension plans, all private industry.

[26] Bureau of Labour Statistics series EBUALLRET00000AP. Percent of employees participating in all retirement plans, all private industry.

[27] The portion of male paid workers covered by a RPP fell from 44% in 1995 to 41% in 2001, however most of this decrease occured between 1995 and 1998 and the coverage rates remained stable thereafter. Source: Statistics Canada, Canada's Retirement Income Programs: a statistical overview. Catalogue no. 74-507-XCB.

holding some positive value) was merely \$10000 (Milligan, 2005). In the current sample of married men age 55-64 in the U.S., only 28% had any positive stock dividends and among those with dividends, the median value was only \$600. When dividend income is added to the baseline specifications for the United States, the coefficient on stock dividend income is significant, but incredibly small in size.[28] Furthermore, the addition of this variable does not change the effect of a wife's participation on her husband's participation decision.

Macroeconomic effects are also important to consider here. To address this, specifications of the baseline model for the United States that included state specific participation rates of 25-54 year olds were also estimated. In the U.S., the macroeconomic effects were barely significant and would be unlikely to explain any increase in participation given that the participation rates of younger workers have been falling in recent years (see Figure 4.6). Again, and more important for the current analysis, the addition of macroeconomic effects to the baseline model did not change the marginal effect of wives' participation. The estimates from similar specifications using Canadian data demonstrated that macroeconomic effects were a significant factor, but again did not change the marginal effect of wives' participation.[29]

Overall, the results of the baseline models reasonably describe the effects of wives' participation on the participation decision of husbands and are robust to the inclusion of other determinants of older men's participation decisions. The baseline model's estimates will be used in the following sections in the decomposition of older men's participation rates and other robustness checks on these estimates are discussed in section 4.4.3.

4.4 Decomposing the Changes in Participation

The purpose of the decompositions in this section is to establish what portion of the increase in older married men's participation rate can be attributed to changes in wives' likelihood of participating in the labour force. I begin by using the estimates from the probit and bivariate probit models of the previous section in a decomposition of the total change in older men's participation rates since the mid-1990s. Here, I use a decomposition methodology similar to that of DiNardo et al. (1996) which easily allows for the use of non-linear functions of covariates in the estimation of the participation decision. In this decomposition, I investigate how (1) changes in older men's characteristics, and (2) changes in the likelihood of married women to participate in the labour force can explain the observed increases in older married men's participation rates. Later in this section, I also consider how changes over time in the parameters describing the husbands participation decision can help explain

[28]From the model estimates, a \$1000 increase in stock dividends would reduce the likelihood of participation by less than two tenths of a percentage point.

[29]The baseline model adding the unemployment rate of 25-54 year olds in each economic region as a covariate was estimated.

the recent increases in older men's participation rates and provide additional evidence of the explanatory power of wives' participation for husbands' participation decisions. At the end of this section, I also present a simple Oaxaca decomposition of historical participation rates to further illustrate how changes in men's characteristics and older wives' participation have influenced the participation decisions of husbands.

4.4.1 Probit/DFL Decomposition of Changes in Participation

The procedure for decomposing the total change in older married men's participation rates since the mid-1990s follows the work of DiNardo et al. (1996). The procedure is similar in spirit to the familiar Oaxaca (1973) decomposition of changes in means, however is easily generalized to allow for the use of non-linear functions of covariates in the estimation of participation rates.

In each stage of the decomposition, counterfactual participation rates are created representing what the participation rate in 2005 (time t) would be if each factor had remained at its mid-1990s levels. For the decomposition of U.S. participation rates, the comparison year (time s) is 1994. For Canada and the U.K., the comparison year is 1995.

The decomposition is sequential in that once the 2005 participation rate has been adjusted for a factor, that factor remains adjusted in the next stage of the decomposition. In the primary order decomposition of older married men's participation rates described below, I begin by adjusting the 2005 participation rate for changes in older men's characteristics (including educational attainment, age structure, and whether there are children at home) followed by adjusting this participation rate for changes in the likelihood of married women to participate in the labour force.

To understand the estimation procedure, it is useful to view each individual observation as a vector (L^H, X^H, L^W, t) made up of the husband's labour force participation status (L^H), the husband's characteristics (X^H), the wife's labour force participation status (L^W), and a date t, all of which are discrete random variables.[30] Each observation belongs to a joint distribution $F(L^H, X^H, L^W, t; \beta, \gamma, \rho)$, where β, γ, and ρ are the population parameters that characterize the distribution.[31] The joint distribution at one point in time is the conditional distribution $F(L^H, X^H, L^W | t; \beta, \gamma, \rho)$. The probability function of L^H at one point at time t may be written as

$$f_t(L^H) = \sum_{X^H} \sum_{L^W} f(L^H, X^H, L^W | t_{L^H, X^H, L^W} = t; \beta, \gamma, \rho) \tag{4.14}$$

[30]For ease of notation, in the following I use the same notation to represent the random variables L^H, X^H and L^W and their set of values. I also omit any subscripts that would identify each function F and f.

[31]Where $\rho = Corr(\epsilon^H, \epsilon^W)$ is the correlation coefficient between the error terms of the latent variable model of the husband's and wife's participation, presented in equations (4.12) and (4.13). See also footnote 33.

$$= \sum_{X^H}\sum_{L^W}\Big[f(L^H|X^H, L^W, t_{L^H|X^H,L^W} = t; \beta, \gamma, \rho) \cdot f(X^H|L^W, t_{X^H|L^W} = t) \cdot f(L^W|t_{L^W} = t)\Big]. \quad (4.15)$$

To obtain the participation rate of husbands, the probability function above is evaluated for $L^H = 1$.[32]

The decomposition then involves different 'datings' for the different explanatory factors. For the first stage of the decomposition, a hypothetical probability function is created to represent the participation decisions of husbands that would have prevailed in time t had the distribution of husbands' characteristics remained as it was in time s. That is, the counterfactual probability function

$$f_{c_1t}(L^H) = \sum_{X^H}\sum_{L^W}\Big[f(L^H|X^H, L^W, t_{L^H|X^H,L^W} = t; \beta, \gamma, \rho) \cdot f(X^H|L^W, t_{X^H|L^W} = s) \cdot f(L^W|t_{L^W} = t)\Big] \quad (4.16)$$

$$= \sum_{X^H}\sum_{L^W}\Big[f(L^H|X^H, L^W, t_{L^H|X^H,L^W} = t; \beta, \gamma, \rho) \cdot \psi_{X^H|L^W} f(X^H|L^W, t_{X^H|L^W} = t) \cdot f(L^W|t_{L^W} = t)\Big] \quad (4.17)$$

is created, where

$$\psi_{X^H|L^W} = \frac{f(X^H|L^W, t_{X^H|L^W} = s)}{f(X^H|L^W, t_{X^H|L^W} = t)} \quad (4.18)$$

is a reweighting function that captures the changes that have occurred in the distribution of older married men's characteristics between the years s and t. Note that by applying Bayes' rule, this reweighting function may be written as

$$\psi_{X^H|L^W} = \frac{f(t_{X^H|L^W} = s|X^H, L^W)/f(t_{X^H|L^W} = s|L^W)}{f(t_{X^H|L^W} = t|X^H, L^W)/f(t_{X^H|L^W} = t|L^W)}. \quad (4.19)$$

For the second stage of the decomposition, a second counterfactual probability function is created to also account for changes in older wives' likelihood to participate in the labour force. That is, the counterfactual probability function

$$f_{c_2t}(L^H) = \sum_{X^H}\sum_{L^W}\Big[f(L^H|X^H, L^W, t_{L^H|X^H,L^W} = t; \beta, \gamma, \rho) \cdot \psi_{X^H|L^W} f(X^H|L^W, t_{X^H|L^W} = t) \cdot f(L^W|t_{L^W} = s)\Big] \quad (4.20)$$

$$= \sum_{X^H}\sum_{L^W}\Big[f(L^H|X^H, L^W, t_{L^H|X^H,L^W} = t; \beta, \gamma, \rho)$$

[32] That is, $f_t(1) = P_t(L^H = 1)$.

$$\cdot \psi_{X^H|L^W} f(X^H|L^W, t_{X^H|L^W} = t) \cdot \psi_{L^W} f(L^W|t_{L^W} = t)\Big] \quad (4.21)$$

where the reweighting function

$$\psi_{L^W} = \frac{f(L^W|t_{L^W} = s)}{f(L^W|t_{L^W} = t)} \quad (4.22)$$

captures changes in older wives' participation decisions. This second counterfactual probability function then represents the participation decisions of husbands had the distribution of their characteristics and the likelihood of their wives not changed since time s.

Once estimates of the reweighting functions in equations (4.19) and (4.22) are found, they can be used to estimate counterfactual participation rates.

To begin, an estimate of the participation rate at any point in time is simply a weighted average of individual's predicted likelihood to participate in the labour force. That is,

$$\widehat{P_t}(L^H = 1) \quad = \quad \frac{\sum_i \omega_{it} G(X_{it}^H \hat{\beta} + \hat{\gamma} L_{it}^W)}{\sum_i \omega_{it}} \quad (4.23)$$

where ω_{it} are sample weights for individuals in time t, $G(\cdot)$ represents the cumulative normal distribution function, and the predicted likelihood of participation is based on the latent variable model described in section 4.3.2 where $L_{it}^H = 1$ when $\epsilon_{it}^H \geq -(X_{it}^H \beta + \gamma L_{it}^W)$ and $L_{it}^W = 1$ when $\epsilon_{it}^W \geq -(X_{it}^H \beta^W + Z_{it}^W \delta)$. The assumption is made that $\rho = Corr(\epsilon^H, \epsilon^W) = 0$ when the husband's decision is estimated using the probit model and $-1 \leq \rho \leq 1$ when the husband's decision is estimated using the bivariate probit model.[33] Note that ρ does not enter the calculation of any reweighting functions.

To obtain estimates of the reweighting function in equation (4.19), $\widehat{\psi}_{X^H|L^W}$, estimates are needed for the conditional probability of being in each year t and s. The probability of being in the year t, given men's characteristics X^H and wives' participation L^W, can be estimated using the probit model

$$P(t_{X^H|L^W} = t|X^H, L^W) = P(\epsilon > -\delta H(X^H, L^W)) = G(\delta H(X^H, L^W)) \quad (4.24)$$

where $H(X^H, L^W)$ is a vector of covariates that is a function of X^H and L^W, G is again the cumulative normal distribution, and the model is estimated by pooling observations from the years t and s and using a dummy variable indicating that the individual is observed in year t or s as the dependent variable. Here, $H(X^H, L^W)$ is a set of dummy variables indicating each possible combination of individual's education-age-child-wife's participation status. The conditional probability $P(t_{X^H|L^W} = t|L^W)$ is similarly estimated using a probit model with wive's participation as the only covariate.

[33]Note also that the assumption is made that the parameters describing the participation decision (β, γ, ρ) do not change over time. This assumption is relaxed and such changes accounted for in section 4.4.3.

To obtain estimates for the second reweighting function in equation (4.22), $\widehat{\psi}_{L^W}$, first note that the function may be defined as

$$\psi_{L^W} = \frac{f(L^W|t_{L^W}=s)}{f(L^W|t_{L^W}=t)} = \begin{cases} \frac{P(L^W=1|t_{L^W}=s)}{P(L^W=1|t_{L^W}=t)} & \text{if } L^W=1 \\ \frac{P(L^W=0|t_{L^W}=s)}{P(L^W=0|t_{L^W}=t)} & \text{if } L^W=0 \end{cases} \tag{4.25}$$

since the wife's participation status L^W can only take values of 1 or 0. The probability $P(L^W=1|t_{L^W}=s)$ is then estimated as the participation rate of wives in the year s. The other probabilities are similarly estimated.

These estimated reweighting functions are then multiplied by the sample weights used in equation (4.23) to create counterfactual participation rates. That is, the $t = 2005$ participation rate that would have prevailed had the distribution of men's characteristics remained as they were in the mid-1990s is

$$\widehat{P}_{c_1t}(L^H=1) = \frac{\sum_i \omega_{it}\widehat{\psi}_{X^H|L^W} G(X_{it}^H\hat{\beta}+\hat{\gamma}L_{it}^W)}{\sum_i \omega_{it}\widehat{\psi}_{X^H|L^W}}. \tag{4.26}$$

Similarly, the 2005 participation rate that would have prevailed had the distribution of men's characteristics and wive's likelihood of participation remained as they were in the mid-1990s is estimated as

$$\widehat{P}_{c_2t}(L^H=1) = \frac{\sum_i \omega_{it}\widehat{\psi}_{X^H|L^W}\widehat{\psi}_{L^W} G(X_{it}^H\hat{\beta}+\hat{\gamma}L_{it}^W)}{\sum_i \omega_{it}\widehat{\psi}_{X^H|L^W}\widehat{\psi}_{L^W}}. \tag{4.27}$$

One drawback of the sequential decomposition is that the effect of a given factor may depend on the order of the decomposition. A reverse order decomposition is therefore undertaken, where changes in wives' participation is considered first and followed by changes in men's characteristics, to check whether the impact of wives' participation is overstated in the primary order decomposition. In the reverse order decomposition, the relevant reweighting functions are defined as

$$\psi_{L^W|X^H} = \frac{f(t_{L^W|X^H}=s|X^H,L^W)/f(t_{L^W|X^H}=s|X^H)}{f(t_{L^W|X^H}=t|X^H,L^W)/f(t_{L^W|X^H}=t|X^H)} \tag{4.28}$$

$$\psi_{X^H} = \frac{f(t_{X^H}=s|X^H)/f(t_{X^H}=s)}{f(t_{X^H}=t|X^H)/f(t_{X^H}=t)} \tag{4.29}$$

and can be estimated in a similar manner to that described above. Note that the reweighting function $\psi_{L^W|X^H}$ can also be stated as

$$\psi_{L^W|X^H} = \frac{\psi_{X^H|L^W}\psi_{L^W}}{\psi_{X^H}}. \tag{4.30}$$

A summary of the reweighting functions used in the decompositions is provided in Table 4.8.

4.4.2 Probit/DFL Decomposition Results

The results of the primary and reverse order decompositions are presented in Tables 4.9, 4.10, and 4.11 for the United States, Canada, and the United Kingdom respectively. The first column in each table are the results of the decomposition when the probit model estimates are used. The second column in each table uses the bivariate probit model estimates in the decomposition.

In the United States, the participation rates of married men age 55-64 increased by 6.4 percentage points. Considering the results of the primary order decomposition, if men's characteristics had not changed since 1994 their participation rates would have been 2.4 percentage points lower in 2005. As such, the changes we've observed in men's characteristics can explain 37% of the total change in older married men's participation rates. If the likelihood of wives to participate in the labour force had not changed since 1994, the participation rate of married men age 55-64 would have been 1.5 percentage points lower in 2005, explaining 23-27% of the total change.[34]

Results are similar for Canada and the United Kingdom. In both countries, however, the effect of changes in men's characteristics is much smaller, explaining between 13% and 17% of the total change in the participation rates of married men age 55-64. In part, this is due to a slightly larger change in the age structure of men in the United States relative to the same groups of men in Canada and the United Kingdom. Although changes in educational attainment are difficult to compare across the countries, it also appears that educational attainment increased more in the United States than in the other two countries. In Canada, the portion of the total change in married men's participation rates explained by changes in wives' labour force participation is much larger than in the United States, explaining between 42% and 46% of the total change. The increase in wives' participation rates was also much larger in Canada (12 percentage points between 1995 and 2005) than in the United States (7 percentage points between 1994 and 2005). In the United Kingdom, the portion explained by changes in wives' participation is slightly lower than in Canada, explaining between 28% and 34% of the total change in married men's participation rates. While the U.K. saw increases in wives' participation comparable to the increases in the U.S., the probit estimates of the marginal effect of wives' participation on husbands' participation decisions was slightly larger for the U.K. than the U.S..

[34]The unexplained portion (0.026 or 40%) represents the the portion that is not explained by changes in characteristics or wives' participation. Here, the omitted year dummy is for 2005, so the unexplained portion is effectively the coefficient on the 1994 year dummy variable.

4.4.3 Additional Evidence

Qualitatively, the reverse order decomposition results are similar to the primary order decomposition results. However, the results suggest that the order of the decomposition matters here. In all three countries, the effect of changes in wives' labour force participation is much smaller when accounted for in the first stage of the decomposition. The effect is still fairly large, however, explaining more than 12% in the U.S., 28% in Canada, and 24% in the U.K.. Furthermore, the effect of changes in men's characteristics is much larger in the reverse order decompositions. This is largest in the United States where changes in men's characteristics explain 48% of the total change in older married men's participation rates.

In the decompositions presented above, it is assumed that the parameters describing the husband's participation decision do not change over time. Relaxing this assumption and accounting for changes in the parameters over time does not substantially change the results of the decompositions. In Tables 4.12, 4.13, and 4.14 the model estimates using single years of data for the U.S., Canada, and the U.K. are presented. In all three countries, the magnitudes of the marginal effects of wives' participation on husbands' decisions change substantially over time but are not significantly different over time for the U.S. or Canada.[35] Although not significantly different, the change in marginal effects has a moderate impact on the reverse order decomposition results, presented in Tables 4.15, 4.16, and 4.17. Consider, for example, the results for the United States. In the primary order decomposition, the change in coefficients is accounted for in the first stage and the results of the decomposition are similar to the results in Table 4.9. In the reverse order decomposition, however, the portion of the total change in older married men's participation explained by changes in wives' participation is much larger, at 22%, since the larger marginal effect in 2005 is used in the creation of the counterfactual participation rate. Overall, however, even when potential changes in parameters over time is accounted for in these decompositions, a large portion of the total change in the participation rate of married men age 55-64 can be explained as husbands responding to the higher likelihood of wives to participation in the labour force.

Several specification tests have been done to check the robustness of the probit and bivariate probit model estimates, focussing on the effect of a wife's participation on the husband's participation decision. In Tables 4.18-4.21, the wife's age is added as a covariate in these models. The addition of this covariate increases the estimated effect of wives' participation, as expected, since the wife's age is effectively controlling for age differences between the husband and wife.[36] In a dynamic context, the age difference between husbands and wives may matter for the retirement decision. For example, if a husband is significantly

[35]Testing the hypothesis $H_o : \gamma^H_{2005} = \gamma^H_{1994}$ results in a z-score=0.8 for the U.S.. Testing the hypothesis $H_o : \gamma^H_{2005} = \gamma^H_{1995}$ results in a z-score=1.55 for Canada and 2.12 for the U.K..

[36]Adding the wife's age as a covariate is also going to capture some cohort effect since, with the inclusion of year dummy variables, entering the wife's age is practically equivalent to entering her year of birth.

older than his wife he can expect his wife to be able to support his retirement longer. If retirement is a relatively permanent action, a younger wife provides the husband with some financial security. As such, controlling for age differences would capture some of the income effect associated with a wife's participation.

Similarly, the inclusion of the wife's wage income captures some of the income effect associated with a wife's participation in the labour force. A specification for the U.S. that included the wife's wage income (not presented here) resulted in the wife's participation having a slightly larger marginal effect. The inclusion of the wife's hourly wages in Canada had the same effect. The inclusion of a potential wage (predicted based on the wife's age and education) did not, however, have a substantial effect on the magnitude of the effect of a wife's participation.

As noted in earlier sections, the econometric model used here does not allow us to simultaneously estimate the effect of a husband's participation decision on his wife's participation decision. To address this, I estimated a model similar to that proposed by Lewbel (2005) which uses the spouse's labour force status interacted with an indicator variable for which spouse acts first in the bivariate probit model.[37] Making the assumption that the older spouse makes the participation decision first, the results using U.S. data support the hypothesis that husbands' and wives' leisure time are complementary to each other. Although the use of this model is informative and addresses the problem of logical inconsistency in the simultaneous equations model, the estimates are not useful in the decomposition of participation rates.

Finally, if the framework for understanding older men's participation decisions is appropriate we would expect to see different effects for different age groups. For example, among younger married men the income effects associated with a spouse's participation in the labour force may be stronger given expected lower levels of wives non-labour income at younger ages. As well, given the different focus on leisure activities when younger, the preferences for shared leisure may not affect the relative value of leisure as much. When the husband's participation equation is estimated using a sample of younger married men age 25-34, the marginal effect of a wife's participation is relatively small as presented in Table 4.22. I would expect this positive effect is in part capturing assortative matching in the marriage market. Among older married men, income effects may be smaller as older individuals may face a lower earnings capacity and the non-labour income of each spouse may actually be higher when both the husband and wife are not working.[38] When the hus-

[37] That is, the model is stated as

$$L_i^{H*} = \gamma^H (1 - D_i) * L_i^W + X_i^H \beta_1^H + X_i^W \beta_2^H + \epsilon_i^H \quad (4.31)$$

$$L_i^{W*} = \gamma^W D_i * L_i^H + X_i^H \beta_1^W + X_i^W \beta_2^W + Z_i^W \delta + \epsilon_i^W \quad (4.32)$$

where $D_i = 1$ when the husband is older and zero otherwise. See Lewbel (2005), section 3.4.

[38] For example, joint social security benefits in the US depend on each spouse's retirement status. In

band's participation equation is estimated for married men age 65-74 the marginal effect of a spouse's participation is significantly larger.

4.4.4 LPM/Oaxaca Decompositions

To further illustrate the role of changes in men's characteristics and the likelihood of wives to participate in the labour force, it is useful to consider how these factors played a role in older men's participation rates prior to the mid-1990s. In this section, I present the results of Oaxaca decompositions of historical participation rates based on the results of a simple linear probability model. Here, I illustrate how the participation rates of married men age 55-64 may have been different in Canada and the United States had their age structure, education, and wives' participation remained as it was in 1980. This exercise is also repeated for the United Kingdom, showing how participation rates would have been different had the distribution of these factors remained as it was in 1992.[39]

The decomposition begins with the estimation of the linear probability model

$$L_{it}^{H} = \beta_0 + \sum_t \beta_t Dt_{it} + \sum_{j=0}^{1} \gamma_j L_{jit}^{W} + \sum_k \delta_k E_{kit} + \sum_\ell \alpha_\ell A_{\ell it} + v_{it} \tag{4.33}$$

in which a full set of dummy variables for each categorical variable is included in the model and a zero-sum restriction on the estimated coefficients of each categorical variable is imposed.[40] Here, L^W has two categories where L_0^W is equal to one when the wife is not in the labour force and zero otherwise, while L_1^W is equal to one when the wife is in the labour force and zero otherwise. Dt represents a full set of year dummies, E_k represents education categories, and A_ℓ represents a full set of age dummies.[41]

The predicted participation rates for each year are then constructed using the means of

Canada, income-tested benefits such as the Guaranteed Income Supplement and Spousal Allowance are available after age 65.

[39]Unfortunately, reliable and comparable household data is not available prior to 1992. Attempts were made to use the UKLFS 1983-1991, but husbands and wives could not be uniquely identified in several years and the resulting predicted values of participation rates were unreasonably inaccurate.

[40]The restricted linear probability model (LPM) used here is described in Gardeazabal and Ugidos (2004) and Fortin (2005). The advantage of this model is that the results of the Oaxaca decomposition will be invariant to which categories of each categorical variable are left out of the regression. The linear probability model provides a convenient approximation to the underlying response probabilities. For example, from the U.S. model, less than one percent of observations have predicted values greater than one. The LPM is used here because the Oaxaca methodology can not easily allow for the use of non-linear models such as a probit model.

[41]The coding of education is slightly different in this specification than those in the previous section in order to be historically consistent, see Appendix B for details. Also, I have excluded from this specification the number of own children in the household given difficulties in consistently identifying children in earlier years of the CPS.

each categorical variable in each year. For example,

$$\overline{L^H}_{A,2005} = \hat{\beta}_0 + \hat{\beta}_{2005} + \sum_{j=0}^{1} \hat{\gamma}_j \overline{L^W}_{j,2005} + \sum_k \hat{\delta}_k \overline{E}_{k,2005} + \sum_\ell \hat{\alpha}_\ell \overline{A}_{\ell,2005}. \tag{4.34}$$

is the predicted participation rate for 2005.[42]

The construction of counterfactual participation rates is then done sequentially. I begin by constructing the historical series of participation rates of older men that would have prevailed had the sample's age structure not changed since 1980 (and 1992 for the U.K.). For example, in this first stage the counterfactual participation rate for 2005, holding age structure constant at its 1980 levels is

$$\overline{L^H}_{B,2005} = \hat{\beta}_0 + \hat{\beta}_{2005} + \sum_j \hat{\gamma}_j \overline{L^W}_{j,2005} + \sum_k \hat{\delta}_k \overline{E}_{k,2005} + \sum_\ell \hat{\alpha}_\ell \overline{A}_{\ell,1980}. \tag{4.35}$$

Counterfactual historical series of participation rates also holding educational attainment and wives' participation rates constant since 1980 (and 1992 for the U.K.) are similarly constructed.

The resulting predicted and counterfactual participation rates are presented in Figures 4.7 and 4.8, demonstrating how age structure, educational attainment, and wives' participation in the labour force have a substantial influence on participation rates. Considering how the age structure of men age 55-64 has played a role, we can see that in the United States, participation rates would have been slightly higher through the 1980s had this group not become 'older' over this period. Furthermore, participation rates would have been much lower in all three countries after the mid-1990s had this group not become 'younger' over this period. Comparing the historical series holding age structure constant (B) and that holding age structure and educational attainment constant over time (C), we can see that educational attainment has played an important role throughout the 1980s and 1990s. The results suggest that by 2005, the participation rates of older men in the United States would have been four percentage points lower than observed, had the educational attainment of these men not increased since the 1980s.

The last series of counterfactual participation rates (series D) in Figures 4.7 and 4.8 illustrate the effect of changes in wives' likelihood of labour force participation on husband's decisions to participate in the labour force. Interestingly, in the United States wives participation does not appear to have an impact on husbands' participation until the late 1980s when we first see the participation rates of older women increase. Similarly, in Canada only small increases in older women's participation occured between the late 1980s and mid-1990s. After the mid-1990s, the effect of wives' participation is much larger given the much

[42]This is derived by taking the expectation of equation (4.33) conditional on $D2005 = 1$ and assumes that $E(v_{it}|D2005_{it} = 1) = 0$.

larger increases in the participation of older women in Canada over this period. This is also seen in the United Kingdom, where the participation rates of older women had not changed substantially between 1992 and 1998, thereby having very little impact on the participation rates of older men. Only after 1998, when larger increases in older wives' participation occur do we see a substantial impact on husbands' participation.

4.5 Future Trends

Can we expect the participation rates of older men to continue to increase? This will largely depend on the characteristics of the cohort of men that will be approaching retirement ages in the near future. Consider the characteristics of men who are currently age 45-54 (presented in Table 4.23) relative to those men who were 45-54 in previous cohorts. While the group of married men age 55-64 became slightly younger between 1995 and 2005 in all three countries considered here (i.e. 45-54 year olds became younger between 1985 and 1995), it appears that by 2015 this group of 55-64 year olds will become a bit older. As older individuals are less likely to participate, this will act to reduce participation rates. Working in the opposite direction, we can expect the education levels of married men age 55-64 to increase over the next decade in Canada and the United Kingdom. In these countries, the increase in educational attainment will counteract the effects of aging. In the United States, however, the education levels of the upcoming cohort do not differ substantially from the current cohort and cannot be expected to influence participation rates.

To place some magnitudes on the future effects of changes in the age structure and education of this group, projected participation rates are created using the probit estimates presented in Tables 4.4, 4.5, and 4.6, and a reweighting function similar to that in equation (4.29) based on the changes we observe in the distribution of characteristics of 45 to 54 year olds between 1995 and 2005. More specifically, I create the reweighting function

$$\psi_X = \frac{f(t_X = 2005|X^H, Age \in [45,54])}{f(t_X = 1995|X^H, Age \in [45,54])} \quad (4.36)$$

$$\approx \frac{f(t_X = 2015|X^H, Age \in [55,64])}{f(t_X = 2005|X^H, Age \in [55,64])} \quad (4.37)$$

where X^H includes a full set of age-education interaction dummy variables. Use of this reweighting function effectively adjusts the distribution of age and education among older married men to reflect the distribution we expect to see in 2015.[43] The resulting participation rates indicate that in the United States and Canada, the changes we can expect in

[43]The reweighting function created here does not account for the fact that survival probabilities are lower at higher ages or that survival probabilities could be different across education groups. For similar reasons, it would be inappropriate to to use the function $f(t_X = 2005|X^H, Age \in [45,54])/f(t_X = 2005|X^H, Age \in [55,64])$.

the age structure and educational attainment of this group may have the effect of slightly reducing participation rates (by only half a percentage point, as summarized in Table 4.24). In the United Kingdom, the effect of expected increases in education attainment on participation rates appear to completely offset the effect of changes in the age distribution.[44]

Further increases in wives' participation could drive further increases in the participation rates of older men in all three countries, however it is difficult to forecast the participation rates of next cohort of wives. Although we do not see large increases in the participation rates of wives (of men age 45-54) between 1995 and 2005, the age participation profiles of these women have flattened at younger ages for recent cohorts (as was shown in Figure 4.3). If these profiles also flatten at older ages, we may see the increases in older women's participation continue over the next decade. To predict the potential effect of increases in wives' participation, the reweighting function

$$\psi_{L^W} = \begin{cases} \frac{Pr(L^W=1|t_{L^W}=2015)}{Pr(L^W=1|t_{L^W}=2005)} & \text{if } L^W = 1 \\ \frac{Pr(L^W=0|t_{L^W}=2015)}{Pr(L^W=0|t_{L^W}=2005)} & \text{if } L^W = 0 \end{cases} \tag{4.38}$$

is applied in a similar manner as the reweighting function in equation (4.25) assuming a participation rate for wives in 2015. Assuming increases in older wives' participation rates comparable to those seen over the past decade, we would expect to see a 1.5 percentage point increase in the participation rates of older men in the United States over the next decade, attributable to husbands' preferences for sharing leisure time with their wives. Similarly, we would expect to see a 2.5 percentage point increase in older men's participation rates in the United Kingdom and a 3 percentage point increase in Canada as husbands respond to the higher likelihood of their wives to participate in the labour force.

4.6 Conclusions

This study's main finding is that a substantial portion of the recent increases in older married men's participation rates may be explained by the recent increase in the participation rates of their wives. Wives' participation in the labour force has this substantial explanatory power because wives leisure time is complementary to the leisure time of their husbands, as evidenced by the positive effect of wives' participation on husbands' participation decisions. This leisure complementarity has led to husbands participating more in the labour force as their wives have become more likely to participate. The creation of counterfactual participation rates and the resulting decompositions of older married men's participation rates demonstrates that in the United States, up to one third of the increase can be explained as a response to changes in wives' labour force participation. As much as one half of the

[44]Note that similar results are found when projections are based on the estimates in section 4.4.4 and the means in Table 4.23.

observed increase in Canada and two fifths of the increase in the United Kingdom can also be explained as a response to changes in wives' participation.

Increases in the educational attainment of older men and changes in the age structure of men age 55-64 are also shown to have significant explanatory power for the recent increase in older men's participation rates. Changes in their characteristics account for up to one half of the increase in older married men's participation rates in the United states, and up to one third of the increase in Canada and the United Kingdom.

Considering future trends in older men's participation rates, we might expect the upward trend in older men's participation rates to continue if the participation rates of older women continue to increase. Such trends would alleviate some concerns associated with our aging populations. To keep in mind, however, this study has left a large portion of the increase in older men's participation 'unexplained'. If, for instance, the performance of the labour market in the United States continues to worsen or the health of Canadians declines, this upward trend may not materialize.

Table 4.1. Characteristics of Married Men Age 55-64, United States

	All Married Men 1994	All Married Men 2005	Wife in LF 1994	Wife in LF 2005	Wife not in LF 1994	Wife not in LF 2005
Participation Rate	0.67	0.74	0.76	0.81	0.56	0.61
Age	59.39	59.12	58.87	58.69	60.02	59.81
Education						
Grade 8 or less	0.11	0.05	0.08	0.03	0.14	0.07
HS dropout	0.11	0.07	0.11	0.06	0.12	0.09
HS grad	0.34	0.30	0.35	0.28	0.32	0.33
Some PS	0.15	0.17	0.15	0.17	0.14	0.15
PS	0.05	0.08	0.05	0.08	0.04	0.07
University	0.14	0.19	0.14	0.21	0.13	0.16
Grad/Prof.	0.11	0.16	0.12	0.17	0.11	0.14
Spouse						
In Labour Force	0.55	0.62	1	1	0	0
Age	56.35	56.22	55.03	55.27	57.94	57.77
Age Difference	3.05	2.89	3.84	3.42	2.08	2.04
Child at Home	0.33	0.31	0.34	0.34	0.31	0.28
Number of Kids	0.47	0.46	0.50	0.50	0.44	0.40

Note. — See Appendix B for a description of the March CPS sample and variables.

Table 4.2. Characteristics of Married Men Age 55-64, Canada

	All Married Men 1995	All Married Men 2005	Wife in LF 1995	Wife in LF 2005	Wife not in LF 1995	Wife not in LF 2005
Participation Rate	0.61	0.68	0.76	0.79	0.47	0.53
Age	59.32	59.09	58.62	58.56	59.94	59.87
Education						
Grade 8 or less	0.22	0.10	0.18	0.08	0.27	0.13
HS dropout	0.20	0.12	0.20	0.12	0.20	0.13
HS grad	0.15	0.17	0.15	0.18	0.15	0.16
Some PS	0.04	0.05	0.05	0.05	0.04	0.05
PS	0.25	0.33	0.26	0.34	0.23	0.32
University	0.07	0.13	0.09	0.13	0.06	0.11
Grad/Prof.	0.06	0.10	0.08	0.11	0.05	0.09
Spouse						
In Labour Force	0.47	0.59	1	1	0	0
Age	56.09	56.06	54.25	54.84	57.72	57.86
Age Difference	3.23	3.02	4.37	3.72	2.22	2.01
Child at Home	0.37	0.32	0.43	0.37	0.32	0.24
Number of Kids	0.56	0.49	0.64	0.58	0.48	0.36

Note. — See Appendix B for a description of the CLFS sample and variables.

Table 4.3. Characteristics of Married Men Age 55-64, United Kingdom

	All Married Men 1995	All Married Men 2005	Wife in LF 1995	Wife in LF 2005	Wife not in LF 1995	Wife not in LF 2005
Participation Rate	0.65	0.71	0.80	0.85	0.48	0.52
Age	59.33	59.16	58.66	58.55	60.05	60.06
Education						
No qualifications	0.28	0.19	0.27	0.16	0.30	0.23
Other qualifications	0.12	0.11	0.12	0.11	0.12	0.12
CSE below grade 1	0.01	0.01	0.01	0.01	0.01	0.01
GCSE A-C or equivalent	0.07	0.11	0.07	0.11	0.06	0.10
A level or equivalent	0.34	0.32	0.34	0.33	0.33	0.30
Higher educ., below degree	0.07	0.09	0.07	0.09	0.06	0.08
Degree or higher	0.11	0.17	0.11	0.18	0.11	0.15
Spouse						
In Labour Force	0.52	0.60	1	1	0	0
Age	56.53	56.72	55.07	55.33	58.12	58.77
Age Difference	2.80	2.44	3.59	3.22	1.93	1.28
Child at Home	0.30	0.29	0.34	0.35	0.27	0.21
Number of Kids	0.41	0.42	0.45	0.49	0.37	0.31

Note. — See Appendix B for a description of the UKLFS sample and variables.

Table 4.4. Model Estimates, Pooled Samples, United States

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife Participates	0.504	0.186	0.592	0.219
	(.014)	(.005)	(.076)	(.028)
Education				
Grade 8 or less	-0.205	-0.072	-0.191	-0.065
	(.026)	(.009)	(.028)	(.011)
HS dropout	-0.134	-0.046	-0.130	-0.044
	(.024)	(.009)	(.025)	(.009)
Some PS	0.124	0.039	0.121	0.037
	(.021)	(.006)	(.021)	(.007)
PS degree	0.109	0.035	0.105	0.033
	(.030)	(.009)	(.030)	(.009)
University degree	0.309	0.091	0.304	0.088
	(.021)	(.006)	(.022)	(.007)
Grad/Prof. degree	0.448	0.125	0.444	0.121
	(.023)	(.006)	(.023)	(.007)
Age	-0.121	-0.040	-0.118	-0.038
	(.002)	(.001)	(.003)	(.002)
Number of Kids	0.086	0.028	0.085	0.027
	(.009)	(.003)	(.009)	(.003)
Constant	7.374		7.158	
	(.151)		(.242)	

Note. — Standard errors are in parentheses. Sample includes married men age 55-64 in 1994-2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old high school graduate in 2005 whose wife is in the labour force and there are no children at home.

Table 4.5. Model Estimates, Pooled Samples, Canada

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife Participates	0.604	0.228	0.522	0.198
	(.011)	(.004)	(.044)	(.016)
Education				
Grade 8 or less	-0.138	-0.048	-0.148	-0.053
	(.018)	(.006)	(.019)	(.007)
HS dropout	-0.052	-0.018	-0.055	-0.019
	(.018)	(.006)	(.018)	(.006)
Some PS	0.007	0.002	0.007	0.003
	(.026)	(.009)	(.026)	(.009)
PS degree	0.066	0.022	0.065	0.022
	(.016)	(.005)	(.016)	(.006)
University degree	0.008	0.003	0.009	0.003
	(.022)	(.007)	(.022)	(.008)
Grad/Prof. degree	0.241	0.075	0.244	0.077
	(.024)	(.007)	(.024)	(.008)
Age	-0.111	-0.037	-0.114	-0.039
	(.002)	(.001)	(.002)	(.001)
Number of Kids	0.128	0.043	0.131	0.045
	(.007)	(.003)	(.008)	(.003)
Constant	6.663		6.880	
	(.115)		(.161)	

Note. — Standard errors are in parentheses. Sample includes married men age 55-64 in 1995-2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old high school graduate in 2005 whose wife is in the labour force and there are no children at home.

Table 4.6. Model Estimates, Pooled Samples, United Kingdom

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife Participates	0.785	0.268	0.560	0.191
	(.011)	(.005)	(.059)	(.020)
Education				
No qualifications	-0.284	-0.084	-0.319	-0.102
	(.015)	(.005)	(.017)	(.006)
Other qualifications	-0.006	-0.002	-0.018	-0.005
	(.019)	(.005)	(.021)	(.006)
CSE below grade 1	-0.095	-0.026	-0.103	-0.030
	(.056)	(.016)	(.062)	(.019)
GCSE A-C or equivalent	-0.043	-0.011	-0.052	-0.015
	(.022)	(.006)	(.024)	(.007)
Higher educ., below degree	-0.057	-0.015	-0.050	-0.014
	(.022)	(.006)	(.025)	(.007)
Degree or higher	0.051	0.013	0.048	0.013
	(.019)	(.005)	(.021)	(.006)
Age	-0.105	-0.027	-0.114	-0.032
	(.002)	(.001)	(.003)	(.002)
Number of Kids	0.041	0.011	0.045	0.013
	(.008)	(.002)	(.009)	(.003)
Constant	6.422		7.098	
	(.125)		(.210)	

Note. — Standard errors are in parentheses. Sample includes married men age 55-64 in 1995-2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old with A-level qualifications in 2005 whose wife is in the labour force and there are no children at home.

Table 4.7. Estimated Effect of Wives' Participation, Pooled Samples, United States

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Baseline	0.504	0.186	0.592	0.219
	(.014)	(.005)	(.076)	(.028)
Specification Includes				
Poor Health[a]	0.505	0.178	0.613	0.216
	(.015)	(.006)	(.087)	(.031)
Stock Market Dividends[b]	0.503	0.186	0.594	0.220
	(.014)	(.005)	(.076)	(.028)
Macroeconomic Effects[c]	0.504	0.187	0.590	0.219
	(.014)	(.005)	(.075)	(.028)

Note. — Baseline estimates refer to the estimates presented in Table 4.4.

[a]Only data from 1996-2005 is used here. An indicator for poor health is used, set to 0 for the calculation of marginal effects.

[b]The value of stock dividends is used here, set to $555 for the calculation of marginal effects

[c]Specifications include year-state specific unemployment rates of 25-54 year olds, set at 4% for the calculation of marginal effects.

Table 4.8. Weights and Coefficients used in the Decompositions

Primary Order Decompositions				
Sample Used[a]	Pooled 1995-2005		Annual 1995&2005	
	Weights	Coef.[b]	Weights	Coef.
2005 participation rate	ω_{i05}	β_p	ω_{i05}	β_{05}
Accounting for:				
Δ coefficients	-	-	ω_{i05}	β_{95}
Δ men's characteristics	$\omega_{i05}\psi_{X^H\|L^W}$	β_p	$\omega_{i05}\psi_{X^H\|L^W}$	β_{95}
Δ wives' participation	$\omega_{i05}\psi_{X^H\|L^W}\psi_{L^W}$	β_p	$\omega_{i05}\psi_{X^H\|L^W}\psi_{L^W}$	β_{95}
1995 participation rate	ω_{i95}	β_p	ω_{i95}	β_{95}
Reverse Order Decompositions				
Sample Used:	Pooled 1995-2005		Annual 1995&2005	
	Weights	Coef.	Weights	Coef.
2005 participation rate	ω_{i05}	β_p	ω_{i05}	β_{05}
Accounting for:				
Δ wives' participation	$\omega_{i05}\psi_{L^W\|X^H}$	β_p	$\omega_{i05}\psi_{L^W\|X^H}$	β_{05}
Δ men's characteristics	$\omega_{i05}\psi_{L^W\|X^H}\psi_{X^H}$	β_p	$\omega_{i05}\psi_{L^W\|X^H}\psi_{X^H}$	β_{05}
Δ coefficients	-	-	$\omega_{i05}\psi_{L^W\|X^H}\psi_{X^H}$	β_{95}
1995 participation rate	ω_{i95}	β_p	ω_{i95}	β_{95}

[a]U.S. Decompositions are using 1994, not 1995.

[b]β_p refers to the estimates presented in Tables 4.4, 4.5, and 4.6, noting the models include a set of dummy variables indicating each year.

Table 4.9. Decomposition Results (Using Pooled Estimates), United States

	(1)[a]	(2)[b]
Predicted participation rate 2005	0.734	0.732
Predicted participation rate 1994	0.670	0.668
Total change	0.064	0.064
Primary Order Decomposition		
Effect of:		
Change in men's characteristics	0.024	0.023
	(37%)	(36%)
Change in wives participation	0.015	0.017
	(23%)	(27%)
Unexplained	0.026	0.024
	(40%)	(38%)
Reverse Order Decomposition		
Effect of:		
Change in wives participation	0.008	0.009
	(12%)	(14%)
Change in men's characteristics	0.031	0.030
	(48%)	(48%)
Unexplained	0.026	0.024
	(40%)	(38%)

[a]Estimates using the probit model estimates of the husband's labour force participation, presented in Table 4.4.

[b]Estimates using the bivariate probit model estimates of the husband's labour force participation, presented in Table 4.4.

Table 4.10. Decomposition Results (Using Pooled Estimates), Canada

	(1)[a]	(2)[b]
Predicted participation rate 2005	0.681	0.683
Predicted participation rate 1995	0.609	0.610
Total change	0.072	0.073
Primary Order Decomposition		
Effect of:		
Change in men's characteristics	0.010	0.011
	(14%)	(15%)
Change in wives participation	0.033	0.030
	(46%)	(42%)
Unexplained	0.029	0.032
	(40%)	(44%)
Reverse Order Decomposition		
Effect of:		
Change in wives participation	0.020	0.017
	(28%)	(23%)
Change in men's characteristics	0.024	0.024
	(33%)	(32%)
Unexplained	0.029	0.032
	(40%)	(44%)

[a]Estimates using the probit model estimates of the husband's labour force participation, presented in Table 4.5.

[b]Estimates using the bivariate probit model estimates of the husband's labour force participation, presented in Table 4.5.

Table 4.11. Decomposition Results (Using Pooled Estimates), United Kingdom

	(1)[a]	(2)[b]
Predicted participation rate 2005	0.714	0.719
Predicted participation rate 1995	0.648	0.656
Total change	0.066	0.062
Primary Order Decomposition		
Effect of:		
Change in men's characteristics	0.009	0.010
	(13%)	(17%)
Change in wives participation	0.023	0.017
	(34%)	(28%)
Unexplained	0.034	0.034
	(52%)	(55%)
Reverse Order Decomposition		
Effect of:		
Change in wives participation	0.016	.011
	(24%)	(17%)
Change in men's characteristics	0.016	0.017
	(24%)	(27%)
Unexplained	0.034	0.034
	(52%)	(55%)

[a]Estimates using the probit model estimates of the husband's labour force participation, presented in Table 4.6.

[b]Estimates using the bivariate probit model estimates of the husband's labour force participation, presented in Table 4.6.

Table 4.12. Model Estimates, Annual, United States

Dependent Variable: Husband's Labour Force Participation								
	Probit				Bivariate Probit			
	1994		2005		1994		2005	
	Coef.	M.E.	Coef.	M.E.	Coef.	M.E.	Coef.	M.E.
Wife Participates	0.421	0.159	0.486	0.181	0.505	0.190	0.791	0.293
	(.047)	(.018)	(.043)	(.016)	(.240)	(.089)	(.258)	(.093)
Education								
Grade 8 or less	-0.303	-0.112	-0.210	-0.074	-0.290	-0.106	-0.166	-0.054
	(.079)	(.030)	(.090)	(.033)	(.087)	(.035)	(.098)	(.035)
HS dropout	-0.032	-0.011	-0.178	-0.063	-0.028	-0.009	-0.152	-0.049
	(.081)	(.028)	(.084)	(.030)	(.082)	(.028)	(.087)	(.030)
Some PS	0.111	0.037	0.138	0.044	0.112	0.037	0.121	0.036
	(.073)	(.024)	(.064)	(.020)	(.073)	(.024)	(.066)	(.020)
PS degree	0.026	0.009	0.042	0.014	0.026	0.009	0.020	0.006
	(.113)	(.039)	(.086)	(.028)	(.113)	(.038)	(.086)	(.026)
University degree	0.202	0.066	0.439	0.126	0.202	0.065	0.406	0.106
	(.076)	(.024)	(.064)	(.018)	(.076)	(.024)	(.071)	(.023)
Grad/Prof. degree	0.287	0.091	0.548	0.150	0.288	0.089	0.518	0.128
	(.088)	(.026)	(.072)	(.018)	(.088)	(.026)	(.079)	(.025)
Age	-0.133	-0.046	-0.094	-0.031	-0.130	-0.044	-0.083	-0.026
	(.009)	(.003)	(.008)	(.003)	(.012)	(.006)	(.013)	(.006)
Number of Kids	0.083	0.029	0.101	0.034	0.082	0.028	0.094	0.029
	(.030)	(.011)	(.028)	(.010)	(.030)	(.011)	(.029)	(.010)
Constant	8.058		5.723		7.837		4.909	
	(.524)		(.475)		(.824)		(.879)	

Note. — Standard errors are in parentheses. Samples includes married men age 55-64 in 1994 or 2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old high school graduate whose wife is in the labour force and there are no children at home.

Table 4.13. Model Estimates, Annual, Canada

Dependent Variable: Husband's Labour Force Participation								
	Probit				Bivariate Probit			
	1995		2005		1995		2005	
	Coef.	M.E.	Coef.	M.E.	Coef.	M.E.	Coef.	M.E.
Wife Participates	0.633	0.244	0.588	0.220	0.701	0.269	0.375	0.141
	(.035)	(.013)	(.034)	(.013)	(.130)	(.048)	(.179)	(.067)
Education								
Grade 8 or less	-0.160	-0.058	-0.178	-0.062	-0.155	-0.056	-0.204	-0.074
	(.057)	(.021)	(.065)	(.023)	(.058)	(.021)	(.069)	(.026)
HS dropout	-0.053	-0.019	-0.131	-0.045	-0.054	-0.019	-0.137	-0.050
	(.057)	(.020)	(.062)	(.021)	(.057)	(.020)	(.062)	(.023)
Some PS	0.107	0.036	-0.133	-0.046	0.103	0.034	-0.141	-0.051
	(.095)	(.032)	(.084)	(.029)	(.096)	(.032)	(.083)	(.031)
PS degree	0.075	0.026	0.038	0.012	0.071	0.024	0.035	0.012
	(.056)	(.019)	(.051)	(.017)	(.057)	(.019)	(.051)	(.018)
University degree	0.140	0.047	-0.075	-0.025	0.134	0.044	-0.076	-0.027
	(.082)	(.027)	(.066)	(.023)	(.083)	(.028)	(.066)	(.024)
Grad/Prof. degree	0.387	0.121	0.166	0.052	0.378	0.115	0.167	0.056
	(.087)	(.025)	(.070)	(.022)	(.088)	(.027)	(.070)	(.023)
Age	-0.124	-0.044	-0.109	-0.036	-0.122	-0.042	-0.117	-0.041
	(.006)	(.003)	(.006)	(.002)	(.008)	(.004)	(.009)	(.004)
Number of Kids	0.108	0.038	0.177	0.059	0.106	0.037	0.186	0.065
	(.022)	(.008)	(.026)	(.009)	(.023)	(.008)	(.027)	(.011)
Constant	7.331		6.580		7.151		7.135	
	(.378)		(.381)		(.515)		(.582)	

Note. — Standard errors are in parentheses. Samples includes married men age 55-64 in 1995 or 2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old high school graduate whose wife is in the labour force and there are no children at home.

Table 4.14. Model Estimates, Annual, United Kingdom

Dependent Variable: Husband's Labour Force Participation								
	Probit				Bivariate Probit			
	1995		2005		1995		2005	
	Coef.	M.E.	Coef.	M.E.	Coef.	M.E.	Coef.	M.E.
Wife Participates	0.769	0.282	0.829	0.277	0.357	0.133	1.002	0.334
	(.036)	(.013)	(.039)	(.013)	(.178)	(.066)	(.203)	(.068)
Education								
No qualifications	-0.190	-0.062	-0.353	-0.102	-0.155	-0.056	-0.354	-0.096
	(.045)	(.015)	(.053)	(.016)	(.054)	(.020)	(.059)	(.020)
Other qualifications	0.023	0.007	-0.014	-0.004	-0.005	-0.002	-0.015	-0.003
	(.061)	(.018)	(.066)	(.017)	(.071)	(.025)	(.069)	(.016)
CSE below grade 1	0.182	0.051	-0.340	-0.098	0.273	0.087	-0.407	-0.113
	(.184)	(.048)	(.180)	(.058)	(.226)	(.066)	(.185)	(.059)
GCSE A-C or	-0.035	-0.011	-0.045	-0.011	0.020	0.007	-0.042	-0.010
equivalent	(.075)	(.023)	(.068)	(.017)	(.088)	(.031)	(.070)	(.017)
Higher educ.,	0.009	0.003	0.008	0.002	0.057	0.020	-0.009	-0.002
below degree	(.075)	(.022)	(.074)	(.018)	(.087)	(.030)	(.076)	(.017)
Degree or higher	0.139	0.040	0.016	0.004	0.176	0.058	0.006	0.001
	(.063)	(.018)	(.059)	(.014)	(.075)	(.024)	(.061)	(.014)
Age	-0.103	-0.031	-0.100	-0.025	-0.120	-0.042	-0.093	-0.021
	(.007)	(.002)	(.007)	(.002)	(.010)	(.005)	(.012)	(.004)
Number of Kids	0.070	0.021	0.005	0.001	0.062	0.022	0.004	0.001
	(.027)	(.008)	(.028)	(.007)	(.032)	(.011)	(.030)	(.007)
Constant	6.146		6.171		7.352		5.608	
	(.394)		(.440)		(.646)		(.803)	

Note. — Standard errors are in parentheses. Samples includes married men age 55-64 in 1995 or 2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old with A-level qualifications whose wife is in the labour force and there are no children at home.

Table 4.15. Decomposition Results (Using Annual Estimates), United States

	(1)[a]	(2)[b]
Predicted participation rate 2005	0.735	0.726
Predicted participation rate 1994	0.670	0.669
Total change	0.065	0.057
Primary Order Decomposition		
Effect of:		
Change in coefficients	0.029	0.020
	(45%)	(35%)
Change in men's characteristics	0.022	0.021
	(34%)	(37%)
Change in wives participation	0.014	0.016
	(21%)	(28%)
Reverse Order Decomposition		
Effect of:		
Change in wives participation	0.008	0.012
	(12%)	(22%)
Change in men's characteristics	0.032	0.030
	(49%)	(52%)
Change in coefficients	0.026	0.015
	(39%)	(27%)

[a]Estimates using the probit model estimates of the husband's labour force participation, presented in Table 4.12.

[b]Estimates using the bivariate probit model estimates of the husband's labour force participation, presented in Table 4.12.

Table 4.16. Decomposition Results (Using Annual Estimates), Canada

	(1)[a]	(2)[b]
Predicted participation rate 2005	0.682	0.684
Predicted participation rate 1995	0.609	0.607
Total change	0.073	0.076
Primary Order Decomposition		
Effect of:		
Change in coefficients	0.021	0.022
	(29%)	(29%)
Change in men's characteristics	0.016	0.015
	(22%)	(20%)
Change in wives participation	0.036	0.039
	(50%)	(51%)
Reverse Order Decomposition		
Effect of:		
Change in wives participation	0.020	0.012
	(27%)	(16%)
Change in men's characteristics	0.022	0.022
	(30%)	(29%)
Change in coefficients	0.031	0.042
	(43%)	(55%)

[a]Estimates using the probit model estimates of the husband's labour force participation, presented in Table 4.13.

[b]Estimates using the bivariate probit model estimates of the husband's labour force participation, presented in Table 4.13.

Table 4.17. Decomposition Results (Using Annual Estimates), United Kingdom

	(1)[a]	(2)[b]
Predicted participation rate 2005	0.714	0.706
Predicted participation rate 1995	0.648	0.656
Total change	0.065	0.050
Primary Order Decomposition		
Effect of:		
Change in coefficients	0.033	0.026
	(51%)	(51%)
Change in men's characteristics	0.008	0.010
	(13%)	(21%)
Change in wives participation	0.023	0.014
	(36%)	(27%)
Reverse Order Decomposition		
Effect of:		
Change in wives participation	0.016	0.020
	(25%)	(40%)
Change in men's characteristics	0.018	0.017
	(27%)	(34%)
Change in coefficients	0.031	0.012
	(47%)	(24%)

[a]Estimates using the probit model estimates of the husband's labour force participation, presented in Table 4.14.

[b]Estimates using the bivariate probit model estimates of the husband's labour force participation, presented in Table 4.14.

Table 4.18. Robustness checks – Model Estimates, Pooled Samples, United States

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife Participates	0.506	0.187	1.329	0.484
	(.014)	(.005)	(.098)	(.033)
Grade 8 or less	-0.205	-0.072	-0.067	-0.019
	(.026)	(.009)	(.032)	(.009)
HS dropout	-0.134	-0.046	-0.080	-0.022
	(.024)	(.009)	(.025)	(.007)
Some PS	0.124	0.039	0.086	0.022
	(.021)	(.006)	(.021)	(.005)
PS degree	0.109	0.035	0.067	0.017
	(.030)	(.009)	(.030)	(.008)
University degree	0.309	0.092	0.247	0.060
	(.021)	(.006)	(.023)	(.006)
Grad/Prof. degree	0.448	0.126	0.379	0.085
	(.023)	(.006)	(.026)	(.007)
Age	-0.122	-0.040	-0.105	-0.028
	(.003)	(.001)	(.004)	(.002)
Wife's age	0.001	0.0003	0.020	0.006
	(.002)	(.001)	(.003)	(.001)
Number of Kids	0.087	0.029	0.092	0.025
	(.009)	(.003)	(.009)	(.003)
Constant	7.368		4.728	
	(.151)		(.433)	

Note. — Standard errors are in parentheses. Sample includes married men age 55-64 in 1994-2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old high school graduate in 2005 whose 55 year old wife is in the labour force and there are no children at home.

Table 4.19. Robustness checks – Model Estimates, Pooled Samples, Canada

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife Participates	0.612	0.231	0.695	0.262
	(.011)	(.004)	(.287)	(.106)
Grade 8 or less	-0.137	-0.048	-0.128	-0.044
	(.019)	(.006)	(.039)	(.016)
HS dropout	-0.052	-0.018	-0.049	-0.016
	(.018)	(.006)	(.021)	(.008)
Some PS	0.006	0.002	0.005	0.002
	(.026)	(.009)	(.026)	(.009)
PS degree	0.066	0.022	0.066	0.021
	(.016)	(.005)	(.017)	(.005)
University degree	0.008	0.003	0.007	0.002
	(.022)	(.007)	(.022)	(.007)
Grad/Prof. degree	0.240	0.075	0.237	0.072
	(.024)	(.007)	(.027)	(.012)
Age	-0.114	-0.038	-0.114	-0.037
	(.002)	(.001)	(.004)	(.004)
Wife's age	0.004	0.001	0.006	0.002
	(.001)	(.000)	(.009)	(.003)
Number of Kids	0.132	0.044	0.131	0.043
	(.008)	(.003)	(.008)	(.005)
Constant	6.634		6.396	
	(.115)		(.850)	

Note. — Standard errors are in parentheses. Sample includes married men age 55-64 in 1995-2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old high school graduate in 2005 whose 55 year old wife is in the labour force and there are no children at home.

Table 4.20. Robustness checks – Model Estimates, Pooled Samples, United Kingdom

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife Participates	0.806	0.279	0.809	0.279
	(.012)	(.005)	(.344)	(.122)
No qualifications	-0.283	-0.085	-0.301	-0.090
	(.015)	(.005)	(.033)	(.018)
Other qualifications	-0.003	-0.001	-0.008	-0.002
	(.019)	(.005)	(.024)	(.007)
CSE below grade 1	-0.095	-0.026	-0.097	-0.027
	(.056)	(.016)	(.063)	(.019)
GCSE A-C or equivalent	-0.041	-0.011	-0.049	-0.013
	(.022)	(.006)	(.025)	(.007)
Higher educ., below degree	-0.057	-0.016	-0.052	-0.014
	(.022)	(.006)	(.025)	(.007)
Degree or higher	0.052	0.014	0.050	0.013
	(.019)	(.005)	(.021)	(.005)
Age	-0.113	-0.030	-0.113	-0.030
	(.002)	(.001)	(.006)	(.005)
Wife's age	0.011	0.003	0.010	0.003
	(.001)	(.000)	(.010)	(.002)
Number of Kids	0.057	0.015	0.054	0.014
	(.009)	(.002)	(.011)	(.003)
Constant	6.314		6.346	
	(.126)		(1.106)	

Note. — Standard errors are in parentheses. Sample includes married men age 55-64 in 1995-2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year with A-level qualifications in 2005 whose 55 year old wife is in the labour force and there are no children at home.

Table 4.21. Robustness checks – Model Estimates, Pooled Samples, United States

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife Participates	0.501	0.167	0.810	0.288
	(.014)	(.005)	(.391)	(.140)
Education				
Grade 8 or less	-0.204	-0.070	-0.159	-0.048
	(.026)	(.009)	(.067)	(.026)
HS dropout	-0.134	-0.045	-0.117	-0.035
	(.024)	(.008)	(.034)	(.013)
Some PS	0.127	0.040	0.115	0.031
	(.021)	(.006)	(.027)	(.010)
PS degree	0.109	0.034	0.095	0.026
	(.030)	(.009)	(.035)	(.011)
University degree	0.311	0.094	0.295	0.073
	(.021)	(.006)	(.033)	(.016)
Grad/Prof. degree	0.449	0.130	0.434	0.100
	(.023)	(.006)	(.035)	(.019)
Age				
55	0.419	0.122	0.404	0.094
	(.032)	(.008)	(.040)	(.019)
56	0.306	0.092	0.292	0.072
	(.031)	(.008)	(.038)	(.016)
57	0.265	0.080	0.256	0.064
	(.031)	(.009)	(.034)	(.014)
58	0.203	0.063	0.192	0.050
	(.031)	(.009)	(.035)	(.013)
59	0.098	0.031	0.093	0.025
	(.030)	(.009)	(.031)	(.010)
61	-0.120	-0.040	-0.118	-0.035
	(.030)	(.010)	(.030)	(.010)
62	-0.401	-0.142	-0.391	-0.127
	(.030)	(.011)	(.035)	(.020)
63	-0.551	-0.200	-0.535	-0.181
	(.030)	(.012)	(.042)	(.026)
64	-0.627	-0.230	-0.604	-0.207
	(.031)	(.012)	(.050)	(.032)

Table 4.21—Continued

Dependent Variable: Husband's Labour Force Participation				
	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife's Age				
40-44	-0.064	-0.021	-0.102	-0.030
	(.056)	(.019)	(.074)	(.021)
45-49	-0.084	-0.028	-0.125	-0.037
	(.028)	(.010)	(.057)	(.014)
50-54	0.010	0.003	-0.016	-0.004
	(.019)	(.006)	(.037)	(.010)
60-64	-0.013	-0.004	0.033	0.009
	(.019)	(.006)	(.063)	(.016)
65+	-0.054	-0.018	0.063	0.017
	(.034)	(.012)	(.155)	(.039)
Number of kids	0.092	0.030	0.093	0.026
	(.009)	(.003)	(.009)	(.004)
Constant	0.219		0.022	
	(.033)		(.259)	

Note. — Standard errors are in parentheses. Sample includes married men age 55-64 in 1994-2005. See Appendix B for details regarding sample selection and explanatory variables. The models include a full set of year dummies. Marginal effects are evaluated for a 60 year old high school graduate in 2005 whose 55 year old wife is in the labour force and there are no children at home.

Table 4.22. Effect of Wives' Participation, by Age Group, United States

Dependent Variable: Husband's Labour Force Participation		
Age Group	Coefficient	Marginal Effect
25-34	0.166	0.019
	(.024)	(.003)
35-44	0.252	0.036
	(.019)	(.004)
45-54	0.340	0.069
	(.016)	(.004)
65-74	0.842	0.272
	(.018)	(.008)

Note. — The probit models include covariates for age, education, number of children, and year. Sample includes married men in each age group, excluding husbands who are more than 15 years older or younger than their wives, years 1994-2005. Marginal effects are evaluated for a 30/40/50/70 year old high school graduate in 2005 with no children and whose wife is in the labour force.

Table 4.23 Characteristics of Married Men Age 45-54

A. Age Structure

	United States			Canada			United Kingdom		
	1985	1995	2005	1985	1995	2005	1985	1995	2005
Age (mean)	49.42	49.15	49.39	49.36	49.09	49.26	49.40	49.21	49.38
Age 45	0.11	0.12	0.11	0.11	0.12	0.11	0.11	0.10	0.11
Age 46	0.10	0.11	0.10	0.10	0.11	0.11	0.11	0.11	0.11
Age 47	0.10	0.13	0.11	0.10	0.12	0.11	0.10	0.12	0.10
Age 48	0.10	0.11	0.11	0.10	0.11	0.10	0.11	0.12	0.11
Age 49	0.10	0.08	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Age 50	0.10	0.09	0.11	0.10	0.10	0.11	0.10	0.09	0.09
Age 51	0.10	0.09	0.09	0.09	0.08	0.09	0.09	0.09	0.10
Age 52	0.10	0.10	0.10	0.10	0.09	0.83	0.09	0.10	0.09
Age 53	0.09	0.08	0.09	0.09	0.08	0.09	0.10	0.08	0.10
Age 54	0.10	0.08	0.10	0.09	0.08	0.08	0.10	0.08	0.10

B. Educational Attainment

United Kingdom				Canada			
	1985	1995	2005		1985	1995	2005
No qualifications	0.48	0.19	0.12	Grade 8 or less	0.26	0.11	0.04
Other qualifications	0.08	0.13	0.10	HS dropout	0.19	0.11	0.06
CSE below grade 1	0.00	0.02	0.03	HS	0.29	0.26	0.28
GCSE A-C or Equiv.	0.09	0.09	0.13	Some PS	0.06	0.06	0.06
A level	0.17	0.33	0.33	PS	0.10	0.29	0.34
Higher ed., < degree	0.06	0.08	0.09	University	0.10	0.18	0.22
Degree or higher	0.12	0.15	0.20				

United States			
	1985	1995	2005
Grade 8 or less	0.10	0.05	0.04
HS dropout	0.13	0.06	0.05
HS	0.36	0.29	0.31
Some College	0.17	0.24	0.26
College Grad	0.24	0.35	0.34

C. Wives' Participation in the Labour Force

	United States			Canada			United Kingdom		
	1985	1995	2005	1985	1995	2005	1985	1995	2005
Rate	0.65	0.75	0.76	0.75	0.80	0.84	0.69	0.78	0.80

Table 4.24. Forecasted Changes in Men's Participation Rates

	U.S.	Canada	U.K.
Predicted 2005 Participation Rate	0.734	0.681	0.714
Effect of 2005-2015			
Change in Age and Education	-0.004	-0.005	-0.001
Change in Wives Participation[a]	0.015	0.032	0.025
Unexplained[b]	0.026	0.029	0.034
Forecasted 2015 Participation Rate	0.771	0.737	0.772

[a]Assumes the same increase in wives participation as observed in the previous decade.

[b]Assumes the same unexplained increase in participation observed over the previous decade, an obviously unfounded assumption.

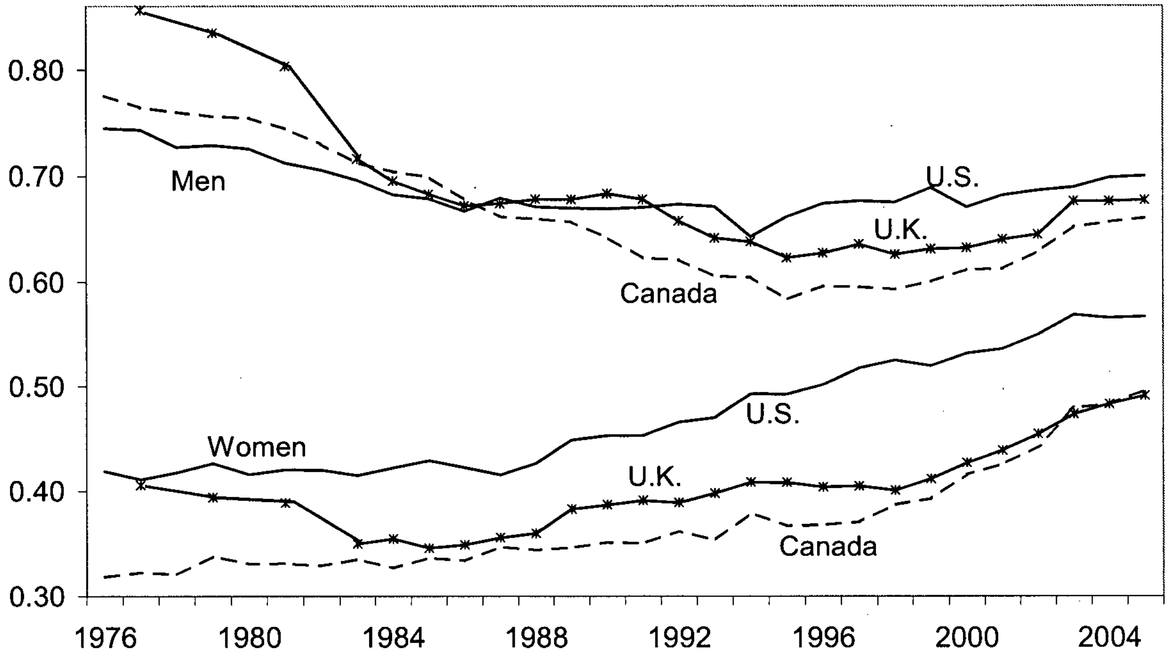


Figure 4.1 Participation Rates of Individuals Age 55-64, by Sex, 1976-2005

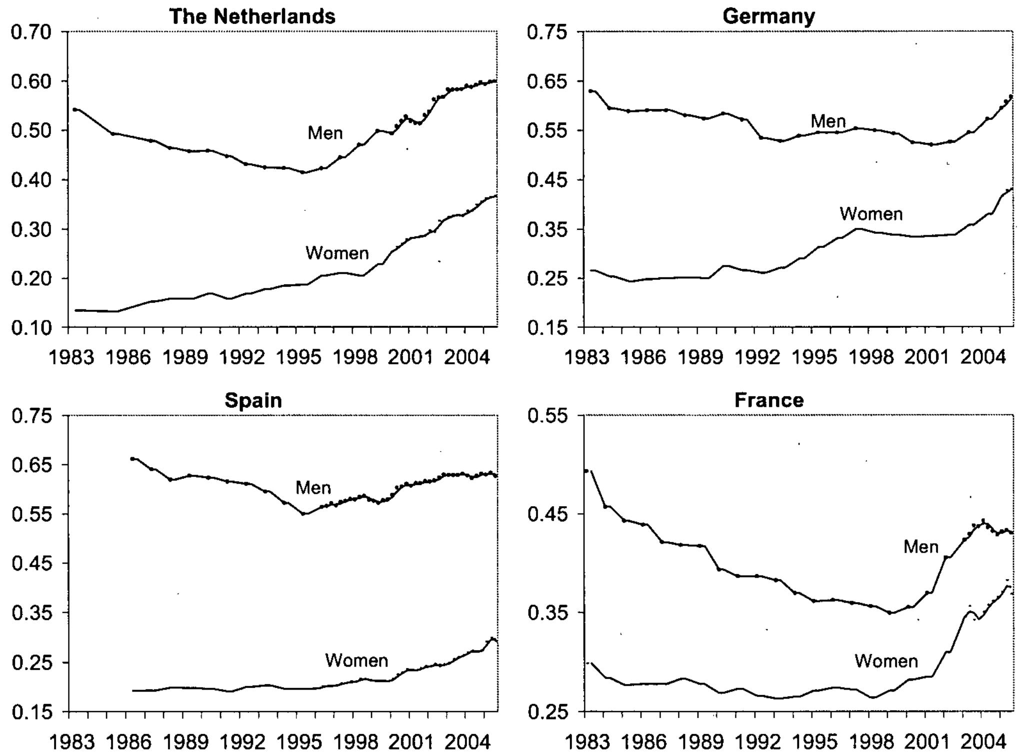
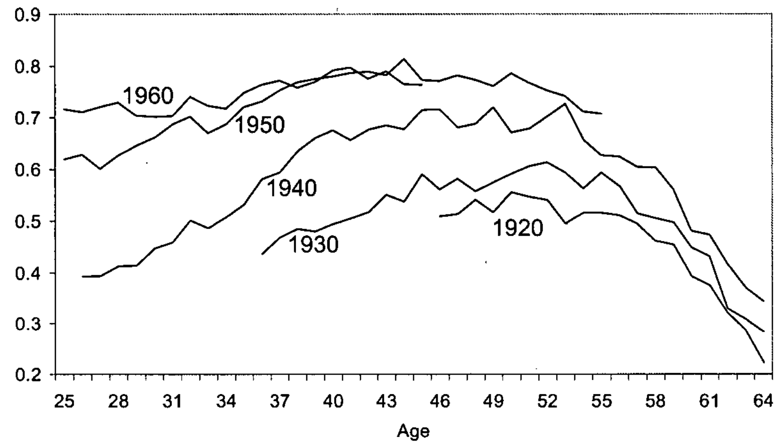
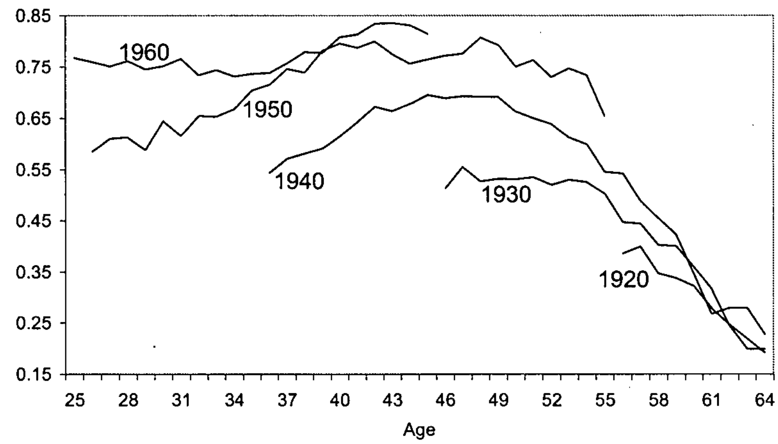


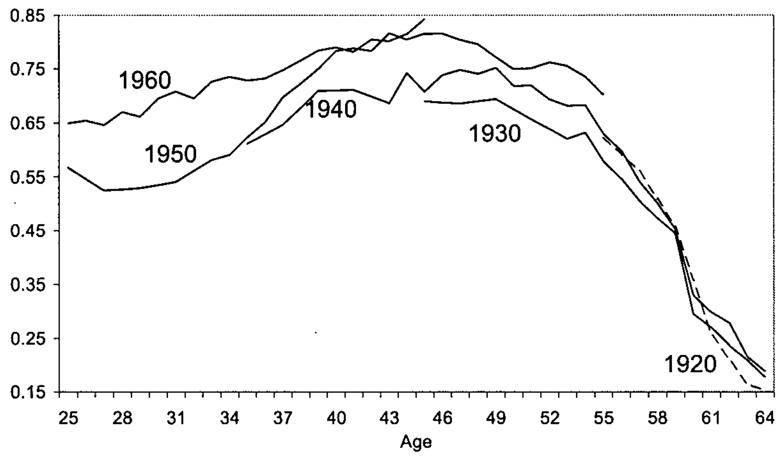
Figure 4.2 Participation Rates of Individuals Age 55-64, by Sex, 1983-2005
Source: Eurostat



A. United States

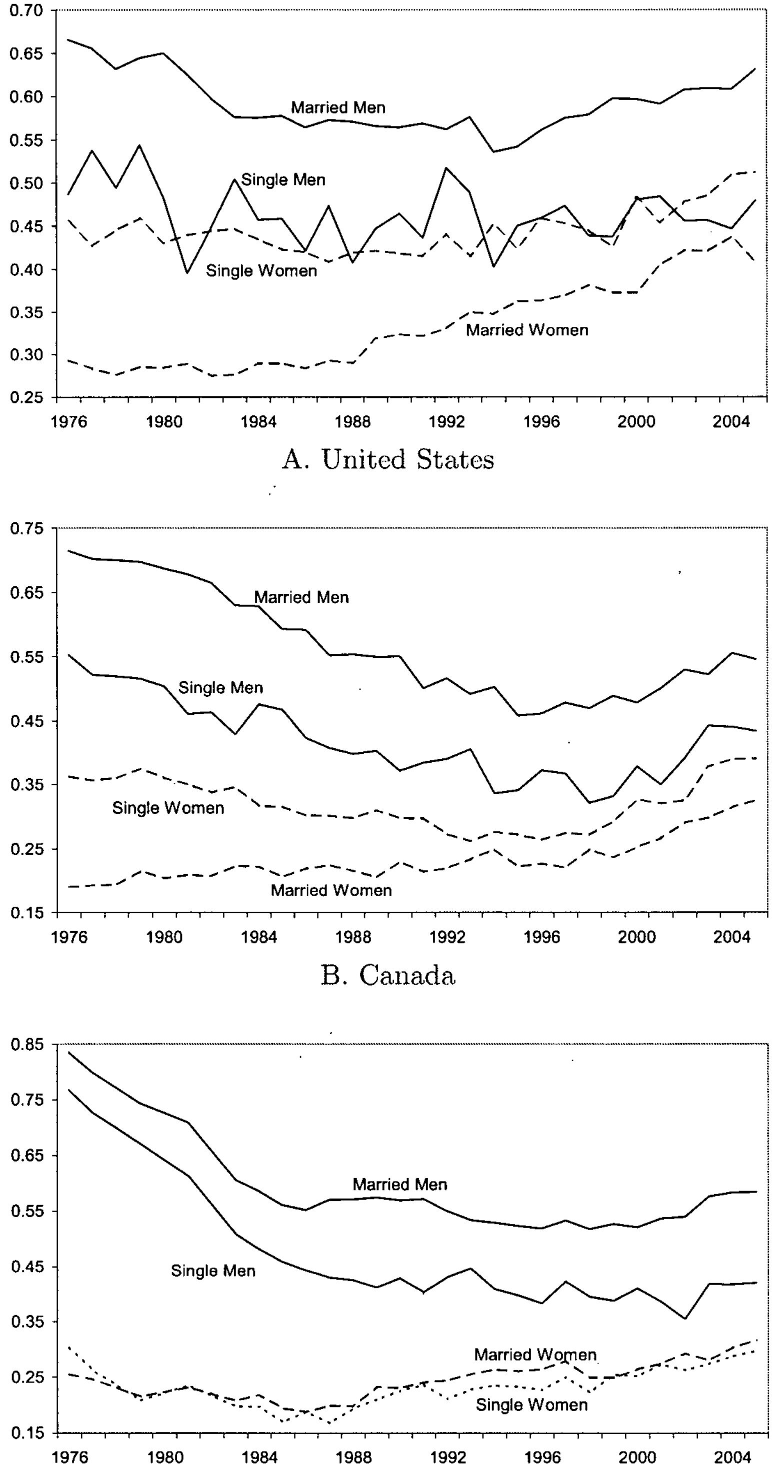


B. Canada



C. United Kingdom

Figure 4.3 Age-Participation Profiles for Selected Birth Cohorts of Women



A. United States

B. Canada

C. United Kingdom

Figure 4.4 Participation Rates of Individuals Age 60-64, by Sex and Marital Status, 1976-2005

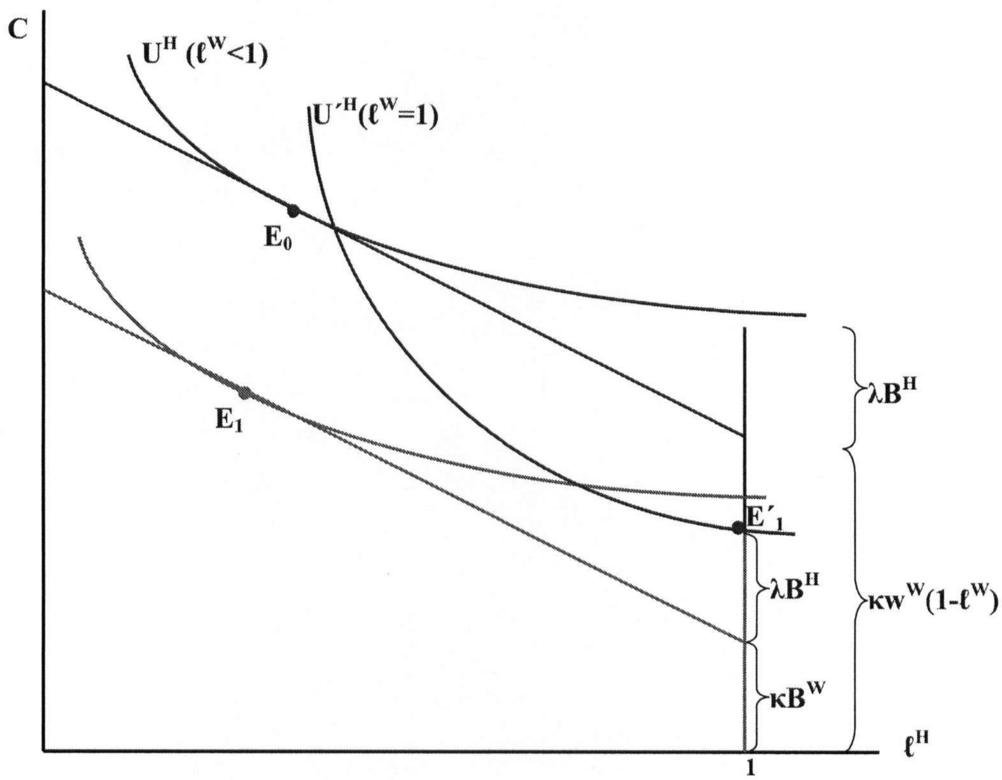


Figure 4.5 Shared Leisure and Income Effects of a Wife's Departure From the Labour Force

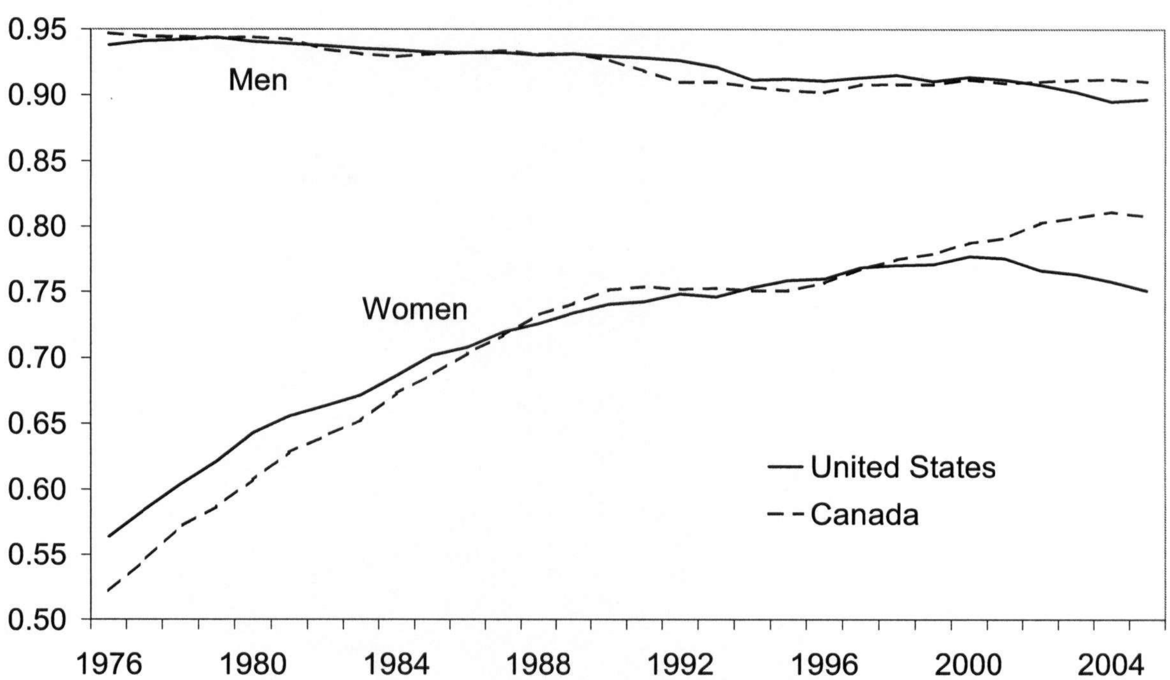
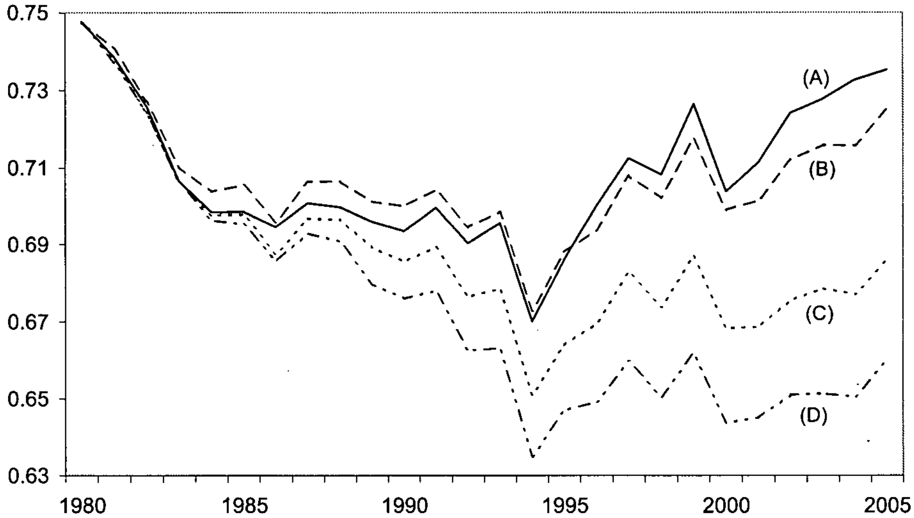
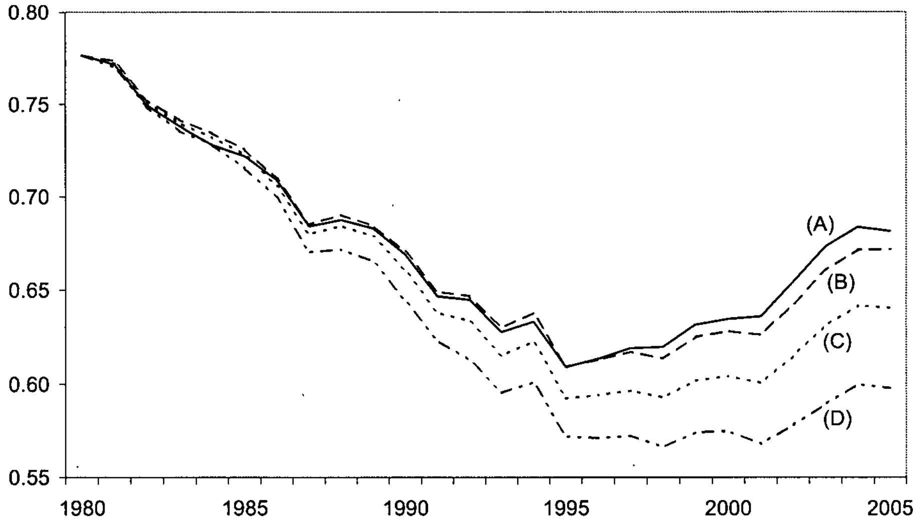


Figure 4.6 Participation Rates of Individuals Age 25-54, by Sex, 1976-2005



A. United States



B. Canada

Figure 4.7 Oaxaca Decompositions of Historical Participation Rates, Married Men Age 55-64, 1980-2005

Note – (A) Predicted values (B) Holding age structure constant at 1980, (C) Holding age structure and education constant at 1980, (D) Holding age structure, education and wives' participation constant at 1980.

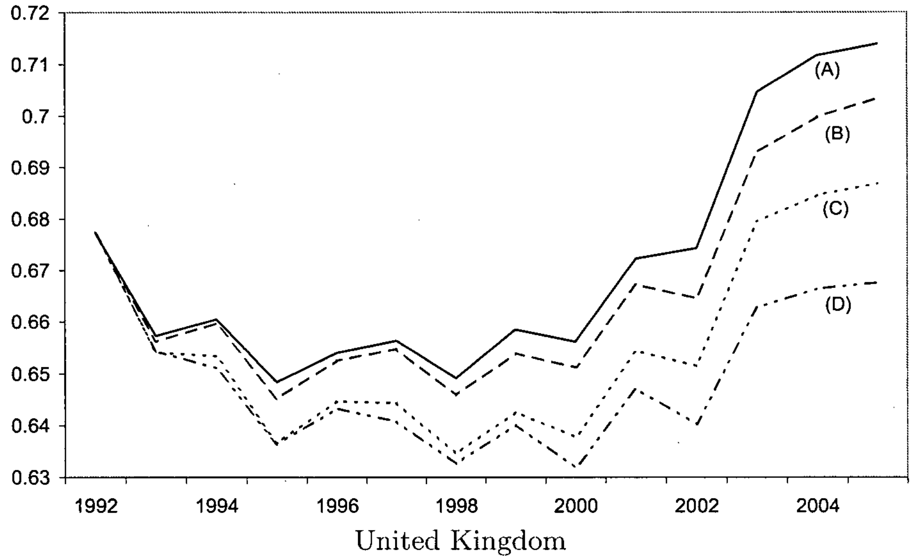


Figure 4.8 Oaxaca Decompositions of Historical Participation Rates, Married Men Age 55-64, 1992-2005

Note – (A) Predicted values (B) Holding age structure constant at 1992, (C) Holding age structure and education constant at 1992, (D) Holding age structure, education and wives' participation constant at 1992.

Chapter 5

Conclusions

The main objective of this thesis was to examine the role of various factors in the labour force participation and retirement decisions of older individuals. The research presented in this thesis will be of interest to those who wish to address concerns about population aging through policy reforms or other means as it provides a greater foundation for understanding the labour market behaviour of older individuals.

Chapter 2 described Canada's retirement income security system and provided a series of simulations that illustrate how many components of the system act to change the incentives to retire. Key components affecting retirement incentives included the actuarial adjustments in CPP/QPP that do not sufficiently compensate individuals for years of foregone pension receipt and clawbacks to the GIS, which act independently and in concert to reduce incentives to continue working at older ages. The international evidence on public pension programs suggests that the structure of these programs affect retirement decisions. In Chapter 3, I estimated the effects of Canada's income security programs on individuals' retirement decisions. The results confirm that Canada's income security programs have significant accrual effects on retirement decisions, indicating that individuals consider the amount of wealth they can gain or lose by delaying retirement. However, unlike some earlier studies I find that Canada's income security programs do not have significant wealth effects. The discrepancy between the results in this chapter and those of previous similar studies is likely due to a relative lack of exogenous variation available to identify the effect of income security wealth over the time period studied here.

The key contribution of Chapter 3 to the literature on retirement behaviour is the examination of health and the incentives in employer-provided pensions as determinants of retirement decisions in Canada. Previous Canadian studies were either not able to measure these determinants, examined health in isolation of other retirement incentives, or did not have micro-data available to estimate the effects of pension incentives. The results of this chapter indicate that individual health has a significant and substantial effect on retirement decisions. Having addressed identification issues associated with using self-assessed health measures, the results also suggest that justification bias may be an important issue when assessing the effects of health. The estimates in this chapter also suggest that employer-provided pensions have significant wealth and accrual effects on the decision to enter retirement. Wealth effects appear to be stronger than accrual effects, which in part captures the differences in wealth between those with and without pension plans. The addition of other forms of income to the measures of wealth and accrual do not significantly change the results, except that the accrual of wealth becomes more significant, indicating that individuals consider their entire financial picture when making the decision to retire. These results should be an important consideration in policy circles – although changing the structure of income security programs may affect individuals' retirement decisions, the effects of health and employer-provided pensions may trump the effects of financial incentives found in any income security programs.

While the analysis presented in Chapters 2 and 3 improve our understanding of the overall effects of public and employer-provided pensions, future research is needed to clarify the potential behavioural effects of changes to specific retirement income policy parameters. The clearest evidence would come from studies using natural experiment approaches to identifying the effects of public or private pensions. However, thus far these studies examining public pension changes have had mixed results and are not able to identify the more complex long run effects of policy change. In the absence of lengthy policy experiments, it is not clear this gap can be filled. There is potential, however, for exploring the effects of changes to employer-provided pension plans if data sets become available that directly link the provisions of employer-provided pension plans to linked employer-employee data sets (such as the Canadian Workplace Employee Survey).

Chapter 4 examined recent trends in the participation rates of older men in Canada, the U.S. and the U.K., finding that a substantial portion of the recent increases in older married men's participation rates may be explained by the recent increase in the participation rates of their wives. Wives' participation in the labour force has this substantial explanatory power because wives leisure time is complementary to the leisure time of their husbands, as evidenced by the positive effect of wives' participation on husbands' participation decisions. This leisure complementarity has led to husbands participating more in the labour force as their wives have become more likely to participate. The creation of counterfactual participation rates and the resulting decompositions of older married men's participation rates demonstrates that in the United States, roughly one quarter of the increase can be explained as a response to changes in wives' labour force participation. As much as one half of the observed increase in Canada and two fifths of the increase in the United Kingdom can also be explained as a response to changes in wives' participation. Increases in the educational attainment of older men and changes in the age structure of men age 55-64 are also shown to have significant explanatory power for the recent increase in older men's participation rates. The potential for education to drive further increases in participation rates, however, appears to have been exhausted while expected increases in older wives' participation are expected to drive further increases in older men's participation.

The evolution of women's labour market behaviour and its impact on the structure of retirement behaviour among men and women is an important area for future research. Not only will the higher participation rates of older wives have an impact on their husbands' participation decisions, women have come to form a larger portion of older labour force participants and the nature of their retirement decisions may differ slightly from men's. For example, the CPP/QPP provisions for time spent caring for children will take on greater importance. Maternity leave provisions in employment contracts and employment insurance schemes have important implications for women's employer-provided pensions and ultimately the timing of their retirement, especially as women appear to have become more career-oriented. Such policies and their potential impact on retirement merit further investigation.

Overall, this thesis has investigated the complex nature of older individuals' labour market behaviour and the research contributes to our understanding of retirement and labour force participation decisions among the elderly.

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Appendix A

Financial Incentives in Income Security Programs for Chapter 3

This appendix provides further discussion of the retirement incentives found in Canada's income security programs. The simulations contained here are similar to those found in Chapter 2, but rely on slightly different assumptions in the creation of income security wealth and accrual measures. Unlike the simulations in Chapter 2, I assume that individuals experience no real wage growth if they continue to work – an assumption that is made in the creation of wealth and accrual measures in Chapter 3. Also, unlike the simulations in Chapter 2, taxes are not accounted for in this section.

Canada's retirement income system contains many provisions that may have both wealth and accrual effects on Canadians retirement decisions. Using the wealth and one year accrual measures, this is demonstrated the simulations presented in Tables A.1 - A.4. For each simulation, I calculate the lifetime benefits that a hypothetical individual at age 55 would receive from Canada's income security system for retirement at ages 55-69. Presented in the table is the income security wealth (ISW), or the present value of lifetime income from income security benefits, if the individual retired at age 55 and at age 69. Also presented is the one year accrual in ISW for delayed retirement. The one year accrual of ISW at age 56 should be interpreted as the wealth that the 55 year old could gain by delaying retirement from age 56 to age 57. In the base case simulation, repeated in each table, I consider a single male at age 55 in 2001 who has earned the average wage since 1966 and is considering retirement between ages 55 and 69.[1] I assume that the individual has no income other than earnings or income security benefits. I assume that the individual will experience no real

[1] Average wages are based on CANSIM II series V78310 for 1965-1983, V250810 for 1984-2000, and V1597104 for 2001.

wage growth if they continue to work. The same assumptions are made for any other cases presented in these tables, unless otherwise stated. For married couples, I assume the spouse is the same age as the individual, with the same earnings history, and will retire at age 60.[2]

In the first row of Table A.1, the single male can accrue small amounts of wealth by delaying retirement at ages 55 and 56. The drop-out provisions play a role here. This individual begins with a 40 year contributory period (1966-2005), but is allowed to drop 15% of his lowest earning years, amounting to 6 years. For retirement at 55, the years of zero earnings from age 55-59 will be dropped. By delaying retirement, the individual can fill one of these zeros with positive earnings and drop an earlier low-earnings year. These provisions continue to work until age 59, however in this example the additional earnings years turn out to be lowest earnings years and do not result in higher CPP benefits upon collection at age 60. Hence, accruals from age 57-59 are zero. If it were the case that the individual earned much more than in earlier years, these accruals would be positive. At age 60, the accrual turns negative. Although an extra year of work may raise the level of CPP benefits the individual could receive through the addition of extra drop-out months and the actuarial adjustment made to CPP benefits, the worker has to give up one year of benefits. Furthermore, any extra CPP benefits he could receive would reduce the GIS benefits he is eligible for. At age 65, the accrual becomes more sharply negative. The reason for this jump down is again the GIS. The extra year of work at age 65 not only increases the level of the CPP benefit upon collection, decreasing the GIS payment, but it also produces earned income that pushes the immediate GIS payment to zero.

The remaining rows of Table A.1 demonstrate how gender and marital status matter for the accrual of wealth. Women have higher ISW and accruals largely because they have higher probabilities of survival after age 55 and therefore will be able to collect benefits for a longer period of time. Married individuals' accruals remain positive at ages 60 and 61. This is in part due to the provisions for survivor benefits. In the case that the spouse passes, the survivor can receive more in survivor benefits if he/she is not already collecting CPP benefits. This is also in part due to the assumptions that the spouse retires at age 60. Although the individual foregoes a year of benefits, the spouse is able to collect benefits for that year reducing the amount that the couple is giving up.

In Table A.2, the simulations demonstrate how other retirement income such as income from employer-provided pensions may affect the accruals that an individual may achieve. I assume that the individual would receive the given pension for retirement at age 55 and that subsequent years the pension will increase at a rate of 3% per year, the expected rate

[2]When calculating ISW, I do not consider the drop-out provisions for child care or disability in CPP/QPP, I discount future incomes at a discount rate of 3% and for the probability of survival (based on Statistics Canada's Lifetables 1996), I assume each period there is some probability the individuals' spouse will die and assign survivor benefits appropriately, and I assume that if the individual does not retire they will experience zero real wage growth.

of inflation used in the simulation. Here, individuals with pension incomes between $2000 and $6000 are initially eligible for some GIS benefits. The benefit reduction rate is the same across individuals, however, so accruals for individuals age 55-59 are the same when pension income is below $6000. When pension income is $8000, however, the accrual in ISW is actually higher at ages 55 and 56. This is because the individual is no longer eligible for GIS benefits, hence increases in CPP benefits for delayed retirement are no longer mitigated by a reduction in GIS. The elimination of the effect of the GIS generates stronger incentives to delay retirement at all ages. At age 60, the accruals are the same for individuals with low pension income as the base case individual, however, an interesting case arises with pension income at $6000. In this case, the individual would have been eligible for a small amount of GIS at age 60. As such the accrual is similar to the higher pension case, but not as high given they are still partly affected by a reduction in GIS. Delaying retirement until age 61 makes the person ineligible for GIS and the individual's accruals become no different than an individual with higher pension income.[3] Notice that the interaction of GIS and CPP changes for delayed retirement can lead to a non-linear age profile of income security wealth. If individuals are forward looking, using the simple one-year accrual may be inappropriate for measuring the gains one can achieve for delayed retirement.

In Table A.3 the simulations demonstrate how differences in earnings levels throughout the individual's work history can affect accruals, with each row representing an individual who has always earned the given fraction of average earnings. An individual who has always earned more than average has nothing to gain by delaying retirement between ages 55 and 59 given that they will be receiving the maximum CPP pension whether or not they delay retirement. For lower income individuals, accruals at age 55 and 56 are lower with lower earnings since CPP benefits will be lower. After age 60, the accruals are higher with lower earnings since the lower income individual is giving up a year of relatively lower CPP benefits.

In Table A.4 the simulations demonstrate how differences in work histories may matter for the accrual of income security wealth. In the base case, the individual has a full earnings history. In the remaining rows, some years of the earnings history are replaced with zeros such that the individual has only 80, 60, 40, or 20% of their earnings history with positive earnings.[4] Interestingly, for retirement at ages 55-59, each of these individuals has the exact same accruals since with additional years of work only 6 years of the history may be dropped from the contribution period for CPP and these individuals effectively drop the same years. After age 60, however, the individuals can increase the number of years

[3]The increase in accruals at later ages is merely a product of the assumptions I've made for pension growth. Although the pension and the GIS thresholds are set to grow at the same rate, they do not adjust dollar for dollar. As such, even individuals with only $2000 will eventually become ineligible for GIS (at age 68) if they continue to work.

[4]I first replace years ending in a 9 or 4 with zeros, then years with an 8 or 3, then years with a 7 or 2, and finally those ending in 1 or 6.

dropped with each extra year worked. This works to the greatest advantage of individuals with the shortest work history, who can drop zeros from their history, whereas individuals with longer histories are dropping low earnings years, but not zero earnings years, having less of an impact on the CPP benefits they would be eligible for.

Overall, these simulations demonstrate how Canada's income security system creates disincentives to continued work, especially among GIS recipients. In general, there appears to be some incentive to continue working until age 60. After age 60, there appears to be two types of individuals who would benefit most by delaying retirement – those with high retirement incomes who are not eligible for GIS benefits and those with poor work histories.

Table A.1. Simulation – Variation in ISW Accruals Across Gender and Marital Status

	ISW at 55	One Year Accruals 55	56	57	58	59	60	61	62	63	64	65	66	67	68	ISW at 69
Males																
single	144549	31	9	0	0	0	-911	-1582	-2216	-2818	-3394	-4649	-4677	-4689	-4684	114968
married	191186	43	12	0	0	0	876	92	-596	-1195	-1720	-2078	-2480	-2835	-3143	178162
Females																
single	173396	35	10	0	0	0	-366	-1066	-1738	-2386	-3019	-4358	-4442	-4516	-4578	146972
married	222447	46	13	0	0	0	1265	299	-549	-1270	-1863	-2280	-2711	-3096	-3434	208869

Note. — All dollar values in 2001 Canadian dollars.

Table A.2. Simulation – Variation in ISW Accruals Across other Retirement Income Levels

	ISW at 55	One Year Accruals 55	56	57	58	59	60	61	62	63	64	65	66	67	68	ISW at 69
Base Case	144549	31	9	0	0	0	-911	-1582	-2216	-2818	-3394	-4649	-4677	-4689	-4684	114968
Other income																
$2000	136262	31	9	0	0	0	-911	-1582	-2216	-2818	-3394	-3989	-3110	-1951	-2326	114004
$4000	127974	31	9	0	0	0	-911	-1582	-2216	-1646	-754	-1087	-1538	-1951	-2326	114004
$6000	119687	31	9	0	0	0	857	938	348	-211	-754	-1087	-1538	-1951	-2326	114004
$8000	118957	47	13	0	0	0	1567	938	348	-211	-754	-1087	-1538	-1951	-2326	114004

Note. — All dollar values in 2001 Canadian dollars. All simulations are for single males. The base case has zero other retirement income.

Table A.3. Simulation – Variation in ISW Accruals Across Earned Income

	ISW at 55	55	56	57	58	59	60	61	62	63	64	65	66	67	68	ISW at 69
		One Year Accruals														
Base Case	144549	31	9	0	0	0	-911	-1582	-2216	-2818	-3394	-4649	-4677	-4689	-4684	114968
Earned income																
1.5	146710	0	0	0	0	0	-863	-1568	-2240	-2879	-3484	-4677	-4717	-4740	-3877	117664
0.8	139093	24	7	0	0	0	-909	-1495	-2046	-2566	-3066	-4584	-4586	-4573	-4545	110756
0.6	129196	18	5	0	0	0	-728	-1180	-1605	-2005	-2390	-4476	-4432	-4378	-4313	103713
0.4	117762	12	3	0	0	0	-485	-787	-1070	-1336	-1593	-4352	-4258	-4157	-4049	95691
0.2	106328	6	2	0	0	0	-243	-393	-535	-668	-797	-2414	-2355	-2294	-2229	94409

Note. — All dollar values in 2001 Canadian dollars. All simulations are for single males. The base case has average income throughout the work history.

Table A.4. Simulation – Variation in ISW Accruals Across Years Worked

	ISW at 55	One Year Accruals 55	56	57	58	59	60	61	62	63	64	65	66	67	68	ISW at 69
Base Case	144549	31	9	0	0	0	-911	-1582	-2216	-2818	-3394	-4649	-4677	-4689	-4684	114968
Years worked																
0.8	135655	1381	1366	1352	1337	1323	-653	-1327	-1972	-2587	-3252	-4420	-4661	-4668	-4659	114214
0.6	125438	1381	1366	1352	1337	1323	-243	-803	-1349	-1877	-2451	-3678	-3702	-3726	-3749	110620
0.4	115203	1381	1366	1352	1337	1323	169	-278	-724	-1165	-1649	-3577	-3560	-3546	-3534	104096
0.2	104994	1381	1366	1352	1337	1323	579	245	-101	-456	-848	-3477	-3418	-3367	-3320	97590

Note. — All dollar values in 2001 Canadian dollars. All simulations are for single males. The base case has worked each year from 1966-2001.

Appendix B

Sample Selection and Construction of Key Variables for Chapter 4

B.1 United States

Current Population Survey Annual Demographic Files (March CPS)

The March CPS provides fairly extensive information on individuals' labour force status, income, job characteristics, and demographics. Each individual in a household is interviewed, allowing us to match an individual to their spouse and other family members.

All samples exclude individuals whose labour force status, or spouse's labour force status, is unknown or missing. This effectively excludes all individuals who are married but the spouse is not present in the household, individuals who are in the armed forces, and individuals whose spouses are in the armed forces. This exclusion drops roughly one percent of observations in each year. In 2005, for example, this results in samples of 6538 married men age 55-64 and 2056 single men age 55-64.

For the descriptive statistics in Table 4.1 and the decompositions, I use samples of married men age 55-64 and I further exclude any husbands that are 15 years older or 15 years younger than their wives. On one hand, this will exclude some observations where individuals have been incorrectly coded as spouses. For legitimately married individuals that are coded properly, we can expect this to exclude husbands who are least likely to be influenced by their wives' participation decisions. These exclusions leave me with 6277 observations in 2005. For the pooled samples 1994-2005, I have 56754 observations.

Marital Status – In the March CPS, only legally married spouses are coded as married. In earlier years, cohabiting spouses were coded the same as roommates and are only recently identified as 'unmarried partners'. To be consistent, I have only included those legally married in my married samples.

Education – Generally, individual's highest level of educational attainment has been recoded into the categories (i) completion of grade 8 or less, (ii) attended high school but did not graduate, (iii) graduated high school, (iv) some post-secondary education, (v) obtained post-secondary degree, (vi) bachelor's degree (vii) graduate level or professional degree. In the Oaxaca decompositions, this is recoded into five categories following Jaeger (1997) to be historically consistent – (i) completion of grade 8 or less, (ii) attended high school but did not graduate, (iii) graduated high school, (iv) some college, and (v) college graduate.

Number of Kids – Any children that are the legal or adopted son or daughter of the husband or the wife are included in the count of children in the family. Children of any age may be included here. This count may include never married children living away from home in college dormitories. The variable is constructed by using the individual's line number, the spouse line number and parent line numbers within each household to match individuals with their children. The variable for whether there are children at home is simply an indicator variable equal to one if the number of kids is positive.

Cohort-specific participation rates at age 40 – Estimates for women born 1926-1965 are obtained by estimating participation rates of 40 year old women using the March CPS files for 1966-2005. Only women whose labour force status is unknown are excluded from these samples. For women born 1920-1925, estimates of the participation rates of women age 40-45 in 1960-1965 from the OECD Statistics Compendium (series U16213291) are used. Reliable estimates of participation rates for women at the age of 40 for women born before 1920 are not available, so the participation rate of women born 1920 is used here. Less than 0.02% of wives in the sample of husbands 1994-2005 were born before 1920. Only 0.2% of wives in the 1994 sample were born before 1920.

B.2 Canada

Labour Force Survey Master Files (CLFS)

The CLFS is a monthly survey that provides information regarding individuals' labour force status, job characteristics and demographics. The master files (as opposed to the public use files) provide more detailed information, including an individual's age rather than an age group. The LFS surveys the same dwelling for 6 months. Only the incoming rotation group is used in the sample. Information for each member of a sampled dwelling is collected and spousal information is provided as part of an individual's observation.

Exclusions to the samples are nearly identical to those made in the March CPS. In addition to the exclusions for the CPS, for several years of the CLFS there are a handful of individuals who are coded as single (never married) yet spousal information is provided for the individual and are also excluded from the samples.

Marital Status – Prior to 1999, no distinction is made in the CLFS between legally married and common-law couples. Although the distinction is made in the more recent files, for the purposes of being historically consistent the Canadian common-law couples will be treated the same as legally married couples.

Education – Generally, education represents the highest level of schooling completed and is recoded into the categories (i) completion of grade 8 or less, (ii) attended high school but did not graduate, (iii) graduated high school, (iv) some post-secondary education, (v) obtained post-secondary degree, (vi) bachelor's degree, and (vii) graduate level or professional degree. As the education variable changes in 1990, for the Oaxaca decomposition education is recoded into the categories (i) completion of grade 8 or less, (ii) grade 9-10 (high school drop out), (iii) grades 11-13 (high school), (iv) some post-secondary education, (v) obtained post-secondary degree, (vi) university degree.

Number of Kids – The number of children in the household is derived by adding up the number of "own children" in the household, already matched to the individual in the LFS. This includes children by birth, adoption or marriage of any age and may include children who are away at school.

Cohort-specific participation rates at age 40 – Estimates for women born 1936-1965 are obtained by estimating participation rates of 40 year old women using the CLFS master files for 1976-2005. Only women whose labour force status is unknown are excluded from these samples. For women born 1915-1935, the participation rates of women age 35-44 from 1955-1975 are used as estimates, obtained from various issues of Canada, Women's Bureau, *Women in the labour force: facts and figures*, Ottawa : Labour Canada, Women's Bureau, 1965-1977. Note these estimates match the participation rates provided by the OECD Statistical Compendium (series 316212291) 1960-1975.

B.3 United Kingdom

Labour Force Survey (UKLFS)

The UKLFS has been conducted as a quarterly survey since 1992. For the years 1992-2005, the spring quarterly household files are used. The survey is conducted biannually from 1975-1983 and annually from 1984-1991 with interviews conducted March-May. Estimates of participation rates presented for 1976, 1978, 1980, and 1982 in this paper are averages of adjoining years. Exclusions to the sample are the same as those for the March CPS.

Marital Status – In this paper, common-law couples have been defined as married. Prior to 1989, however, cohabiting couples were not separately identified in the UKLFS.

Education – The UKLFS reports an individual's highest qualification, the coding of which is expanded over the years to include more detailed categories. I have recoded this to (i) degree or higher (which includes university degrees), (ii) higher education, below degree, (iii) A level or equivalent, (iv) GCSE A-C or equivalent, (v) CSE below grade 1 or equivalent, (vi) other qualifications, and (vii) no qualifications. The qualifications are coded in much more detail and are easily categorized consistently after 1993.

Number of Kids – The number of children represents all children of the individual in the same family unit. This will only include never-married children and children who are not parents themselves. This will include any other adult children in the household.

Cohort-specific participation rates at age 40 – Estimates for women born 1935-1965 are obtained by estimating the participation rate of women age 40 in each available year 1975-2005. For women age 40 in the years 1976, 1978, 1980, and 1982, an average of previous and following cohorts is used. Participation rates for earlier years are not readily available. For women born 1916-1932, estimates of the participation rate of women age 40-44 in Great Britain are constructed using various issues of the *Annual Abstract of Statistics* which provide estimates of the number of employees (employed women and women registered as unemployed) and population estimates for each year 1956-1972. Note that this series closely matches that constructed by Sprague (1988), except that the Sprague (1988) estimates are slightly higher given that she attempts to estimate the number of unregistered unemployed women over this time period based on the number of men not registered 1971 onwards. For women born 1933 and 1934, the participation rate at age 40 is filled with linearly interpolated values based on values for the 1932 and 1935 cohorts.

B.4 Other Data

Eurostat

The European participation rates presented in Table 4.2 were constructed using the series for "Inactive population as a percentage of the total population (of a given sex) by age groups (%)" for each country from Eurostat (http://epp.eurostat.cec.eu.int). The series is reported quarterly since 1983 and is based on the EU Labour Force Survey.