Income Security Programs and Retirement in Sweden*

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Abstract

We examine the effects of economic incentives inherent in pension schemes and income security programs on retirement behavior in the Swedish labor market. We use social security wealth and three alternative measures of accrual (one-year benefit accrual, peak value and option value). The social security system, occupational pensions as well as insurance on the labor market, i.e., unemployment, sickness and disability insurance are considered. We estimate a model using panel data on about 30 000 men and women born between 1927 and 1940, observed between 1983 and 1997. The model is then used to simulate the effects of two alternative systems: one where eligibility for benefits in the prevailing system is delayed by three years and another where replacement levels are reduced.

Keywords: Benefit accrual, peak value, option value, disability insurance.

JEL codes: J26, J21, J2.

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1 Introduction

As compared to most other industrialized economies, Sweden has high labor force participation among older workers. In the group of countries studied in Gruber and Wise (1999),[1] only France, Germany and Japan have higher male labor force participation among 55 year olds, while only Japan has higher participation rates among 60 year olds. By age 65, labor force participation is higher in the US, Canada and Japan than in Sweden.

Despite these relatively high participation rates, Sweden shares the trend of declining labor force participation among elderly workers experienced in recent decades in other western industrialized economies: labor force participation among men aged between 60 and 64 has declined from about 85 percent in the early 1960s to about 55 percent in the mid-1990s.

Since the general health status of the Swedish population has improved over this period of time, the decline in labor force participation has to be explained by other factors. These may include changes in the availability of programs for financing early exit from the labor market, improved economic conditions in the population, changes in economic incentives in general and in collective agreements on retirement age between trade unions and employers' confederations.

In this study we estimate how economic incentives inherent in the income security system and compulsory old-age pensions affect retirement behavior. Social security policy may have a dual effect on economic incentives for labor force participation. First, it may affect the level of an individual's social security wealth. An increase in social security wealth will increase an individual's de-

[1] These countries are Belgium, Canada, France, Italy, Germany, Japan, the Netherlands, Spain, the UK and the US.

mand for all goods, including leisure and will, therefore, increase his propensity to retire early. Second, it may affect the accrual in the social security wealth from additional work. High accrual from working one additional year implies a substitution effect to delay retirement.

In our retirement probit regressions, net social security wealth is included to measure the income effect. We use three different measures of accrual: benefit accrual, peak value and option value. The measure of benefit accrual is myopic in the sense that it refers only to the immediate gain or loss to a worker from remaining in the labor force one additional year. The measure of peak value encompasses future possible gains from remaining in the labor force. In addition to considering future possible income gains, the measure of option value also allows for different valuations of leisure time when retired.

A large share of those who permanently leave the Swedish labor market receive their main income from disability, sickness or unemployment insurance. The replacement levels in these programs are in general higher than in the old-age pension scheme, which has to be taken into account when measuring the economic incentive variables. However, since labor market insurance programs have requirements on health or employment status, support from these programs is not an available option for all workers. To avoid potential endogeneity problems, we use the eligibility probabilies as weights when calculating net social security wealth and the accrual measures for all workers in the sample.

In addition to estimating the econometric model, we simulate the effect of two hypothetical policy reforms. The first delays the age of eligibility for all retirement schemes by three years. In the second experiment, existing retirement schemes are superseeded by a program that replaces 60 percent of predicted

earnings at age 60. The normal retirement age is 65, but the pension can be claimed from age 60 to age 70, with an actuarial reduction or increase of 6 percent for every year in advance or delay from age 65.

We use a panel data set containing individual characteristics (such as education and sector of employment), detailed information on income components between 1983 and 1997, and contributions to the public pension scheme extending back to 1960. The data set was obtained by merging information from censuses along with tax, social insurance and education registers. We restricted the sample to men and women born between 1927 and 1940, which resulted in a sample size of about 30 000 individuals, and we study their retirement behavior between 1984 and 1996. This is the first time this comparatively rich data set has been used in a study on retirement behavior. Therefore, we provide detailed descriptions of how different variables, in particular date of retirement, are measured.

Our results support the view that economic incentives matter for retirement behavior on the Swedish labor market. Estimates of the econometric model reveal that measures of economic incentives are, in general, significant, with the expected signs. However, the results from the simulations emphasize the importance of collective agreements on normal retirement age, which are supported by Swedish labor legislation.

The paper is organized as follows. In Section 2 we describe the institutions that affect the economic incentives for retirement decisions - such as rules for different pension schemes, labor market insurance, housing allowances and income taxes - during the period under study, i.e., 1983 - 1997. Parts of this section are very detailed, mainly to facilitate further research on economic incentives and

retirement behavior. (Most readers can skip large parts of this section without losing the ability to follow the rest of the paper.) Section 2 also provides a descriptive analysis of the frequency of different pathways to permanent exit from the labor market. Section 3 reviews previous research on retirement behavior in Sweden. We present the the data set in Section 4 and show how the different measures of economic incentives are obtained in Section 5. The empirical models and estimation results are outlined in Section 6. Section 7 reports results from simulations of the estimated models. Section 8 concludes.

2 Institutional Background

We begin by describing the general policy environment for income security, old-age pensions and income taxes in Sweden pertinent to the cohorts in our sample, born between 1927 and 1940, and the time period under study, i.e., 1983 - 1997. We then describe the frequency of different pathways to retirement.

2.1 The Social Security System

The public old-age pension system in Sweden consists of three parts: a basic pension, a supplementary pension (known as *allmän tilläggspension* or ATP) and the part-time retirement pension. These are financed through proportional payroll taxes (employers' contributions) levied on wages.

All Swedish citizens and all persons residing in Sweden are entitled to a *basic pension*. In principle, everyone receives the same amount regardless of previous earnings. The amount is reduced if the duration of residence in Sweden is less than 40 years and the number of years with labor income in Sweden is less than 30 years. Like all social insurance schemes, the basic pension is related to a basic amount (BA). Although the BA is linked to the consumer price index (CPI) it

is decided each year by the government. A majority in the Swedish Parliament can thus make discretionary changes which deviate from the development of the CPI. During the 1990s, pensions were not fully aligned with price indexing, due mainly to several measures aimed at cutting the government budget deficit. In 1995, the BA was SEK 34,986, and the annual wage of an average production worker was SEK 189,488.

The basic pension for a single old-age pensioner is 96% of the BA; it is reduced to 78.5% if the person is married. Before 1995, it was not reduced unless the individual was married to someone who also received the basic pension. Individuals with no, or low, ATP are entitled to a special supplement. This supplement is independent of marital status and has grown from 42% of the BA in 1983 to 55.5% as of 1993. The special supplement is reduced on a one-to-one basis against the supplementary pension. Thus a single old-age pensioner with only a basic pension and a special supplement receives 151.5% of the BA. In 1995, this amounted to SEK 53,004 in annual pension or 28.0% of the annual earnings of an average production worker.

The basic pension also contains a survivor's pension. Widows receive 90% of a BA until they reach the age of 65. If a woman is younger than 50 when her husband dies, the amount is reduced. The basic pension for widows is income tested since 1997. Children normally receive 25% of a BA, but the amount may be higher if there is no ATP.

A new, gender-neutral transitional pension for men and women born 1945 and later was implemented in 1990 . The transitional pension is paid for six months after the decease of a spouse and amounts to 90% of a BA. The transitional pension can be prolonged for a survivor who has the custody of children

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The benefit level of ATP is related to an individual's earnings history and is determined in three steps. The first step involves determining pension-rights income for each year from the age of 16. Pension-rights income is calculated on the basis of income from labor reported in an individual's annual tax return and is the share of the income exceeding 1 BA and below the social security ceiling at 7.5 BA.[2] It is set to zero if annual income from labor does not exceed 1 BA. Besides earnings and income from self-employment, transfer payments from social insurance, such as income from sickness and unemployment insurance, the parental cash benefit, and the partial retirement pension are included in pension-rights income. Three years of pension-rights income greater than zero between the ages of 16 and 64 are required to receive an old-age pension from the ATP scheme.

In the second step, average pension points are calculated by dividing pension-rights income by the corresponding year's BA to obtain the pension points for each year. Thus, due to the social security ceiling at 7.5 BAs, the maximum number of pension points an individual may receive in any given year is 6.5. Average pension points comprise the average of an individual's 15 best years of earnings.

The final step is to calculate an individual's ATP benefit (Y_i) by applying the formula:

$$Y_i = 0.6 \cdot AP_i \cdot \min\left(\frac{N_i}{30}, 1\right) \cdot BA,$$

where AP_i denotes individual average pension points, BA is the basic amount

[2] The proportional payroll tax used to finance the ATP scheme is paid also on the share of income exceeding 7.5 BA.

and N_i is the number of years the individual has reported a pension-rights income greater than zero. Thirty years with pension points are required for full ATP for individuals born in 1924 and thereafter. Inserting the amount of the BA in 1995 into the ATP formula reveals that the maximum pension amount from the Swedish national pension system in 1995 was SEK 170,032.

There are no dependent's benefits within the ATP scheme, that is, the amount of the pension is independent of marital status, and there is no splitting of future ATP benefits in the event of a divorce.

For women born before 1945, the survivor's benefit in the ATP system is 35-40% of the deceased husband's ATP pension for a surviving wife and 10-15% (20-30% after the 1990 reform) for a surviving child, depending on the number of children. The widow's pension is 35% if there are children in the household who are eligible for a children's pension and 40% otherwise. Before the 1990 reform, the widow's pension from ATP was lifelong.

As of 1991, extensive transition rules apply for new survivors. Women born before 1930 still receive a life long widow's pension. For a widow born between 1930 and 1944, her survivor's ATP is reduced after age 65, taking into account her own ATP. The rules vary somewhat for different birth cohorts. As for the basic pension, for women born after January 1, 1945, the widow's pension is replaced by a gender-neutral transition pension. The transition pension is paid for six months after the decease of a spouse. However, women born in 1945 and thereafter may also receive a widow's pension according to special rules and based on the deceased husband's pension points up until 1990.

The basic pension and ATP can be claimed in advance from age 60[3] and

[3] In 1998 the early retirement age was raised to 61.

postponed until age 70. If an individual chooses to withdraw from the labor market in advance of reaching 65, the amount of the monthly benefit is permanently reduced by 0.5% for each month of early withdrawal; for example, if an individual retires at 60, the permanent reduction is 30%. If an individual decides to claim a pension later than at age 65, the pension income is permanently increased by 0.7% for each month of postponement.

A *partial retirement pension* allows workers aged 61 and older to reduce their hours of work and receive a benefit to replace lost earnings. To be eligible for part-time retirement, a worker must have accumulated 10 years of pension-rights earnings after age 45 and must work at least 17 hours per week after the reduction. As of July 1, 1994, the benefit is 55% of the difference in earnings before and after part-time retirement.

The principal rules of a new pension system, intended to replace the basic pension, ATP and partial retirement pension were decided in 1994. The main changes are: earnings from an individual's entire life cycle are counted when pension income is determined, rather than only the 15 best years; pensions are related to the real growth rate in the entire economy rather than price indices; changes in life expectancy also affect annual pension income, i.e., increased life expectancy and lower economic growth rates reduce individual pension income at a given retirement age. The first birth cohort affected by the new system comprises those born in 1938, who will have 4/20 of their pension determined according to the new rules and the remainder according to the old rules. The share in the new system is then increased by 1/20 for each successive birth cohort.

2.2 Occupational Pensions

Almost all of the Swedish labor market is covered by central agreements between the unions and employers' confederations. These central agreements include occupational pension schemes financed through employers' contributions. There are basically four occupational pension plans covering different groups on the labor market: (1) blue-collar workers in the private sector; (2) white-collar workers in the private sector; (3) central government employees; (4) local government employees;[4] Pension rights are transferable among these four main schemes. Each of these pension schemes is briefly described below concentrating on the time period covered by the panel data set used in this study, i.e. 1983-1997.

2.2.1 Occupational Pensions for Private Sector Blue-collar Workers

In 1996, the earlier pay-as-you-go pension scheme (STP) was replaced by a fully funded pension plan. The blue-collar workers in our sample are thus covered by three different occupational pension regimes: those born between 1927 and 1931 who are covered entirely by STP; those born between 1932 and 1938 who may choose between the STP rules and a "transitional pension"; and those born in 1939 and later are covered by the transition pension.

As a monthly payment starting the month of a worker's 65th birthday, STP could not be claimed in advance or postponed. The size of the pension was determined as 10 percent of the average of the worker's monthly earnings during his three best years between age 55 and 59. If the worker contributed to the scheme less than 30 years after age 28, the pension was reduced proportionally. To receive any pension at all, a worker was required to contribute at least three

[4] See Kangas and J. Palme (1989) for a more detailed description of different occupational pension schemes in Sweden.

years between ages 55 and 59. STP is indexed by the BA and the social security ceiling at 7.5 BAs applies here as well.

In the new, fully funded pension scheme for blue-collar workers, a share of gross earnings is paid into a personal account in a pension fund. Between 1996 and 2000, the contribution rate was 2.0 percent of gross earnings and, according to the new agreement, in effect from 2000, the share is 3.5 percent. Each worker can choose among about a dozen insurance companies to manage his pension fund. The first cohort affected by the new system was born in 1932. However, since this cohort, as well as the later cohorts in our sample, worked under the STP system, they have not made any payments to pension funds and are, therefore, subject to so-called transition rules.

Pensions under these transition rules are determined by the sum of two parts. The first part is 10 percent of average earnings, deflated by the BA, below the social security ceiling from age 30. The second part is the amount a worker receives from the funded pension. Since the STP scheme allows a worker to choose the average of his best three years between ages 55 and 59, and the pension from the funded system is very low, pensions under the transition rules are in general lower than STP. However, the birth cohorts between 1932 and 1938 may opt for the old STP scheme if it turns out to be more favorable.

2.2.2 Occupational Pensions for Private Sector White-collar Workers

White-collar workers in the private sector are covered by ITP, ITPK and ITPG. ITP is a benefit defined scheme, ITPK is fully funded, and ITPG guarantees that a worker covered by ITP receives at least what he would have been entitled to if he had been covered by the STP scheme.

Retirement age	Reduction/enhancement
60	0.739
61	0.783
62	0.831
63	0.884
64	0.942
65	1
66	1.076
67	1.154
68	1.241
69	1.338
70	1.448

Table 1: Reduction (enhancement) if ITP is claimed in advance (postponed).

ITP is determined by a worker's earnings the year before he retires: it is 10% of that year's salary up to 7.5 BAs, 65% of the salary between 7.5 and 20 BAs, and 32.5% between 20 and 30 BAs. As in the STP scheme, the pension is reduced proportionally if a worker has contributed during less than 30 years since age 28. Contributions to ITP have been around 4.5 percent of gross earnings in the 1980s and 1990s. The normal retirement age for ITP is 65. Table 1 shows the reduction (enhancement) if a worker starts to claim (postpone) retirement benefits between ages 60 and 70. ITP can also be claimed before age 60, in which case the amount of the pension is determined by an individual actuarial adjustment.

ITPK was introduced in 1977 and is a fully funded system. During the 1980s and 1990s, contributions amounted to approximately 2 percent of each worker's labor earnings up to 30 BAs. Contributions to the ITPK scheme start when a worker is aged 30. He is free to choose a company to manage his ITPK pension. ITPK is normally claimed as monthly payments over a five-year period after retirement. As ITPK was introduced in 1977, it is maturing during the period

covered by our data; the 1927 cohort of workers were aged 50 in 1977 and the 1940 cohort was aged 37. This implies that the ITPK pensions are on average larger for the younger cohorts.

2.2.3 Pensions for Central Government Employees'

Pensions for central government employees are regulated in central agreements between the trade unions and the state. Prior to 1992, the occupational pension scheme for employees in the central government provided a gross pension in the sense that it totally replaced the state pension for workers covered by the scheme. The size of the pension was calculated as 65 percent of earning the year before retirement. A full pension required 30 years of earnings and the pension was reduced proportionally if the worker did not fulfill that requirement.

Most people employed by central government have a mandatory retirement age of 65. There are several exceptions, e.g. military personnel whose mandatory retirement age is 55. Before 1992, central government employees could not claim their occupational pension prior to their mandatory retirement age. If they wanted to retire earlier, they could claim their state pension with actuarial adjustment and their occupational pension as a life annuity. This annuity was calculated as 65 percent of 95 percent of an individual's earnings the year before he retired. This amount was not indexed and not paid out until he reached the mandatory retirement age. After that, it was indexed by the BA and paid as a lifelong annuity.

After 1992, two supplementary occupational pension schemes, one fully funded and one pay-as-you-go, replaced the former gross pension. In the fully funded system, 1.7% of a worker's annual salary, starting from 1991, is paid to a pension fund. The pay-as-you-go scheme is very similar to the ITP, but it is de-

termined by average earnings during the five years preceding retirement rather than by an individual's earnings the year before retirement. It is 10% of this five-year average up to 7.5 BAs, 65% between 7.5 and 20 BAs, and 32.5% between 20 and 30 BAs. The pension is reduced proportionally if the requirement of 30 years of contributions to the scheme since age 28 is not fulfilled.

In contrast to the pre-1992 occupational pension for central government employees, the post-1992 pension can be claimed five years before the mandatory retirement age with an actuarial adjustment. This adjustment is a 0.4 percent lifelong reduction for each month the pension is received prior to an individual's 65th birthday. However, if someone retires before age 60, the pre-1992 rules apply, i.e., no life annuity prior to the mandatory retirement age. This pension can also be postponed, with a 0.4 percent lifelong increase for each month it is delayed up to five years after the mandatory retirement age.

2.2.4 Pensions for Local Government Employees'

The pension plan for employees in local governments (or municipalities) is regulated by a central agreement between the union and a confederation for Sweden's municipalities. Two agreements affect pensions for the time period covered by the data in this study: the first was made in 1978 and the second in 1985.

According to the 1985 agreement, the size of the pension is determined by the average of the employee's five best years of earnings during the seven-year period prior to the year of retirement. The pension is then calculated as 96% of this amount below 1 BAs, 78.5% between 1 and 2.5 BAs, 60% between 2.5 and 3.5 BAs, 65% between 7.5 and 20 BAs, and 32.5% between 20 and 30 BAs. A full pension requires 30 years of employment in the local government sector between ages 18 and 65; otherwise the pension is reduced proportionally. This

pension scheme is fully coordinated with the state pension. This means that only the amount exceeding the state pension is paid.

The normal retirement age is 65 for most local government employees. But an individual can enter retirement at age 60 and postpone it until 67. If he retires before age 65, his pension is reduced for the rest of his life by 0.3% per month between ages 63 and 65, by 0.4% between ages 62 and 63, and by 0.5% per month between ages 60 and 62. The pension is increased by 0.1% for each month the individual decides to continue to work after age 65. The rules for claiming before age 60 are very similar to those in the pension scheme for central government employees: the pension is transformed into a life annuity which cannot be claimed before age 65.

2.3 Disability, Sickness and Unemployment Insurance[5]

2.3.1 Disability Insurance

The disability insurance (DI) scheme is very similar to the state old-age pension during the period covered by the study. It consists of a basic pension, an income-related ATP supplement and a special supplement. Pension income is determined in much the same way as the old-age pension benefit, but without any actuarial reduction for early retirement. An "assumed" pension point is calculated for each year between the year of retirement with DI and age 64. The formula for old-age ATP is then applied to actual as well as assumed points between ages 16 and 64. A disability pension can be received from age 16. Eligibility requires certification from a physician that an individual's capacity to work is permanently reduced by at least 25% due to illness, physical or

[5] In addition to the public labor market insurance, which we will consider here, there are negotiated occupational insurances for disability and long term sickness.

mental incapacity etc. To receive a full disability pension, working ability must be completely lost, although an individual may also be awarded, 25, 50 or 75 percent DI corresponding to different degrees of lost ability to work.[6] Between 1970 and 1991, disability pension were also granted for labor market reasons. The requirements then were that the individual was 60 years old or more and had exhausted his right to unemployment insurance.

In practice, the strictness with which medical screening is applied varies over time. When analyzing granting rates of different local social insurance offices, it is also evident that it varies between different parts of the country. The rules regarding eligibility for DI have been tightened up considerably through successive changes in legislation in July 1993, October 1995, and January 1997.

2.3.2 Sickness Insurance

Sweden has universal sickness insurance covering all employees and self-employed which is financed through payroll taxes. This insurance provides compensation for foregone earnings to workers who are not able to carry out their regular work due to temporary health problems. It has undergone several changes over the time period covered by our data set. Prior to the first major reform in 1987, compensation was calculated on the basis of annual earnings, but during the first two weeks of illness it only covered foregone earnings during scheduled work time from the second day in a sickness spall. After the reform, 90 percent of forgone earnings up to the social security ceiling were compensated from the first day of a sickness spell. The second major reform took place in 1992, when employers had to take responsibility for sickness insurance during the first two weeks of a spell. The replacement level, the share of foregone earnings replaced

[6] Before 1993, the levels were 50, 67 and 100 percent.

by the insurance, has been changed on several occasions between 1983 and 1997. In 1993, the replacement level for long sickness spells, which is most relevant for the purpose of this study, was reduced from 90 to 80 percent of foregone earnings between days 91 and 365 in a spell, and to 70 percent after one year. In 1996 it was changed to 75 percent for all long-term spells and, as of 1998, it is 80 percent for all spells.

Eligibility for compensation after seven days of a sickness spell requires a certificate from a physician. The certificate then has to be renewed at least every third month for continued compensation. A physician has to certify that temporary illness does not permit the insured individual to perform his regular work, and that he will be able to return to the labor force after recovery. Otherwise, the worker should be granted DI. The compensation level of sickness insurance is higher than that of DI for most workers. This implies that a worker has economic incentives to remain on sick leave, rather than DI, even if the probability of returning to the labor force is very low. The law does not stipulate an upper limit on the length of a sickness-benefit spell.

2.3.3 Unemployment Insurance

Unemployment insurance (UI) is twofold: one part consists of the same amount for all unemployed workers, and the second depends on an insured worker's income level before he became unemployed. A worker is not eligible for the second part unless he belong to an unemployment benefit fund. All members of labor unions automatically belongs to an unemployment benefit fund. It is also possible to be a member of an unemployment benefit fund without being a union member, if the worker has the occupation covered.

Unemployed workers who actively search for a new job are eligible for UI.

Refusal to accept a "suitable" job offer from the public employment office might lead to exclusion from compensation. In general, a worker can reject two, but must accept the third suitable job offer. An unemployed worker was entitled to UI compensation for 300 days up to age 55 and for 450 days thereafter.[7] However, if a worker undergoes one or more training programs, the compensation period can be renewed several times.

The compensation level is very similar to sickness insurance with one important exception: the income ceiling of UI is lower. The UI ceiling is not indexed: changes in the ceiling are made on a discretionary basis by the government. By the end of the period covered by our data (1997), the income ceiling for UI was SEK 199,650 SEK compared to SEK 272,250 for the price-indexed social security ceiling used for sickness insurance. The changes in the compensation level of sickness insurance, reported in the preceding subsection also apply to UI.

2.4 Income Taxes and Housing Allowances

Besides the effect of the social security system, retirement incentives are also affected by income taxes.[8] Sweden has an integrated income tax system. Individuals pay local and national income taxes. The national government determines the tax base for national and local taxes. After a major tax reform in 1991, the tax base is now divided into earned income and capital income. All income from the social insurance system is included in earned income along with wages and salaries. As of 1991, there is a national proportional tax of 30% on taxable income from capital. Earned income is taxed nationally and locally. The local

[7] This was changed to age 57 in December 1997.
[8] See Aronsson and Walker (1997) for a detailed description of the Swedish tax system.

tax rate is determined independently by each of Sweden's 283 municipalities. Local tax rates are clustered around 31%. Prior to 1991, the marginal tax rate on pension income was affected by capital income, since there was no division of the tax base into earned income and capital income.

Local income taxes are proportional, while the national income tax is progressive. After the 1991 tax reform, national income tax was set at (almost) zero below a certain breakpoint, and at 20% on all income above that level. In 1995, the latter tax was temporarily increased to 25%. These rules may give the false impression that there are only two possible marginal tax rates on earned income. But there is a basic deduction that varies among different earned-income brackets . There are also special rules for the basic deduction for old-age pensioners, which largely determine their marginal tax rates.

Old-age, disability, and survivor's pensioners with low income are entitled to a housing allowance. In 1995, this allowance was at most 85% of the housing cost up to a certain ceiling and above a certain floor. It is reduced by 40% (45 at high income levels) of income in excess of a basic pension and special supplement, and by 2% of wealth. In 1994, about 30% of all old-age pensioners received housing allowances, and the average amount was about SEK 17,673, that is, 33% of the amount of the lowest pension from the national pension system.

2.5 Mandatory Retirement Rules on the Swedish Labor Market

Sweden has a normal retirement age of 65.[9] Older workers are not covered by employment security legislation,[10] that is, workers older than 65 are not covered

[9] Wadensjö (1989) examines the implications of 65 as a normal retirement age in detail.

[10] Less than 5% of employees on the Swedish labor market are not covered by a central

by seniority rules and therefore protected the least if a firm wants to scale down. Furthermore, workers over 65 are not entitled to UI. On the other hand, the wage cost for employers is lower because they do not have to pay payroll-taxes to national or occupational pension schemes for employees over 65.

Central and local government employees automatically lose their jobs at age 65. Exceptions from this rule are permitted for one year. In the private sector, collective agreements between the trade unions and the employers' confederations as a rule also prescribe strict rules for mandatory retirement at age 65. As the number of these agreements is very large, it is hard to get an overview of the overall strictness of the rules for mandatory retirement.

2.6 Sources of Income after Retirement

As has already indicated, the Swedish welfare system provides several options for early exit from the labor market. In order to gain an understanding of to what extent these different options are used, let us consider the cohorts in our data set for persons born between 1927 and 1932. These are the birth cohorts that have reached the "normal" retirement age of 65 in 1997 (the end of the period under study).

Table 2 shows the percentage share of workers in this subsample who receive their main income (more than 50 percent of their total non-labor income) from one of ten different sources of income after retirement. The last row in the table indicates that none of the sources of income accounts for more than 50 percent of the retired worker's non-labor income.

The sources of income listed in Table 2 can be divided into three groups. The first group consists of schemes designed to serve as old-age pension programs:

agreement in which case they are protected by employment security legislation until age 67.

		Men	Women
1.	State old-age pension	33.70	26.99
2.	Occupational pension	13.68	14.21
3.	Disability pension (DI)	6.55	6.59
4.	Survivor's pension	-	3.99
5.	Wife's supplement	0.02	2.00
6.	Severance payments from employer	0.60	0.69
7.	Private pension	0.86	0.76
8.	Sickness insurance	20.53	26.88
9.	Unemployment insurance	8.35	6.42
10.	Partial retirement benefit	10.04	6.83
11.	No income source more than 50 %	5.67	4.64

Note: The 10.02 percent of the male and the 6.11 percent of the female subsample not yet retired by the end of the panel are included in source 1. Source 5 also includes some other minor benefits in addition to wife's supplement.

Table 2: Percentage share of the pathways to permanent exit from the labor market showing main source of income (more than 50 percent from the indicated source); cohorts born 1927-1932; by gender.

the state old-age pension (1), occupational pensions (2), pensions provided by the employer or severance payments (6), private pensions (7) and partial retirement benefits provided by social security (10). The second group comprises insurance programs against income loss from poor health or unemployment: disability insurance (3), wife's supplement (5), sickness insurance (8) and the unemployment insurance (9). In contrast to the first group, claiming support from the sources in the second group is not a viable option for everyone due to the health or unemployment requirements of the programs. The third group contains only one source: survivor's pension (4).

According to Table 2, the second (insurance group) account for about 35 percent of the male and about 40 percent of the female subsample. Within this group, sickness insurance is the dominant initial source of income: more than 20 percent of the men and 27 percent of the women. In the first (old-

	Men					Women				
	1	2	3	4	5	1	2	3	4	5
1. State old-age pension	25.65	36.24	28.34	41.12	48.93	24.26	31.00	25.86	25.41	41.58
2. Occupational pension	5.11	19.45	31.98	16.89	4.41	4.17	12.56	16.44	20.54	5.84
3. Disability pension (DI)	7.06	4.36	8.87	5.71	8.96	5.96	5.32	10.76	6.37	5.15
4. Survivor's pension	-	-	0.29	-	-	2.70	3.28	3.74	4.82	5.50
5. Wife's supplement	0.05	-	-	-	-	2.78	0.23	1.94	1.94	4.81
6. Severance payments from employer	0.05	1.65	-	0.75	0.14	0.25	3.05	0.30	0.17	1.03
7. Private pension	0.37	1.00	-	0.37	3.13	0.33	0.79	-	0.60	4.81
8. Sickness insurance	31.13	12.55	13.95	17.02	17.78	34.80	18.78	22.42	28.34	16.84
9. Unemployment insurance	13.10	7.66	4.8	2.48	5.69	14.05	8.60	5.38	1.81	6.87
10. Partial retirement benefit	12.92	8.84	7.27	9.32	7.68	6.21	10.29	8.97	5.68	3.09
11. No income source >50 %	4.55	8.25	4.51	6.34	3.27	4.49	6.11	4.19	4.31	4.47

Note: The 10.02 percent of the male and the 6.11 percent of the female subsample who are not yet retired by the end of the panel are included in source 1.

Table 3: Percentage share of the pathways to permanent exit from the labor market showing main source of income (more than 50 percent from the indicated source); cohorts born 1927-1932; by gender and socio-economic group; (1) blue-collar workers in private sector; (2) white-collar workers in private sector; (3) central government employees; (4) local government employees; (5) self-employed.

age retirement) group, private pensions and employer-provided pensions are relatively unimportant as the main source of income of the newly retired.

To study whether or not the initial path to retirement varies among workers assigned to different occupational pension schemes, i.e., different socio-economic groups, we repeated the analysis above, but divided the subsample into groups corresponding to assignment to different occupational pension schemes. These results are shown in Table 3.

It is evident from Table 3 that there are large differences between workers in different occupational pension schemes. Blue-collar workers in the private sector, covered by the STP scheme, are much more likely to receive their main initial income from sickness or unemployment insurance compared to all other groups. A further distinct result is that employees in the public sector, both

		Number of years living on first main source of income					
Path		1	2	3	4	5+	Average
SI → state old-age pension	12.00	62.18	22.44	10.90	3.85	0.64	1.59
SI → occupational pension	7.07	97.28	2.72	0	0	0	1.02
SI → DI	61.03	30.50	44.72	18.87	4.09	1.83	2.03
SI → survivor's pension	0.62	-	-	-	-	-	-
SI → wife's supplement	0.50	-	-	-	-	-	-
SI → severence payments	0.54	-	-	-	-	-	-
SI → private pension	0.23	-	-	-	-	-	-
SI → UI	5.11	93.98	3.01	2.26	0	0.75	1.50
SI → partial retirement benefit	0.04	-	-	-	-	-	-
SI → mixed sources	12.76	42.17	39.76	11.45	5.12	1.50	1.84
$n = 2601$							
UI → state old-age pension	47.64	27.94	39.69	18.54	7.05	6.79	2.26
UI → occupational pension	3.48	10.71	85.71	3.57	0	0	1.93
UI → DI	20.27	7.98	57.06	31.29	3.07	0.61	2.31
UI → survivor's pension	0.12	-	-	-	-	-	-
UI → wife's supplement	1.12	-	-	-	-	-	-
UI → severence payments	0.37	-	-	-	-	-	-
UI → private pension	14.18	45.61	44.74	7.89	1.75	0	1.66
UI → partial retirement benefit	0.25	-	-	-	-	-	-
UI → mixed sources	12.56	30.69	54.46	8.91	3.96	1.98	1.92
$n = 804$							

Table 4: Main source of income after a spell with sickness or unemployment insurance after permanent exit from the labor market; number of years with sickness and unemployment insurance, respectively, as main source of income before transition; percentage shares, cohorts born 1927-1932.

state and local government, are less likely to have their main income from UI when they exit the labor force.

Since workers are able to switch between different sources of income after permanent exit from the labor force, it may be misleading to describe only the first main source.[11] Table 4 shows the percentage distributions of the second main source of income for those who initially left the labor market with sickness or unemployment insurance, the number of years they retain their first

[11] For example, we found 677 different permutations of the main source of income after retirement in our sample.

source, as well as the average number of years on their first main source of non-work income. Since those who start to receive old-age pension benefits at retirement are most likely to continue to do so, and those who leave the labor force with disability insurance as their main source of income will automatically begin receiving old-age pensions at age 65, these groups are excluded from the transitions listed in Table 4.

According to Table 4, most of those who initially had sickness insurance benefits as their main income source receive a disability pension as their second main source. More than 70 percent of this group receive sickness insurance only one or two years before the transition to disability insurance.

The picture is somewhat more diverse for those who initially receive UI benefits as their main source of income. More than 45 percent switch to an old-age pension. Almost 70 percent of UI benefit recipients have a UI benefit prior to the transition to some other benefit for one or two years. About 20 percent switch to a DI pension, and a considerable fraction, 14.18 percent, switch to sickness insurance benefits as their next main source of income.

Table 5 goes one step further and reports what happens after the states considered in Table 4. Most of those who switch from SI to UI, and from UI to SI, ended up with DI as their main source of income. Table 5 also reveals that most of the second transitions took place within one or two years.

The percentage distribution of the number of years during which retirees received their main income from other sources starting to receive their main income from DI is reported in Table 6. It is evident that those who retire at relatively older ages make a faster transition to DI. Table 6 may also serve as a summary of the results previously obtained on transitions between sources of

Path		Number of years on second main income source					
		1	2	3	4	5+	Average
SI → UI → state old-age pension	29.96	89.47	2.63	7.89	0	0	1.18
SI → UI → occupational pension	1.56	-	-	-	-	-	-
SI → UI → DI	55.47	94.37	4.23	0	0	1.41	1.10
SI → UI → wife's supplement	2.34	-	-	-	-	-	-
SI → UI → mixed sources	10.94	100	0	0	0	0	1.00
$n = 128$							
SI → mixed sources → old-age pension	28.57	45.74	35.11	12.77	6.38	0	1.80
SI → mixed sources → occupational pension	1.82	-	-	-	-	-	-
SI → mixed sources → DI	65.05	38.79	43.46	10.28	5.14	2.34	1.89
SI → mixed sources → survivor's pension	3.04	-	-	-	-	-	-
SI → mixed sources → wife's supplement	0.30	-	-	-	-	-	-
SI → mixed sources → UI	1.22	-	-	-	-	-	-
$n = 328$							
UI → SI → old-age pension	27.27	36.67	56.67	6.67	0	0	1.70
UI → SI → occupational pension	0.91	-	-	-	-	-	-
UI → SI → DI	60.91	49.25	41.79	5.97	2.99	0	1.63
UI → SI → wife's supplement	0.91	-	-	-	-	-	-
UI → SI → mixed sources	10.00	-	-	-	-	-	-
$n = 110$							
UI → mixed sources → old-age pension	73.78	37.10	51.61	8.06	3.23	0	1.77
UI → mixed sources → occupational pension	1.19	-	-	-	-	-	-
UI → mixed sources → DI	23.81	20.00	70.00	5.00	5.00	0	1.95
UI → mixed sources → SI	1.19	-	-	-	-	-	-
$n = 84$							

Table 5: Main source of income after sickness or unemployment insurance and other sources of income as second main source after permanent exit from the labor market; number of years with second main source of income before transition; percentage shares; cohorts born 1927-1932.

	Number of years before DI as main income source					
	1	2	3	4	5+	Average
Age 50-55						
Sickness insurance	9.09	37.60	33.47	9.09	10.74	2.75
Unemployment insurance	-	7.69	30.77	15.38	46.15	4.00
All	8.91	35.66	33.33	9.30	12.79	2.81
Age 55-60						
Sickness insurance	20.10	42.44	27.17	6.67	3.62	2.31
Unemployment insurance	3.92	40.20	38.24	13.73	3.92	2.74
No income source more than 50 % alone	51.02	18.37	24.49	6.12	-	1.86
All	18.91	41.21	28.70	7.66	3.53	2.36
Age 60-65						
Sickness insurance	49.31	40.79	9.95	-	-	1.60
Unemployment insurance	10.42	64.58	25.00	-	-	2.15
No income source more than 50 % alone	75.56	18.89	5.56	-	-	1.30
All	49.74	39.48	10.78	-	-	1.61

Table 6: Percentage distribution of the number of years after permanent exit from the labor force before DI becomes the main income source. Retirees with initial income from sickness/unemployment insurance only.

income after permanent exit from the labor force. It shows that a majority in most groups make the transition to DI within two years after they retired.

Finally, Figure 1 shows the relation between retirement age and the average number of years before a worker receives DI as his main source of income, provided that his initial main source was from one of the labor market insurance programs. In particular, there is a very clear relationship between age of exit from the labor force and the average number of years with unemployment or sickness insurance benefits.

In summary, this section showed that there is a great deal of heterogeneity in the way Swedish workers finance their retirement. Two important conclusions emerge. First, pathways to retirement vary considerably between different groups of workers. Blue-collar workers in the private sector, in particular, get their income from insurance against poor health or unemployment after having

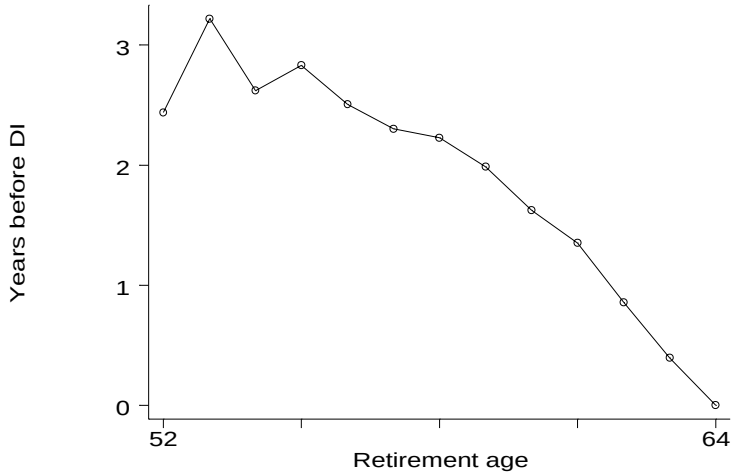

Figure 1: Average number of years after retirement before DI becomes the main source of income; only workers with main initial source of income from insurance.

permanently left the labor force to a much larger extent than other groups. Second, although a large share of workers rely on SI and UI as their main source of income in the initial state after a permanent exit from the labor force, most of them switch to DI after one to two years. This period decreases with the age of retirement.

3 Research Background

Despite the importance of early retirement from the labor market, the empirical research on retirement behavior is very meager on Swedish data. The most ambitious attempt to formally model retirement choice is found in Hansson-Brusewitz (1992). In the empirical part of his study, Hansson-Brusewitz estimates a labor supply model with joint decisions on the number of hours of work and labor force participation. Among other things, he simulates the effects on

total labor supply of introducing a partial pension scheme and replacing the ATP system with a scheme where pensions amount to 60 percent of average lifetime earnings. He found that the partial retirement scheme has a positive effect on total number of hours of work. As regards the hypothetical reform of the ATP system, he found a small positive effect on hours of work, but a small negative effect on desired retirement age.

Sundén (1996) studies to what extent changes in rules in general, and in particular the introduction of the partial retirement benefit, could account for the changes in retirement behavior between 1974 and 1981, or to what extent these changes rather could be referred to changes in individual preferences. She estimates a conditional/multinomial logit model with four different retirement options and then decomposes the overall change in retirement behavior between 1974 and 1981. She finds that most of the observed changes could be referred to preferences, i.e., an estimated coefficient in the model. Changes in rules, reflected in variables in the model, have a very small effect.

Skogman Thoursie (1999) investigates whether or not economic incentives affect the probability that a disability pension will be granted. He used a sample from the Swedish Level of Living Survey and estimated a reduced form conditional logit model. The difference between the predicted income from DI and the predicted income from labor was used as a measure of economic incentives. The results showed that a gain in predicted income from DI relative to income from labor increases the probability that a worker will exit the labor market with a disability pension. The interpretation of the result is that economic incentives do in fact affect the number of new disability pensions.

Wadensjö and Palmer (1996) compare disability policies in Sweden and the

Netherlands. Both countries have generous disability programs, which provide major pathways to early exit from the labor market. Despite the similarities, there is a higher labor force participation rate among older workers in Sweden than in the Netherlands. The authors point to some peculiarities in the Swedish labor market and disability policies that might account for the different outcomes. Among these distinctive features are the emphasis on the "work principle" in Swedish social and labor market policy, the low unemployment rates (until the recession in the 1990s), the possibilities in Sweden of combining work and pensions through partial benefits and the vocational rather than medical focus of rehabilitation policy.

4 Data

4.1 Origin of the Data Set

We use the Longitudinal Individual Data panel data set (LINDA) recently constructed by Statistics Sweden, the Department of Economics at the University of Uppsala and the National Social Insurance Board. LINDA is a pure register sample, i.e., no interviews were made when the data were collected.

LINDA contains data from three main registers:

1. Income and Wealth Register (*Inkomst- och Förmögenhetsstatistiken*, IoF). This income tax registers consists of tax return data on all people registered as taxpayers in Sweden. LINDA contains data from this register for each year between 1968 and 1997. For the years 1983-1997, the IoF includes detailed data on taxable and non-taxable transfers based on registers from the National Social Insurance Board, the National Board for Educational Assistance and some other authorities.

2. Population Census (*Folk- och Bostadsräkningen*, FoB). FoB exists for every fifth year between 1960 and 1990, and is obtained from mailed questionnaires. Everyone living in Sweden is included in the FoB and participation in the census in compulsory.

3. The National Social Insurance Board Registers for pension points (based onearnings). LINDA contains data from this register for each year between 1960 and 1997.

LINDA also contains data on education from the National Education Register and on employment from the Board for Labor Market Policy register.

The original sample for the LINDA panel is a random draw of 300 000 individuals from the 1995 IoF. The sampling procedure used to update the panel backwards and forwards from 1995 is designed so that each yearly cross section of LINDA is also a representative sample of the whole Swedish population.

The LINDA panel also contains information on the spouse of each individual originally included in the sample. In general, the same variables as for the original individuals are also available for their spouses. There are two, somewhat different, definitions of "spouse" in LINDA. The first is the tax-authority definition of spouses (*samtaxerad*) as either formally married, or as cohabiting and having common children. Information on spouses according to this definition is available for each year between 1968 and 1997. The second definition refers to all spouses that in the mailed questionnaire have reported that they are living together, i.e. share housing. This information is only available for the years of the FoB. When calculating incentive variables for this analysis, we used the first definition because it is available for all years under study.

	Men	Women	Men and Women
Individuals born 1927-1940	22 375	21 948	44 323
Neither emigrated nor dead in 1983	22 055	21 798	43 853
Usable earnings histories	22 046	21 781	43 827
Not retired at age 50	20 364	19 576	39 940
Not retired in 1983	18 163	15 916	34 079
Employed in 1983	15 619	14 820	30 439

Table 7: Number of individuals remaining after each step in the sample selection.

4.2 Sample Selection

For purpose of our study, we have restricted the population in several dimensions. First, the period of analysis is restricted to the years 1983-1997, primarily because the LINDA panel contains much more detailed information on individual sources of income for this period compared to the period preceding 1983.

Second, the population is restricted to individuals born between 1927 and 1940, i.e., those who were born in 1927 were age 56 in 1983 and 70 in 1997; those born in 1940 were age 43 in 1983 and 57 in 1997. Third, we have restricted the sample to those who had not already permanently exited from the labor force at age 50. Table 7 shows the number of individuals remaining in the sample at different stages of the selection process.

Since LINDA is a register sample obtained from national registration, the attrition of the panel is somewhat different compared to panels obtained from surveys. There are two main sources of attrition: mortality and permanent emigration. Table 8 shows the number of individuals remaining in the sample in different years covered by the panel.

	Men	Women	Men and Women
1983	15 619	14 820	30 439
1984	15 578	14 812	30 390
1985	15 535	14 794	30 329
1986	15 479	14 775	30 254
1987	15 390	14 731	30 121
1988	15 325	14 698	30 023
1989	15 237	14 654	29 891
1990	15 144	14 612	29 756
1991	15 043	14 550	29 593
1992	14 914	14 495	29 409
1993	14 789	14 438	29 227
1994	14 664	14 363	29 027
1995	14 518	14 282	28 800
1996	14 370	14 194	28 564
1997	14 194	14 103	28 297

Table 8: Number of individuals remaining in the sample during the period under study.

4.3 Measurement of Variables

4.3.1 Measuring Date of Retirement

As the data set only includes register information, there is no *self-assessed* information on date of retirement. It does, however, contain detailed information on sources of income for each individual in the sample. The sources of income that enable workers to remain out of the labor force, listed in Table 2, enable us to *indirectly* measure the date of permanent exit from the labor market, i.e., date of retirement. We investigated two definitions for measuring full-time retirement:

1. *Full time out of the labor force by source of income.* An individual is considered to be out of the labor force full time if, in a particular year, he receives more than 80 percent of his income from the sources listed in Table 2.

Difference, years	≤ -3	-2	-1	0	1	2	≥ 3
Men							
Aged 50-55	10.67	4.94	37.58	44.27	2.23	0.32	0
Aged 55-60	7.89	2.12	34.66	51.56	2.46	0.81	0.50
Aged 60-65	2.75	1.24	29.26	61.73	3.87	0.60	0.55
Aged 65-70	1.24	0.13	14.76	74.06	5.66	2.02	2.15
Women							
Aged 50-55	16.47	7.72	37.83	36.80	1.19	0	0
Aged 55-60	11.34	4.96	38.46	43.54	1.10	0.53	0.08
Aged 60-65	4.47	2.26	38.76	52.98	1.14	0.14	0.26
Aged 65-70	2.84	0.69	21.86	72.03	1.81	0.60	0.17

Table 9: Difference in years between age of permanent exit from the labor force using the earnings-from-labor (Def. 2) measure of retiremen and source-of-income difinition (Def. 1); by age groups of retirement (source-of-income definition).

2. *Full time out of the labor force by earnings from labor.* An individual is considered to be out of the labor force full time if, in a particular year, he has labor earnings of less than one BA.

This leads us to two different definitions of date of retirement: (1) the year preceding the first year an individual is out of the labor force full time according to the source of income definition and remains so for the rest of the period covered by the panel; (2) the year preceding the first year an individual is out of the labor force full time according to the earnings from labor definition and remains so for the rest of the period covered by the panel.[12]

These two definitions of retirement are compared in Table 9, which shows the distribution in percentage shares of the difference between the age of retirement resulting from two measures. The results are shown for four subsamples by age group of retirement according to the earnings-from-labor definition.

[12] An obvious problem with this way of measuring date of retirement is that workers who are regarded as retired could in fact have returned to the labor market after 1997 (the last year included in the panel), i.e., on average we will underestimate the date of retirement and the degree of underestimation is positively correlated to the date of retirement.

Table 9 shows that there are differences between the two measures. First, there is a thick clustering of observations in the 0 and -1 columns. A relatively simple explanation as to why the earnings-from-labor measure gives a retirement age one year before the source-of- income measure is that a worker is likely to earn more than one BA the year he retires - unless he does not retire until the end of the year. Therefore, as indicated above, we have set the year of retirement at the year before the worker starts to permanently earn less than 1 BA from labor.

Likewise, it is very likely that labor income exceeds 20% of total income the year a worker retires. Consequently we set the year of retirement at the year before the worker starts to permanently receive less than 20% of his income from labor. For the majority of individuals in our sample, one BA is larger than 20% of income. If, due to the timing of retirement during the year, earnings fell between 20% and one BA, a one-year difference between the two measures is recorded.

Second, there are relatively many observations in the ≤ -3 column. These workers reach the earnings-from-labor criterion three or more years before the source-of-income definition, i.e., they have several years with earnings from labor below one BA but exceeding 20% of total income. There are several explanations for such observations. They can refer to partially retired low-income workers, those who live on their own savings or, which is probably more common, on the income of other members of the household. Another possibility is that workers exit from the regular labor market and enter the informal sector of the economy. Such individuals appear more frequently in the female subsample and, more importantly, in the age group that, according to the earnings-from-labor

measure, retired early. These groups represent very few observation: the figure of 16.47% for women who retired between ages 50 and 55 in the ≤ -3 column corresponds to only 63 observations.

Moreover, Table 9 shows that a considerable share of the individuals who retire after age 65 according to the earnings-from-labor criterion had retired according to the source-of-income criterion two or more years earlier. In other words, they continued to work part time after retirement while simultaneous receiving their main income from old-age pension benefits. There is no earnings test in Sweden's old-age pension schemes, i.e., it is possible to receive (full) pension benefits and continue to work. The decision to retire (leave the labor force) and the decision to claim a benefit are separate. Table 9 shows that almost 10% of the men who retired between ages 65 and 70 according to the earnings-from-labor definition claimed a benefit at an earlier age. Women did this to a considerably smaller extent. In the case of high-income workers, the source-of-income definition might be more appropriate, since earnings above one BA correspond to relatively few hours of work.

To conclude the comparison between the two definitions of full-time retirement, let us first note that the resemblance between the two measures of retirement seems to be good for most individuals in the sample. However, the source-of-income definition missed that some individuals, primarily women, leave the labor force without immediately claiming full benefits from any of the programs considered in Table 2. Also, some individuals, primarily men, remain part time in the labor market at a relatively old age, but are still measured as retired full time by the source-of-income definition of retirement. These two disparities imply that the earnings-from-labor definition of retirement is more useful, and

we restrict ourselves to using this definition when describing the transition to full-time retirement.

4.3.2 Measuring Other Included Variables

We used the extensive earnings histories as well as information on the incomes of spouses included in LINDA to calculate the economic incentive for remaining in the labor force. Here, there are two problems associated with using the earnings-from-labor variable. First, some of the observations are missing. This could be due to the fact that a worker is temporarily out of the labor force or out of the country. In such cases we simply imputed the missing earnings observation by taking the average of the surrounding observations, or, if the missing observations are from the beginning of the observed period of time, we imputed the missing observation by taking the average of the first three earnings observations.

Second, and more important, when a worker retires, the contrafactual earnings from labor cannot be observed. Nevertheless, this earnings level is, of course, important for the retirement decision and, as discussed in Section 5, it is required in order to calculate the incentive measures. To predict future earnings, we simply take the average of earnings over the last three years of a worker's observed earnings records indexed by the CPI.

Lifetime earnings are measured as the sum of the constant and the fixed effect, from a fixed-effects regression on labor earnings between 1983 and 1997 on age, age squared and dummy variables for each year included. Exactly the same strategy is used for measuring life time earnings for the spouse.

Our dataset does not contain any direct information that specifies to which occupational pension scheme each individual belongs. Given the importance of

	Men		Women		Men and Women	
	Number	%	Number	%	Number	%
Blue collar, private sector	6 188	39.62	3 137	21.17	9 325	30.64
White collar, private sector	4 972	31.83	2 614	17.64	7 586	24.92
Central government employees	2 110	13.51	2 348	15.84	4 458	14.65
Local government employees	2 349	15.04	6 721	45.35	9 070	29.80
All	15 619	100	15 165	100	30 439	100

Table 10: Classification of individuals into pension schemes.

occupational pension schemes this is, of course, essential information. However, as described in Section 2, occupational pension schemes are associated with the different trade unions which, in turn, are associated with different personnel categories and sectors of the economy. The FoBs contain information on the sector in which each individual works as well as socio-economic group. This information can then be used to predict to which occupational pension scheme each individual belongs.

We use information from the FoBs (censuses) in 1980, 1985 and 1990. If an individual has retired by the date of a census, it does not contain any information on either his socio-economic group or sector of employment. This means that there is less information missing from the 1980 census compared to the other two censuses. Therefore, we used the 1980 census to predict the occupational pension scheme. However, for missing values in this census we used information from the 1985 census and, if necessary, also from the 1990 census. The resulting distribution among occupational schemes is shown in Table 10.

We used the same strategy to measure individual education level. In the first place we used information from the 1993 education register. For missing observations we used data from the 1994, 1995 and 1995 registers, respectively. Table 11 gives a short description of each education level along with the percentage

Level	Description of the Schooling Level	Men, %	Women, %
1	Compulsory school only (7 or 8 years)	42.58	35.63
2	Junior secondary school (9 or 10 years)	4.44	8.24
3	Vocational school secondary school $\leqslant$ 2 years,	20.06	33.06
4	Upper secondary school $\geqslant$ 3 years, sixth form of comprehensive school (UK), senior high school (US)	14.61	4.71
5	Post-upper secondary school $\leqslant$ 2 years, junior college (US), e.g. nursing school	7.35	9.03
6	Post-upper secondary school $\geqslant$ 3 years, e.g. buissiness administration, engineering or medicine and Ph.D.s	10.96	9.33

Table 11: Number of observations at different education levels.

share of observations in each category.

Finally, we used controls for place of residence. Sweden is divided into 25 counties. LINDA contains annual information on in which county an individual is registered for local taxes; this is the measure used for place of residence.

5 Construction of Incentive Measures

5.1 Definitions of the Incentive Measures

We use of four different measures of economic incentives for retirement decisions:

1. benefit accrual;
2. effective tax/subsidy rate;
3. peak value;
4. option value;

Benefit accrual measures the increase in pension wealth a worker gains by postponing retirement and claiming a benefit for one year. The present value

of a worker's pension wealth at year t if he retires at age r is defined as

$$SSW(t,r) = \sum_{s=r}^{\max age} \delta^{s-t} E_t B(s,r), \tag{1}$$

where $E_t B(s,r)$ is the expected benefit at age s if the worker retires at age r, i.e.,

$$\begin{aligned} E_t B(s,r) = {} & p(s \mid t)\, q(s \mid t)\, BM(s,r) + \\ & + p(s \mid t)\,(1 - q(s \mid t)) BS(s,r) + \\ & + (1 - p(s \mid t)) q(s \mid t)\, S(s,r,t), \end{aligned} \tag{2}$$

where $BM(s,r)$ is the amount of a worker's pension benefit at age s if he is married and retires at age r; $BS(s,r)$ is the amount of a worker's pension benefit at age s if he is not married and retires at age r; $S(s,r)$ is the amount of the survivor's benefit when the worker would have been aged s and retired at age r; $p(s \mid t)$ is the probability of survival at time s conditional on survival at time t; $q(s \mid t)$ is the probability of the spouse surviving at age s conditional on survival at age t; and δ is the discount factor. $S(s,r,t)$ depends on the spouse at time t as well as the retirement age r, while $BM(s,r)$ and $BS(s,r)$ are not dependent on t since we assume perfect foresight about wages.

The benefit accrual at age t is defined as

$$ACCR(t) = \sum_{s=t+2}^{\max age} \delta^{s-t} E_t B(s,t+2) - \sum_{s=t+1}^{\max age} \delta^{s-t} E_t B(s,t+1). \tag{3}$$

The effective tax/subsidy rate measure relates benefit accrual to the net wage if the worker stays in the labor market one additional year, i.e.

$$TS(t) = -ACCR(t)/W(t+1), \tag{4}$$

where $W(t+1)$ denotes labor earnings at age $t+1$.

Peak value is defined as social security wealth (SSW) at its maximum value minus SSW at time t, i.e.

$$PEAK(t) = \max_{r=t+2,\ldots,71} \sum_{s=r}^{\max age} \delta^{s-t} E_t B(s,r) - \sum_{s=t+1}^{\max age} \delta^{s-t} E_t B(s,t+1)$$

This measure is forward looking in the sense that it not only takes into account the immediate accrual in SSW of working an additional year, but also the accruals in future years.

Option value is related to the notion that an individual's retirement decision also depends on how he or she values consumption and leisure at different ages. At any given age (t) it is assumed that the worker compares the expected present value of retiring at that age with the value of retiring at each age (r) in the future.

The expected utility at age t of retiring at age r is defined as

$$V(t,r) = \sum_{s=t}^{r-1} \beta^{s-t} (Y(s))^{\gamma} p(s \mid t) + \sum_{s=r}^{\max age} \beta^{s-t} (kB(s,r))^{\gamma} p(s \mid t), \qquad (5)$$

where β is the subjective discount rate, k reflects the marginal utility of leisure and γ measures marginal utility of consumption. The option value of retiring at age t is

$$OPT(t) = V(t,r^*) - V(t,t+1) \qquad (6)$$

where r^* is the optimal retirement age, i.e., the option value can be interpreted as the loss in utility of retiring today rather than preserving the option to retire at the preferred age.

All of these incentive measures abstract from the possibility of retiring without claiming a benefit and of claiming a benefit without retiring. In an expanded

model, an individual who is not retired, and does not claim a benefit in one year, could choose between four options the next year:

1. continue to work and not claim a benefit;
2. retire and start claiming a benefit;
3. retire without claiming a benefit; and
4. claim a benefit without retiring.

Here we continue to abstract from the numerous possibilities of partial retirement in the Swedish system. In a utility-maximizing framework, it is conceptually straightforward to take all four options into account. However, this approach complicates the retirement model considerably and, considering the extent to which our data are dominated by options (1) and (2), we do not think it is justified .

The fact that we have relatively few observations on options (3) and (4) may be explained by the progressive income tax, which creates an incentive to smooth income over time. To the extent options (3) and (4) are dominated by (1) and (2), they can be disregarded as we do in our model.

5.2 Sources of Income after Retirement

As pointed out in Section 2, workers may use several different sources of income provided by the Swedish social insurance system after having permanently left the labor force. Moreover, different sources of income also implied varying income levels after retirement. In general, the replacement levels from disability insurance and, in particular, from unemployment and sickness insurance, are significantly higher compared to the old-age pension alternative. However, as

indicated in Section 2, these sources of income are not available to all workers. It is only possible to observe, ex post, that an individual who actually receives support from a particular insurance is eligible for it. Whether an individual who continues to work one additional year is, in fact, qualified for benefits from a particular program cannot be determined. This complicates the construction of the incentive measures, since they are based on expected income after retirement.

An extreme way of handling this problem is to assume that each worker, at each point of time, is eligible for support from the program which provides the most generous support. However, since this does not apply to some of the workers in the sample, such a measure would overestimate the true income after retirement for some of the workers, thereby underestimating the effect of economic incentives. Another extreme would be to assume that the old-age pension is the only alternative available. But this would, certainly not apply to those workers who are affected by the economic incentives inherent in labor market insurance, thereby underestimating the effect of the economic incentives.

A third alternative would be to assume that insurance is an alternative available only to those who in fact claim some kind of insurance when retiring. This procedure, however, would give rise to an endogeneity problem. If the retirement income from an insurance program, which is considerably higher than that from an old-age pension were assigned *only* at the point in time when a worker actually retired, and not in the preceding time period, it would be recorded as an increase in retirement income the year retirement actually take place. This, in turn, would imply that the effect of economic incentives is overestimated.

To avoid the problems involved in these approaches, we used a "probabilistic" or instrumental variable (IV) approach. To explain how the incentive measures are calculated using this approach, let us take SSW as an example. Social security wealth from the old-age pension system, which is available without any requirements regarding health status or unemployment, is denoted SSW_{OAP}. A worker's social security wealth, if he is eligible for labor market insurance, is denoted SSW_{LI}. If the worker's probability of access, at a particular point in time, is p, then his social security wealth can be written

$$SSW = SSW_{OAP} + p\,(SSW_{LI} - SSW_{OAP})\,. \tag{7}$$

Calculating this measure involves two problems. The first concerns calculation of SSW_{LI}. Not only does Sweden's welfare system offer several different labor market insurance programs, but workers are also able to shift between different programs. Ideally, SSW_{LI} should be divided up to account for different systems, with a probability assigned to eligibility for each of them. However, as noted in Section 2, considering all permutations of the main source of income over time resulted in 677 different combinations in the sample. In practice, it is obviously not feasible to calculate the economic incentive measures for hundreds of pathways.

Several simplifications can be made, however. For example, a behavioral model could be applied to predict how workers choose among different insurance programs. On the other hand, according to Section 2, most workers who retire by claiming labor market insurance follow a similar pattern. So, rather than applying a behavioral model, we used a common, synthetic "insurance path" to approximate the shifts between different insurance programs over time.

It was noted in Section 2 that the replacement rates for sickness and un-

employment insurance are quite similar, in particular for workers who have an insured income below both the social security and the unemployment insurance ceilings. This applies to most of the blue-collar workers in our sample, for most of the time period under study. These are also the workers that are the ones who are most likely to initially finance their retirement from insurance. That is, the accuracy in predicting income after retirement it is not likely to be impaired if, when choosing between sickness and unemployment insurance, the "right" insurance program is not used.

As shown in Figure 1, the length of the time before the transition to DI is highly dependent on a worker's age when he permanently leaves the labor force. In constructing the synthetic "insurance path" to retirement, we therefore use retirement age as a predictor of the length of the period with unemployment or sickness insurance before the transition to DI. In Figure 2, predicted values from a regression of the average number of years with sickness or unemployment insurance before DI on a quadratic function of retirement age are added to the data shown in Figure 1. As is apparent from the figure, the function gives a very good fit to the observed averages.[13]

When calculating the incentives measures, we assume - for each age - that a worker receives sickness or unemployment insurance with a replacement rate of 80% during the number of years predicted by the quadratic function, and after that shifts to DI as his main source of income. From age 65, no workers are eligible for any type of labor market insurances and, consequently, all incentive measures are calculated using the old-age pension alternative only.

[13] As there are very few observations on retirement before age 54, and as the estimated function actually increases between retirement ages 52 and 53, we used 2.75 years up to age 54. After that age, we applied the quadratic function.

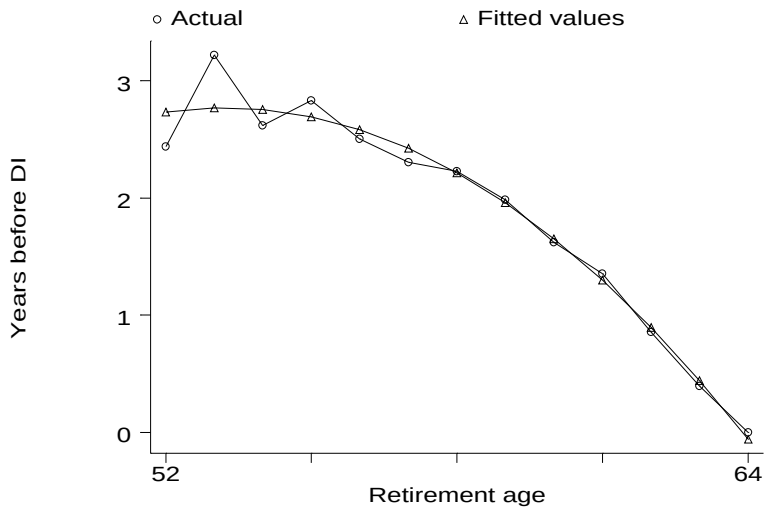

Figure 2: Fitted values from regressing the average number of years with sickness or unemployment insurance as the main source of income before DI becomes the main source on a quadratic function in retirement age along with actual sample averages.

The second main problem with using the IV or probability approach concerns assigning the probability of being eligible for labor market insurance. Ideally, we would like to know, at each point in time, every worker's probability of being eligible for labor market insurance. Since this information is not available, we estimated a probit equation where the dependent variable is the observed take-up rate of the labor market insurance programs. The specification of the probit equation is a polynomial in age, indicators for six education levels, indicators for four socio-economic groups, marital status and indicators for the 25 different counties in Sweden. The results from the probit regression are shown in Table 12.

	Men		Women	
	$\widehat{\beta}$	$\frac{\widehat{\beta}}{s_{\widehat{\beta}}}$	$\widehat{\beta}$	$\frac{\widehat{\beta}}{s_{\widehat{\beta}}}$
Age	0.444	7.71	0.088	45.69
Age^2	-0.003	-6.20	-	
$Occ2$	-0.253	-13.37	-0.255	-9.03
$Occ3$	-0.148	-6.05	-0.140	-5.89
$Occ4$	-0.214	-8.68	-0.189	-9.89
$Occ5$	-0.214	-8.50	-0.237	-6.09
$Occ6$	-0.290	-7.56	-0.404	-7.63
$Elev2$	0.119	3.60	-0.066	-2.45
$Elev3$	0.075	4.26	-0.051	-2.99
$Elev4$	-0.035	-1.05	-0.077	-2.16
$Elev5$	-0.151	-4.60	-0.201	-6.80
$Elev6$	-0.281	-8.88	-0.339	-10.64
$Married$	-0.100	-6.64	0.057	3.62
α	-17.03	-10.28	-6.853	-59.70
Controls for counties	Yes		Yes	
Pseudo R^2	0.0761		0.0717	

Table 12: Probit estimates of probability of getting disability, sickness or unemployment insurance benefits.

5.3 Calculating Retirement Income Components and Income Taxes

Calculations of the incentive measures for the individuals in the sample require calculating the old-age pension, disability, sickness and unemployment insurance benefits for each individual at every possible retirement age. It is also imperative that income taxes and housing allowances be taken into account. The frequent changes that have taken place in the Swedish system for housing allowances and income taxes not only require some approximations, but also raise issues about expectations.

The most straightforward component to calculate in the economic incentive measures is income from the defined benefit pension schemes, i.e., the state basic and supplementary pension (ATP) and the four main occupational pension

schemes. Compared to e.g. income taxes, the rules for these pension schemes do not change very often and, given the detailed earnings histories in our data set, we were able to calculate these incomes accurately.

For the defined contribution schemes - ITPK, the central government employees' supplementary pension and the post-reform pension scheme for blue-collar workers in the private sector - the size of the pension depends on the return of the particular fund that each may choose to manage his pension. Calculating the hypothetical outcome for these pensions therefore involves approximations. As regards the ITPK scheme, we used an algorithm for calculating the size of the pension provided by the insurance company (called SPP) which administrates the largest share of the ITPK pensions. As suggested by SPP, we used an annual interest rate of 2.25 percent (net after taxes and administrative costs).

We used the same algorithm for the supplementary pension scheme for central government employees, while taking into account that a lower share of the wage sum which is paid into the pension scheme compared to the ITPK, as well as the fact that this scheme went into effect after ITPK. In the case of the post-reform pension scheme for blue-collar workers in the private sector, we used an algorithm provided by the company which manages the largest share of these pensions.

The calculations with respect to income taxes are more complicated. Although there has only been one major reform of the Swedish income tax system during the period covered by our data, several year-to-year changes have taken place. Since the number of years included is quite large, considering all changes would be unrealistic. To simplify matters, we chose an approximate strategy. We began by regressing the amount of taxes on taxable income. Since income

tax rates are different for people still in the labor force compared to retirees, we have estimated separate functions for retired and non-retired. We used a third degree polynomial to model the marginal tax rates in the pre-reform income tax system, and three linear segments for the post-reform marginal tax rates. We then used the estimated functions for each year to calculate individual taxes. A similar procedure was applied for housing allowances.

The forward looking measures, peak value and option value, require the worker to compare expected income among all possible retirement ages. This implies predicting hypothetical individual labor earnings after the workers had actually retired. For these calculations we chose a latest possible retirement age of 71. This, in turn, requires predicting labor earnings up until year 2010. For these out-of-sample predictions, we used the same strategy as outlined in Section 4, i.e., we took the three-year averages for the years preceding the year with missing labor earnings.

All three incentive measures used in this study involve individual expectations on future net income streams, which to a large extent are affected by future changes in benefits and income taxes. For example, the economic incentives for a retirement decision in the late 1980s are affected by whether or not an individual anticipated the 1991 income tax reform, and we assume that it was anticipated. Another example is the occupational pension scheme for blue-collar workers in the private sector. The trade union and the employers confederation agreed on a new pension scheme in 1996. However, another new agreement went into effect on January 1, 2000 and the pensions of some workers were affected retroactively. Needless to say, it is impossible to know which changes the workers anticipated. We assume that they anticipated all changes

until January 1, 2000, but none thereafter.

5.4 Sample Estimates of Different Incentives Measures

Tables 13-16 report the sample distribution of the incentive measures by age. Table 13 shows social security wealth, benefit accrual and the tax/subsidy rate, i.e., benefit accrual as a share of labor earnings minus payroll and income taxes in the individual's last year of work. Table 14 reports the peak value and option value distributions for men. Tables 15 and 16 list the corresponding distributions for women. In addition to the median, the 10th and 90th percentiles of the distribution are given for the benefit accrual, peak value and option value measures.

Benefit accrual exhibits a marked increase at age 57. This is due to the rule in the STP scheme that at least three years of work between ages 55 and 59 are required in order to be eligible for the STP pension. The increase is more marked, also regarding the median, in the male subsample because a larger share of the male labor force comprises blue-collar workers. The next, noticeable increase is at age 59. This may be explained by the way the pension schemes for central and local government employees are constructed (see Section 2). This spike is substantially more marked in the female subsample, mainly because the largest share of the female labor force in Sweden works in the local government service sector.

The forward looking incentive measures, peak value and option value, show - although on a different levels - a similar pattern as they both decrease over the observed ages. However, the quantiles of the option value measure evolves more smoothly over the ages, which is not surprising given the way in which it is calculated. The 90th percentiles of the peak value fall considerably between

ages 59 and 60, which, again, reflects the makeup of the pension schemes for central and local governments employees.

The last column in Table 13 gives the tax/subsidy rates obtained in Palme and Svensson (1999) for a representative worker: born in 1930, assigned to the STP occupational pension scheme and a median income earner throughout his working career. As can be seen in the table, the tax rates are somewhat higher in the dataset used here. This may be explained by differences in the way these two sets of tax rates were obtained.

First, in Palme and Svensson (1999), labor market insurance was not considered in the base case. This may explain the different general levels up to age 63 since this type of insurances entails more generous replacement rates as compared to old-age pension. Second, the representative worker was assumed to be assigned to the STP pension scheme. The dip in the tax rate at age 56 is definitely related to the way this pension scheme is constructed which is less marked in the present data set which comprises individuals from all occupational pension schemes. Third, the dataset now used encompasses the pre-reform income tax system up until 1991, with substantially higher marginal tax rates. This difference may explains the somewhat higher tax rates after age 63. Finally, the results from the present dataset are medians from the distribution of tax rates rather than tax rates from the median income earner. The direction in which this difference works is not clear.

Age in First Year	SSW	Accrual				Tax/subsidy rate	
after Retirement	Median	Median	10th pt	90th pt	S.D.	Median	Previous Volume
55	948989	382	-20274	21936	71529	0.336	0.231
56	974320	152	-19458	35625	73008	0.334	0.221
57	1003271	16441	-16031	108728	87613	0.225	0.056
58	1075949	-1087	-21220	18912	77718	0.341	0.153
59	1109640	-1796	-22126	222696	139078	0.328	0.146
60	1173201	-10289	-35414	17373	77408	0.416	0.350
61	1197662	-16059	-40906	4531	73985	0.455	0.358
62	1216410	-23303	-49215	-5420	60565	0.507	0.253
63	1228947	-31069	-63912	-14456	60458	0.536	0.290
64	1238792	-23063	-50215	-5530	59259	0.468	0.313
65	1254391	-26947	-101476	-9830	59584	0.203	0.036
66	1271583	-31923	-94670	-18370	44432	0.238	0.085
67	1282659	-38386	-92745	-28024	32551	0.285	0.128
68	1290440	-44607	-94781	-35262	29727	0.334	0.169
69	1295627	-51173	-97298	-42884	25119	0.389	0.193
70	1297843						

Table 13: Social security wealth, benefit accrual and tax/subsidy rates; 1995 SEK (CPI used as deflator); men.

Age in First Year	Option Value				Peak Value			
after Retirement	Median	10th pt	90th pt	S.D.	Median	10th pt	90th pt	S.D.
55	5246	1647	9523	3333	66730	-9154	325490	181269
56	4429	1384	8265	3005	66891	-6693	305466	173308
57	3540	1165	7074	2667	71401	-7095	288716	164726
58	1936	404	5880	2501	2096	-18214	272519	166101
59	1092	171	4894	2231	-1022	-20128	268150	158549
60	138	-340	1289	1278	-9624	-34251	45005	97583
61	-1	-426	805	1084	-15527	-39014	18257	85430
62	-124	-521	523	911	-22474	-47366	4186	72261
63	-209	-680	291	808	-29646	-61330	-9893	65724
64	-130	-569	253	703	-22788	-48854	-4528	57479
65	-227	-1153	51	622	-26923	-100668	-9782	53890
66	-306	-1090	-96	494	-31911	-94646	-18370	44169
67	-414	-1064	-245	353	-38386	-92745	-28024	32308
68	-512	-1063	-366	301	-44607	-94781	-35262	29727
69	-609	-1024	-470	240	-51173	-97298	-42884	25119

Table 14: Forward looking incentive measures (peak value and option value) by age; 1995 SEK (CPI used as deflator); Parameter values for option value measure $\beta = 0.96$, $\gamma = 0.6$, and $k = 4.3$; men.

Age in First Year	SSW	Accrual				Tax/subsidy rate
after Retirement	Median	Median	10th pt	90th pt	S.D.	Median
55	696605	428	-15672	7195	25509	0.297
56	724122	339	-15915	8464	27175	0.297
57	753329	2891	-14848	62285	35195	0.275
58	795780	316	-16742	8056	31554	0.299
59	824257	5312	-18527	292313	138095	0.246
60	954033	-3774	-27355	25364	36694	0.343
61	974571	-9397	-31320	16538	31533	0.407
62	984589	-16461	-38217	6463	29881	0.494
63	991527	-23154	-52301	-3482	32043	0.568
64	992685	-14054	-37449	21032	39108	0.445
65	1007711	-25576	-86969	-1227	47920	0.263
66	1002203	-24791	-83963	-6361	35455	0.281
67	1007145	-25917	-81610	-11420	31002	0.311
68	997192	-31746	-82028	-16204	28008	0.367
69	988545	-33089	-77194	-16940	25608	0.356
70	991613					

Table 15: Social security wealth, benefit accrual and tax/subsidy rate by age; 1995 SEK (CPI used as deflator); women.

Age in First Year	Option Value				Peak Value			
after Retirement	Median	10th pt	90th pt	S.D.	Median	10th pt	90th pt	S.D.
55	52212	29934	76897	19592	58273	-7063	361878	165455
56	48137	26863	71863	18673	58754	-6156	360700	164342
57	43681	23569	66017	17565	62725	-4893	350520	160349
58	38412	19716	59514	16472	19595	-13714	346500	162776
59	34186	16537	53801	15352	14173	-16557	341941	160737
60	24998	10715	41764	12379	-2715	-26791	64298	58191
61	21179	8273	36977	11357	-8610	-31113	40328	47925
62	17803	6174	32668	10321	-15245	-37750	21771	43874
63	15002	4494	28648	9405	-19523	-48765	14820	43540
64	12587	3412	24683	8230	-13388	-36941	24157	42987
65	9578	1279	20043	7267	-24474	-86617	-927	47410
66	7706	1018	16285	5834	-24506	-83620	-6228	34826
67	5849	608	12239	4468	-25675	-81327	-11390	29956
68	3890	342	8553	3278	-31619	-82028	-16141	28041
69	2330	200	5288	2144	-33089	-77194	-16732	25701

Table 16: Forward looking incentive measures (peak value and option value); 1995 SEK (CPI used as deflator); parameter values for option value measure $\beta = 0.97$, $\gamma = 0.75$, and $k = 1.25$; women.

6 Empirical Model and Results

6.1 Empirical Specification

We use the following empirical specification for the retirement decision model:

$$R_{it} = \delta_0 + \delta_1 ACC_{it} + \delta_2 SSW_{it} + \delta_3 AGE_{it} + \delta_4 PREARN_{it} + \delta_5 EARN_{it} +$$
$$\delta_6 PREARN_{it} * EARN_{it} + \delta_7 SPEARN_{it} + \beta X_{it} + \upsilon_{it}$$

where ACC_{it} is the measure of accrual at time t; SSW_{it} is the net present value of social security wealth discounted back to time t; AGE_{it} represents the individual's age either by a linear variable or by indicators for each age; $PREARN$ is the individual's predicted earnings at time t and the square of this measure; $EARN$ is a measure of the individual's lifetime earnings and its square; $SPEARN$ is lifetime earnings of the spouse, its square and the spouse's net social security wealth discounted back to time t; X is a set of personal characteristic variables, including marital status, education level ($Educ1 - Educ6$),[14] socioeconomic group ($Occ1 - Occ4$)[15] and indicators for each of Sweden's 25 counties (cf. Section 4 for the construction of these variables).

The focus of our interest is on the dual effect of economic incentives for retirement created by the social security system. Higher social security wealth will increase an individual's demand for all goods - including leisure time, i.e., retirement. This effect is measured by SSW and we expect a positive sign on this variable. However, if the accrual from working one additional year is sufficiently large, then the substitution effect, induced by the accrual, will dominate the income effect and the worker will choose to continue to work.

[14] These education levels refer to those described in Table 11.
[15] The socio economic groups are explained in Table 10.

Therefore we expect the sign on ACC to be negative. As indicateded in Section 5, we use three different measures of accrual: benefit accrual, peak value and option value.

Among the changes in the Swedish income tax and security systems outlined in Section 2, the following are particularly helpful for identification of the empirical model: the income tax reform (1991); the reform of the occupational pension scheme for central government employees (1992); the maturing of the fully funded supplementary pension scheme for white-collar workers in the private sector (ITPK, in 1977) and for central government employees (1991); and the transition from a pay-as-you-go to a fully funded pension scheme for blue-collar workers in the private sector (1996).

Although the data set has a panel structure, identification of the empirical model prevents us from using e.g. a fixed effect approach to control for unobserved heterogeneity. We use the data set as a cross section in the estimation and use observable demographic characteristics to control for heterogeneity. This means that most individuals are included in the data several times. To correct the standard errors for dependence between different observations on the same individual, we use the Huber-White sandwich estimator, which allows for general dependence within clusters of observations.

6.2 Sample Characteristics

Since only workers older than age 50 are included in the sample, the first observations on the cohorts born between 1934 and 1940 were not used in the estimation. The final sample consists of 127 390 observations (from 15 619 individuals) in the male subsample and 123 979 observations (from 14 820) individuals in the female subsample.

	Men		Women	
	$Mean$	s	$Mean$	s
Retired	0.055	0.228	0.060	0.238
Benefit accrual	2 786	88 798	5 009	54 267
Peak value	83 079	177 741	97 966	158 950
Option value	4 137	4 140	45 993	23 882
SSW	1 125 860	409 609	836 456	290 059
Log lifetime earnings	11.73	0.39	9.81	0.42
Predicted log earnings	12.30	0.43	11.89	0.45
Education 1	0.446	0.497	0.351	0.477
Education 2	0.039	0.194	0.079	0.269
Education 3	0.176	0.381	0.321	0.467
Education 4	0.143	0.350	0.046	0.209
Education 5	0.077	0.266	0.095	0.293
Education 6	0.119	0.324	0.103	0.304
Occupation 1	0.382	0.486	0.200	0.400
Occupation 2	0.331	0.471	0.180	0.384
Occupation 3	0.129	0.336	0.154	0.361
Occupation 4	0.158	0.365	0.466	0.499
Married	0.754	0.431	0.723	0.448
Log lifetime earnings of spouse	24.01	15.08	23.58	15.43
SSW, spouse	838 826	728 845	942 550	748 000

Note: For the option value measure we use $\beta = 0.91$,$\gamma = 0.50$,and $k = 3$ for the male subsample and $\beta = 0.97$,$\gamma = 0.75$,and $k = 1.25$ for the female subsample.

Table 17: Means and standard deviations of the variables included in the sample used in estimations; monetary values in SEK (1997 prices deflated by the CPI).

Table 17 reports means and standard errors of most of the variables included. Due to space limitations we have excluded descriptive statistics of the 25 indicator variables for the 25 counties.

6.3 Estimation Results

The results from the probit regression on retirement decisions are shown in Table 18 for men and Table 19 for women. Each of the tables shows six different specifications. The three measures of accrual described in Section 5.1 are used in

alternative specifications, i.e., the one-year benefit accrual, the peak value and the option value accrual measures respectively. For each measure of accrual, there is one specification with a linear age variable ($M1$) and one with indicator variables for each one-year age group ($M2$).

To evaluate the specification of model, we have tested for joint significance of the main groups of variables included, i.e., the incentive variables, the additional variables for the workers' economic situation, education level, socio-economic group, family income, and county of residence. The results show that all these groups are significantly different from zero, on the five percent level, in all specifications.

We estimated the parameters in the option value measure by a grid search, where the maximum of the log likelihood from the M2 model was used as a value function. Although the log likelihood function for men was shown to be very flat with respect to γ, a maximum was found at $\beta = 0.96$, $\gamma = 0.60$, and $k = 4.3$. These parameter values were then used to obtain the estimates presented in Table 18. However, we also estimated the model using approximately the parameter values obtained by Stock and Wise (1990), i.e., $\beta = 0.97$, $\gamma = 0.75$, and $k = 1.25$. These values gave smaller coefficient estimates for the option value variable (coefficient/10^6 at -5.62 (-5.74) for the M1 and -5.98 (-6.20) for the M2 specification, respectively), but slightly larger for the SSW variable (coefficient/10^6 at 0.13 (2.31) for the M1 and 0.09 (1.57) for the M2 specification respectively).

For the female subsample, the grid search did not result in any maximum since the log likelihood function was decreasing in k in the permitted region of values for k. For the estimates reported in Table 19 we used $\beta = 0.97$, $\gamma = 0.75$,

	Accrual		Peak value		Option value	
	$M1$	$M2$	$M1$	$M2$	$M1$	$M2$
ACCR/10^6	-0.21	-0.05	-0.74	-0.48	-38.70	-55.20
	(-2.08)	(-0.51)	(-8.56)	(-6.41)	(-7.91)	(10.25)
1 million change	-0.02	-0.01	-0.05	-0.05	-2.85	-4.18
SSW/10^6	0.31	0.30	0.57	0.40	0.11	0.05
	(6.53)	(6.21)	(3.19)	(8.59)	(2.14)	(0.10)
1 million change	0.02	0.02	0.01	0.01	0.01	0.01
Lifetime earnings	-1.44	-1.06	-1.35	-1.10	-0.91	-0.58
	(-1.00)	(-0.73)	(-0.95)	(-0.77)	(-0.65)	(-0.41)
Lifetime earnings^2	0.03	0.01	0.09	0.07	0.08	0.09
	(0.42)	(0.17)	(1.24)	(1.04)	(1.04)	(1.18)
Predicted earnings	-0.66	0.74	2.44	2.48	2.37	3.18
	(0.42)	(0.46)	(1.54)	(1.56)	(1.50)	(2.00)
Predicted earnings^2	-0.07	-0.07	-0.08	-0.09	-0.08	-0.10
	(-1.64)	(-1.72)	(-2.16)	(-2.27)	(-2.08)	(-2.38)
Lifetime*Predicted	0.16	0.14	-0.02	-0.03	-0.04	-0.14
	(1.10)	(0.99)	(-0.19)	(-0.21)	(-0.30)	(-0.92)
(Lifetime*Predicted)^2	-0.01	-0.01	-0.01	-0.01	-0.01	0.01
	(-1.64)	(-1.38)	(-0.50)	(-0.33)	(-0.26)	(0.46)
Education2	0.21	0.20	0.21	0.21	0.20	0.21
	(6.56)	(6.49)	(6.65)	(6.59)	(6.60)	(6.54)
Education3	0.19	0.19	0.19	0.19	0.19	0.20
	(11.53)	(11.30)	(11.71)	(11.49)	(11.73)	(11.67)
Education4	0.14	0.13	0.14	0.14	0.14	0.16
	(6.77)	(6.64)	(7.23)	(7.12)	(7.24)	(7.40)
Education5	0.12	0.11	0.13	0.12	0.13	0.14
	(4.75)	(4.48)	(5.23)	(4.95)	(5.25)	(5.22)
Education6	0.07	0.07	0.09	0.09	0.09	0.10
	(2.67)	(2.64)	(3.35)	(3.31)	(3.35)	(3.58)
Occupation2	-0.15	-0.14	-0.14	-0.13	-0.13	-0.12
	(-8.63)	(-8.18)	(-8.08)	(-7.67)	(-7.86)	(-7.14)
Occupation3	0.02	0.02	0.02	0.02	0.02	0.03
	(1.09)	(1.21)	(1.18)	(1.27)	(1.32)	(1.50)
Occupation4	-0.21	-0.21	-0.14	-0.15	-0.15	-0.13
	(-9.39)	(-9.45)	(-6.21)	(-6.50)	(-6.66)	(-5.64)
Age	0.13		0.13		0.12	
	(48.92)		(48.99)		(37.97)	
Married	-0.07	-0.07	-0.05	-0.05	-0.02	-0.01
	(-1.47)	(-1.62)	(-1.10)	(-1.26)	(-0.48)	(-0.08)
Lifetime earn.,spouse	0.03	0.03	0.02	0.03	0.02	0.03
	(2.53)	(2.88)	(2.56)	(2.91)	(2.26)	(2.54)
Lifetime earn.,spouse^2	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(-2.62)	(-2.97)	(-2.64)	(-2.99)	(-2.33)	(-2.60)
SSW,spouse/10^6	0.03	0.03	0.03	0.03	0.03	0.03
	(2.23)	(2.30)	(2.18)	(2.26)	(2.09)	(2.13)
Indicators for age	No	Yes	No	Yes	No	Yes
Indicators for counties	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.1574	0.1798	0.1594	0.1815	0.1587	0.1823
Ln L	-23 910	-23 274	-23 852	-23 226	-23 873	-23 204

Table 18: Results from probit regressions on individual retirement decision; men (15 619 individuals and 127 390 observations).

	Accrual		Peak value		Option value	
	$M1$	$M2$	$M1$	$M2$	$M1$	$M2$
ACCR/10^6	-0.72	-0.06	-1.01	-0.80	-27.1	-27.7
	(-4.76)	(-0.40)	(-10.61)	(-8.38)	(-23.47)	(-24.57)
1 million change	-0.06	-0.05	-0.08	-0.07	-1.95	-2.13
SSW/10^6	0.32	0.35	0.11	0.16	-0.72	-0.76
	(7.67)	(8.04)	(2.34)	(3.32)	(-11.38)	(-11.62)
1 million change	0.02	0.03	0.01	0.01	-0.05	-0.06
Lifetime earnings	-5.8	-5.42	-4.59	-4.39	-3.21	-2.90
	(-3.14)	(-2.82)	(-2.37)	(-2.20)	(-1.58)	(-1.37)
Lifetime earnings^2	0.36	0.30	0.39	0.34	0.59	0.57
	(4.57)	(3.69)	(4.89)	(4.10)	(6.40)	(5.88)
Predicted earnings	4.71	4.85	6.55	6.47	8.26	8.74
	(2.84)	(2.80)	(3.80)	(3.61)	(4.73)	(4.69)
Predicted earnings^2	-0.20	-0.23	-0.22	-0.24	-0.12	-0.15
	(-3.15)	(-3.31)	(-3.44)	(-3.53)	(-2.26)	(-2.44)
Lifetime*Predicted	0.07	0.11	-0.19	-0.13	-0.79	-0.81
	(0.41)	(0.61)	(-1.09)	(-0.67)	(-4.34)	(-4.18)
(Lifetime*Predicted)^2	-0.00	-0.00	-0.00	-0.0	0.00	0.00
	(-1.53)	(-1.35)	(-0.20)	(-0.22)	(2.02)	(2.19)
Education2	0.05	0.04	0.05	0.04	0.08	0.07
	(2.21)	(1.72)	(2.22)	(1.75)	(3.02)	(2.57)
Education3	0.07	0.06	0.07	0.06	0.08	0.08
	(4.06)	(3.77)	(4.14)	(3.87)	(4.95)	(4.76)
Education4	0.06	0.05	0.06	0.05	0.09	0.08
	(1.98)	(1.48)	(1.89)	(1.43)	(3.01)	(2.48)
Education5	-0.01	-0.01	-0.01	0.01	0.03	0.03
	(-0.25)	(-0.30)	(-0.24)	(0.20)	(1.17)	(1.28)
Education6	-0.09	-0.11	-0.06	-0.08	-0.04	-0.05
	(-3.25)	(-3.64)	(-2.02)	(-2.51)	(-1.31)	(-1.45)
Occupation2	-0.11	-0.10	-0.13	-0.12	-0.02	-0.01
	(-4.95)	(-4.46)	(-5.73)	(-5.20)	(-0.86)	(-0.62)
Occupation3	-0.04	-0.03	-0.05	-0.04	-0.01	-0.01
	(-1.65)	(-1.21)	(-2.38)	(-1.91)	(-0.58)	(-0.34)
Occupation4	-0.14	-0.14	-0.06	-0.07	-0.13	-0.12
	(-7.50)	(-7.49)	(-2.93)	(-3.39)	(-6.77)	(-6.18)
Age	0.15		0.15		0.09	
	(57.16)		(55.80)		(24.38)	
Married	0.28	0.30	0.28	0.30	0.35	0.38
	(4.52)	(4.64)	(4.45)	(4.67)	(5.46)	(5.72)
Lifetime earn.,spouse	0.00	0.00	0.00	-0.00	0.00	0.00
	(0.21)	(0.03)	(0.05)	(-0.10)	(0.25)	(0.06)
Lifetime earn.,spouse^2	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(-0.62)	(-0.44)	(-0.45)	(-0.30)	(-0.70)	(-0.50)
SSW,spouse/10^6	-0.02	-0.02	-0.02	-0.02	-0.03	-0.03
	(-1.14)	(-1.27)	(-1.25)	(-1.34)	(-1.54)	(-1.67)
Indicators for age	No	Yes	No	Yes	No	Yes
Indicators for counties	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.1739	0.1976	0.1761	0.1993	0.1859	0.2110
Ln L	-23 523	-22 847	-23 460	-22 799	-23 181	-22 467

Table 19: Results from probit regressions on individual retirement decision; women (14 820 individuals and 123 979 observations).

and $k = 1.25$.

The most important result from the estimates is that economic incentives seem to matter for retirement behavior: the coefficients for the social security wealth variable are in general significantly positive and those for the different accrual measures are, as expected, significantly negative. The magnitude of the effect is still an open question, however. According to the results of the implied probability effect of changing the incentive measure by SEK 1 million, the effect appears to be very small. It should be kept in mind, however, that as is evident from Table 17, the average probability of retirement is fairly low in the sample (0.055 for men and 0.060 for women), i.e., an implied probability effect of 0.03 corresponds to about a 50 percent increase in retirement. To gain a better understanding of the implications for the magnitude of the effects of economic incentives from the estimates, we simulated the effects of two hypothetical reforms; cf. Section 7.

It is evident from the results that the forward looking incentive measures, peak value and option value, work better than the benefit accrual measure. The benefit accrual coefficient is only significantly different from zero, on a five percent level, for women with the linear specification in age. However, also for this specification, the log likelihood values are larger for the models with the peak value and option value measures, respectively. Considering the design of many of the pension schemes, e.g. the STP scheme where three years of earnings between ages 55 and 59 are required to be eligible for any pension at all, this outcome was expected.

There is no unambiguous ranking between the peak value and the option value measures: the log likelihood for the option value specification is higher

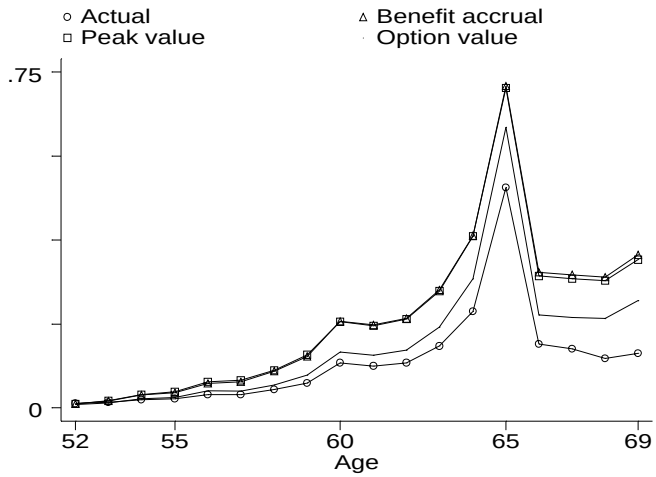

Figure 3: The implied probability effect of the age dummies from the M2 specification with different incentive measures along with the actual hazard rate out of the labor force by age; men.

in the male subsample for the M2 specification, but lower for the M1 specification and in the female subsample. In the female subsample, the measure of social security wealth takes an unexpected, negative sign when the option value incentive measure is used.

Another issue that could not be resolved on the basis of the results reported in Tables 18 and 19 alone is the extent to which the economic incentive measures capture the observed pattern of retirement behavior. Figures 3 and 4 show the implied probability effect of the age indicator variables, along with the actual hazard rate out of the labor force, by age for the male and female subsamples, respectively. Our interpretation of this result is that the economic incentive measures do not fully capture the age pattern of retirement. The spike at age 65 tells us that collective agreements on retirement ages, as described in Section 2.5, probably have considerable influence on retirement behavior.

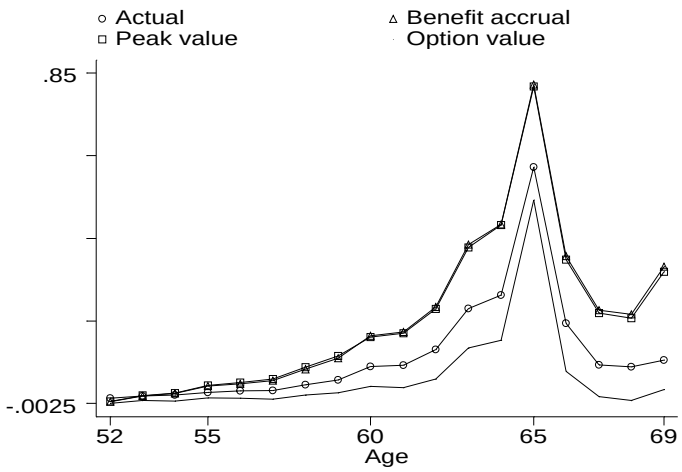

Figure 4: The implied probability effect of the age dummies from the M2 specification with different incentive measures along with the actual hazard rate out of the labor force by age; women.

7 Simulations

To evaluate the implications of the estimates, we simulated the effects of two hypothetical policy reforms on labor force participation. For the male subsample, all three measures of accrual were used in the simulations, whereas we only use one measure for the female subsample. Since we were not able to estimate the parameters in the option value measure for females, we used the peak value measure.

In the first policy reform, the age of eligibility for all programs is delayed by three years. That is, the state old age pension, as well as the occupational pension programs, could be claimed from age 63 rather than age 60. The actuarial adjustments of pension levels, within both the public and occupational pension systems, depart from age 68 rather than 65. Moreover, access to labor market insurance (DI, SI and UI) is delayed by three years. The probit regression model

for probability of insurance eligibility was used to predict eligibility probabilities under this policy reform.

In the second reform, the entire income security program (the state old-age pension, occupational pensions and labor market insurance) is replaced by a hypothetical common pension scheme. This scheme replaces 60 percent of predicted earnings[16] at age 60 if it is claimed at the normal retirement age of 65. The pension could be claimed from age 60 and delayed until age 70. There is a six percent actuarial reduction for each year of retirement before age 65 and a six percent increase for each year retirement is delayed after age 65. Since there is no labor market insurance, a worker who decides to retire before age 60 receives no income until age 60.

Figures 5 and 6 compares the sample median social security wealth by age, under the three policy alternatives: the actual and the two hypothetical policies for males and females respectively. For males, it can be seen that there is a substantial difference between the actual system and the two hypothetical schemes. At age 60, the SSW is about 20 percent lower under policy alternative 1 and about 10 percent lower under policy alternative 2. As regards policy alternative 1, this difference is due to delaying of all benefits and in the case of the second policy alternative due to the abolition of labor market insurance and a reduction in replacement rates.

For females, Figure 6 shows that the median social security wealth is higher under the second policy alternative for all ages. The most likely explanation to this outcome is that, since the pension income is determined by predicted earnings at age 60, there is no reduction for being temporarily out of the labor

[16] We use the strategy for predicting future earnings described in Section 5.

force before age 60, as there is in the actual system. For both males and females, all differences are counteracted by progressive income taxes and housing allowances.

Figures 7 to 10 show the three alternative measures of accrual by age under the different policy alternatives. Figure 7 shows that there are two spikes in the benefit accrual of working: the first one is for working during one's 57th year under the actual system (due to the rules in the occupational pension scheme for blue-collar workers) and the second one is for working during one's 57th year (due to the rule that pension benefits could not be claimed until age 60). Under the first policy alternative, these spikes are delayed by three years under the first policy alternative and are entirely removed under the second policy alternative. It can also be seen that benefit accrual is zero up to age 60 under the second policy alternative, since earnings before age 60 do not affect the benefit after retirement under this policy alternative. The six percent actuarial adjustment under the second policy alternative is not enough to generate positive benefit accrual after age 59.

The peak value measures under the different policy alternatives, shown in Figure 8 for men and Figure 9 for women, also reflect the particulars of each policy: the fall in peak value, due to the rules in the blue-collar worker pension scheme, is delayed by three years under the first policy alternative, while the peak value under the second policy alternative is constant up to age 60.

The median option value measure in Figure 10 shows a marked difference between the first policy alternative on one hand, and the actual system and the second policy alternative on the other. The option value of not retiring is, of course, higher if the benefits are delayed by three years.

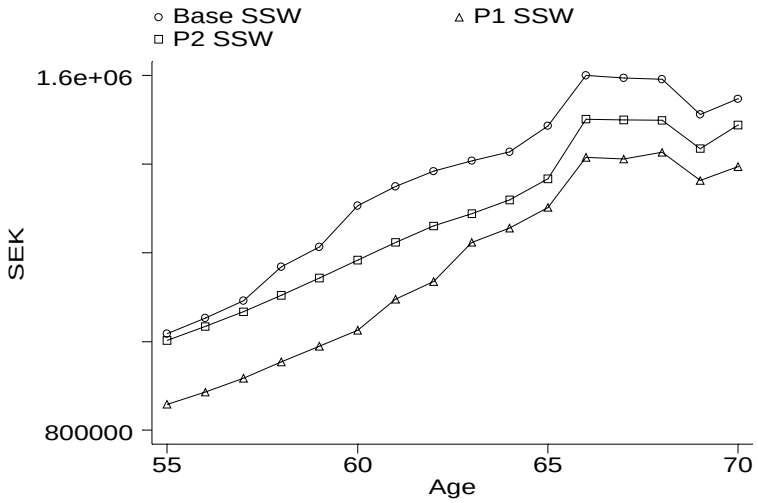

Figure 5: Median social security wealth; actual and simulated under policy alternatives 1 and 2, respectively; men.

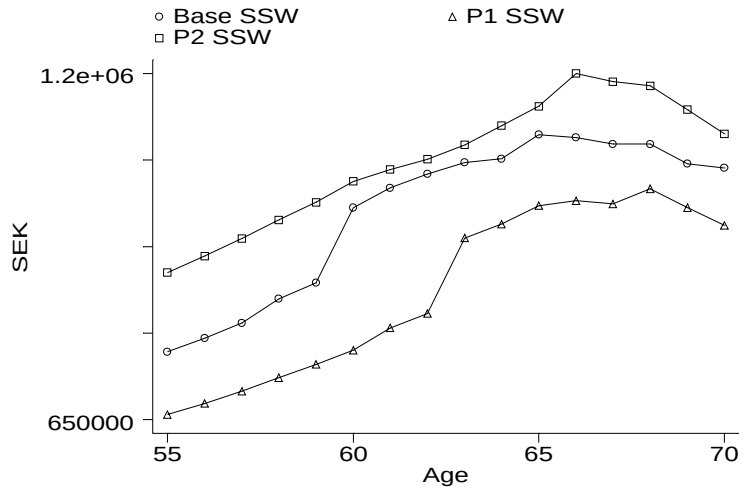

Figure 6: Median social security wealth; actual and simulated under policy alternatives 1 and 2, respectively; women.

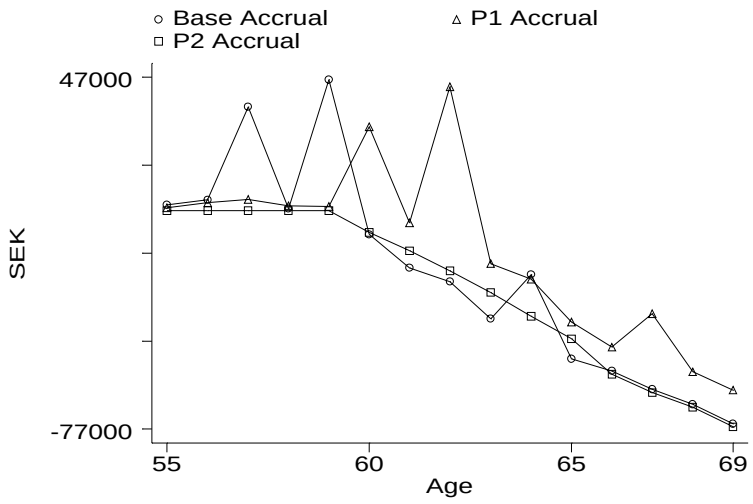

Figure 7: Median benefit accrual; actual and simulated under policy alternatives 1 and 2, respectively; men.

We carried out three different simulations for each policy change. The first simulation, S1, used the model with the linear specification in age (M1). The second, S2, used the model with age dummies (M2) without changing anything except the measures of economic incentives according to the two proposed policy changes. The specification with indicator variables for each age group is likely to be over-parameterized in the sense that the estimated age pattern of retirement reflects some features of the pension system, in addition to variations in preferences for leisure by age and institutions on the labor market. This, in turn, implies that the predicted effect of a change in the social security system is underestimated. We therefore used the outcome from this simulation as a lower bound.

In the third simulation, S3, we again used the M2 model, but here, for the first policy alternative, each dummy variable is incremented by three years in

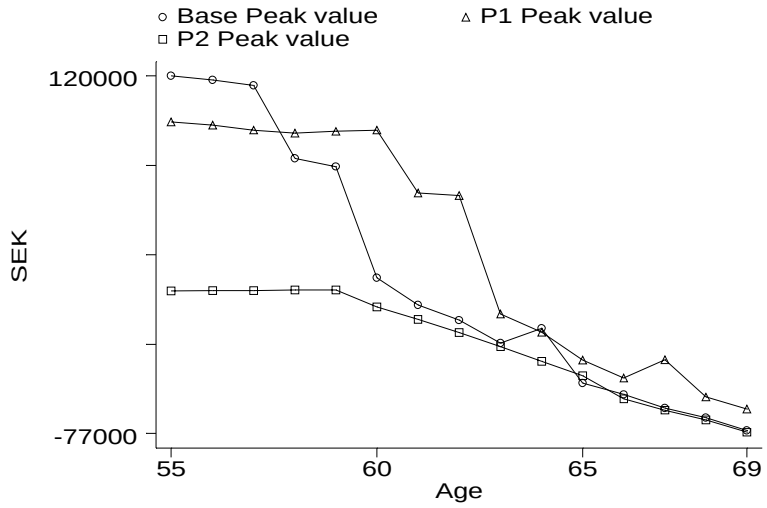

Figure 8: Median peak value; actual and simulated under policy alternatives 1 and 2, respectively; men.

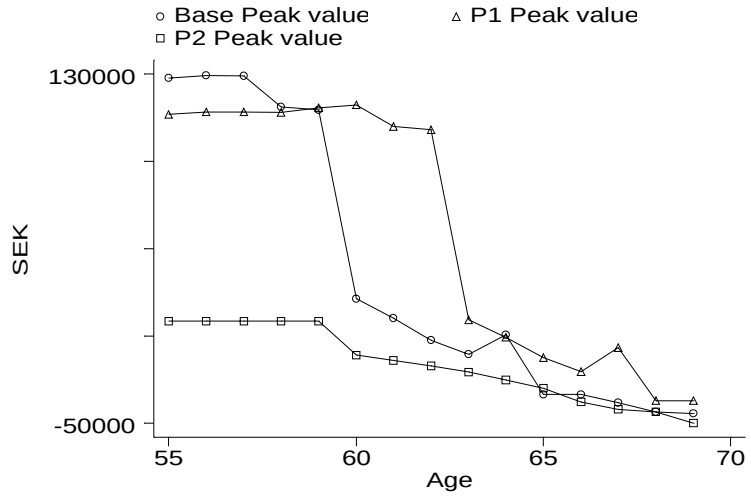

Figure 9: Median peak value. Actual and simulated under policy alternative 1 and 2, respectively; women.

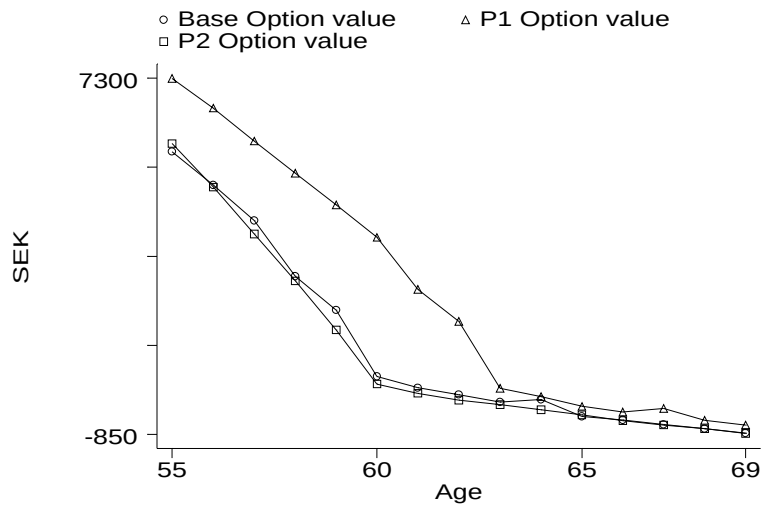

Figure 10: Median option value; actual and simulated under policy alternatives 1 and 2, respectively; men.

addition to the changes done in S2. This procedure corresponds to the (unrealistic) assumption that the entire age pattern of retirement behavior estimated by the age indicator variables is determined by the social security system. We use this simulation as an upper bound on the predicted outcome. For the second policy alternative, the ages for early and normal retirement coincide with those in the actual Swedish system. This means that the S2 and S3 simulations coincide.

Since we used three different measures of accrual for each of the three simulations in the male subsample, and only peak value in the female subsample, there are nine simulations for men and three for women. We present three different outcomes from the simulations. First, Table 20 shows the predicted average retirement rate and age for each policy alternative and each simulation. Figures 11 - 34 show predicted hazard rates out of the labor force and cumulative distri-

Model	Baseline		Policy 1		Policy 2	
	Retirement Rate	Retirement Age	Retirement Rate	Retirement Age	Retirement Rate	Retirement Age
Men						
S1 and benefit accrual	0.0586	62.60	0.0526	62.99	0.0561	62.75
S2 and benefit accrual	0.0587	62.59	0.0532	62.94	0.0563	62.73
S3 and benefit accrual	0.0587	62.59	0.0263	65.18	0.0563	62.73
S1 and peak value	0.0586	62.60	0.0542	62.86	0.0598	62.50
S2 and peak value	0.0587	62.59	0.0547	62.83	0.0597	62.50
S3 and peak value	0.0587	62.59	0.0276	65.03	0.0597	62.50
S1 and option value	0.0586	62.59	0.0510	63.12	0.0572	62.72
S2 and option value	0.0587	62.59	0.0511	63.08	0.0578	62.67
S3 and option value	0.0587	62.59	0.0280	64.99	0.0578	62.67
Women						
S1 and peak value	0.0628	61.98	0.0583	62.20	0.0698	61.56
S2 and peak value	0.0627	61.95	0.0586	62.16	0.0689	61.57
S3 and peak value	0.0627	61.95	0.0274	64.49	0.0689	61.57

Note: Sine workers older than age 70 are not included in the data, we set the hazard rate at age 70 to one (100 percent).

Table 20: Average retirement rates and retirement ages in simulations.

bution functions of retirement by age. Each figure shows three graphs: one for the model prediction of actual policy and one for each of the policy alternatives, respectively.

It is evident from Table 20 and the figures that all models predict the largest effect on retirement behavior from the first policy alternative. This result also applies to the female subsample, although the effect is smaller: Table 20 shows that in predictions where the peak value accrual measure is used, retirement is delayed by on average around 0.25 years in the male subsample compared to around 0.21 years in the female subsample in the S1 and S2 simulations.

The difference between S2 and S3, a measure of the uncertainty in the predictions, is marginally larger for women, 2.33 years compared to 2.20 for men, using the peak value accrual measure. This difference differs between different accrual measures: 1.91 for the option value measure compared to 2.24 for the

simple one-year accrual in SSW. Since the one-year age group dummy variables reflect unmeasured features of the income security system, in addition to changes in preferences for leisure by age and effects of institutions on the labor market, an interpretation of this result could be that the option value measure does a better job of measuring economic incentives of the income security system as compared to the other two measures of accrual.

Although the uncertainty in the predictions using the option value is smaller as compared to the other two measures of accrual, the difference between S2 and S3 is still larger than the - on average - about one half year delayed retirement, which is predicted as a lower bound on the outcome regarding retirement behavior from this policy reform. This means that there is still a large element of uncertainty in the predictions from all our models. Given the strict regulations on normal retirement age in large areas of the Swedish labor market, and the impact of social norms, it is unrealistic to attribute *all* the effect of shifting the one-year age group dummies to unmeasured features of the income security programs. It would, however, require a somewhat different research strategy to obtain a more precise estimate of the impact of these factors.

For the second policy alternative, the effects on retirement are small, and ambiguous with respect to accrual measure in the male sub sample. Figures 5 - 10 showed that we may suspect that there are counteracting effects: at least two of the accrual measures (benefit accrual and peak value) are larger before age 60 under the actual system, which will work towards earlier retirement under this policy alternative, while Figure 5 shows that the social security wealth is lower under the second policy alternative, which will on average delay retirement.

In the female sub sample there is an effect towards earlier retirement under

the second policy alternative. Figure 6 shows that this effects is likely to be due to the increase in social security wealth for women under the second policy alternative.

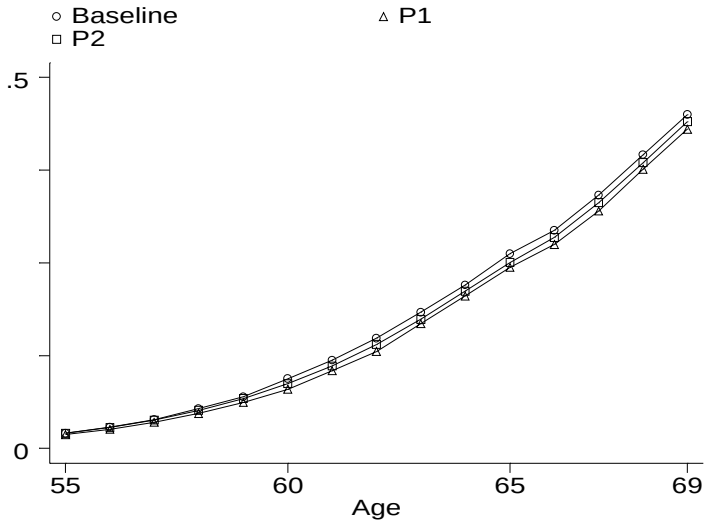

Figure 11: Predicted hazard rates; S1 using benefit accrual estimates; men.

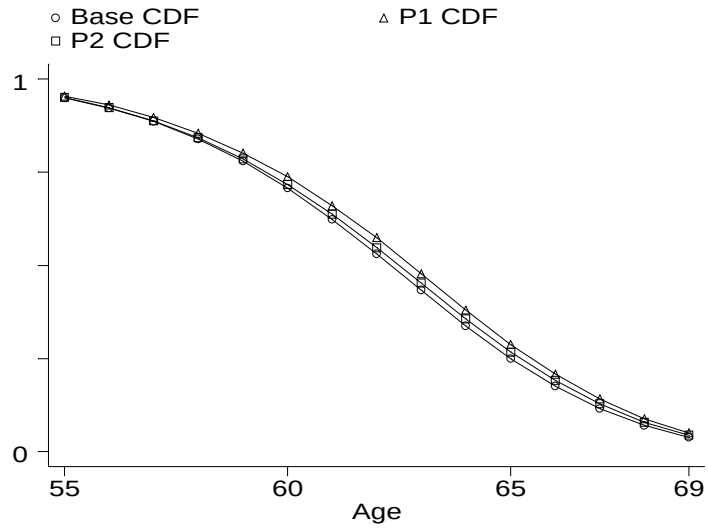

Figure 12: Predicted CDF; S1 using benefit accrual estimates; men.

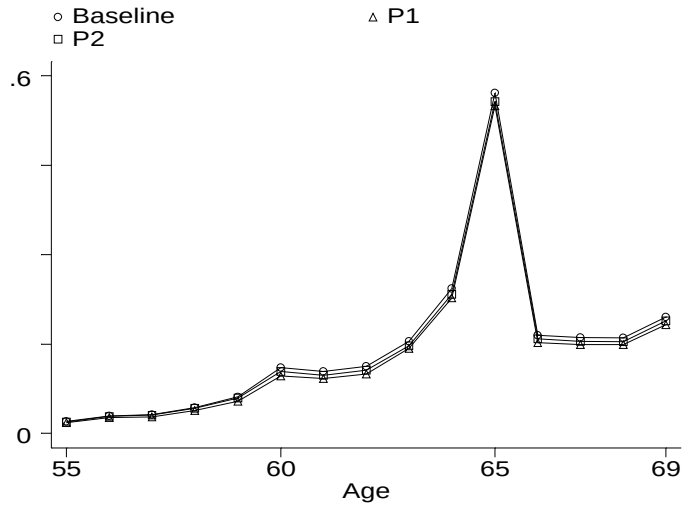

Figure 13: Predicted hazard rates; S2 using benefit accrual estimates; men.

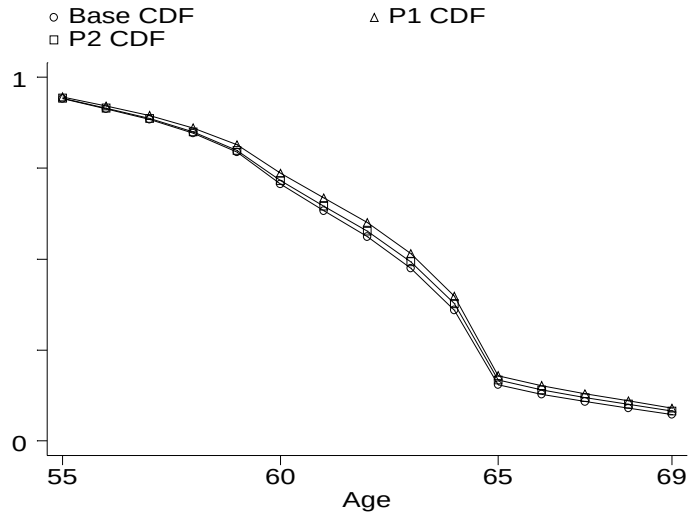

Figure 14: Predicted CDF; S2 using benefit accrual estimates; men.

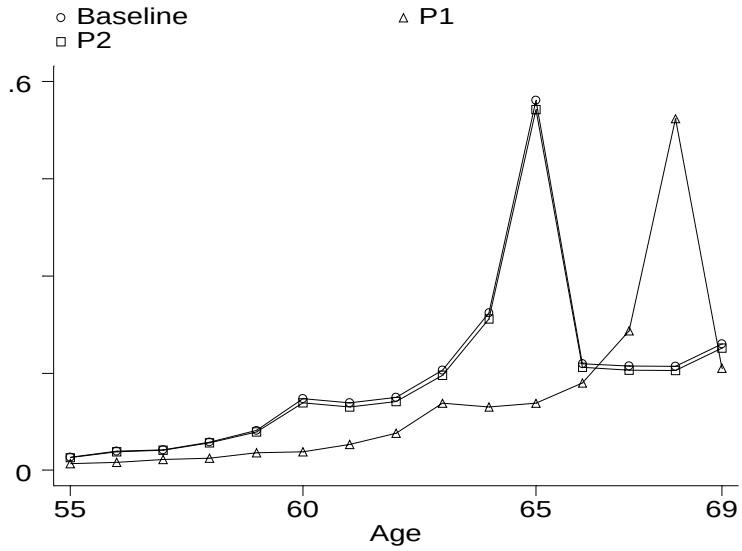

Figure 15: Predicted hazard rates; S3 using benefit accrual estimates; men.

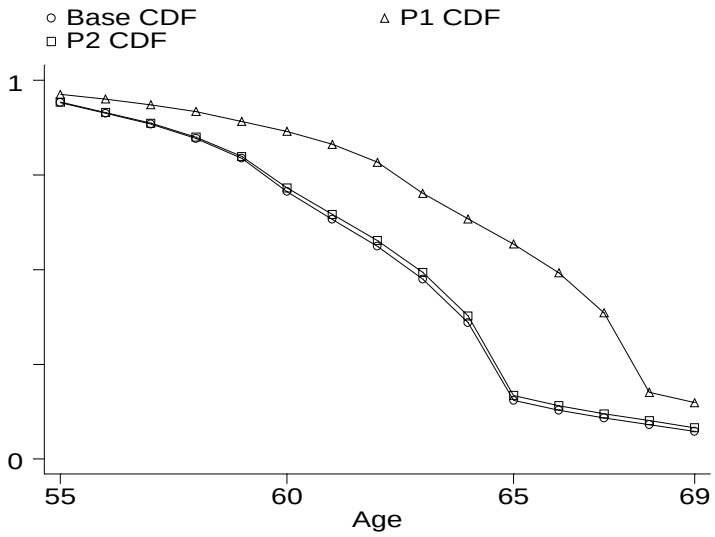

Figure 16: Predicted CDF; S3 using benefit accrual estimates; men.

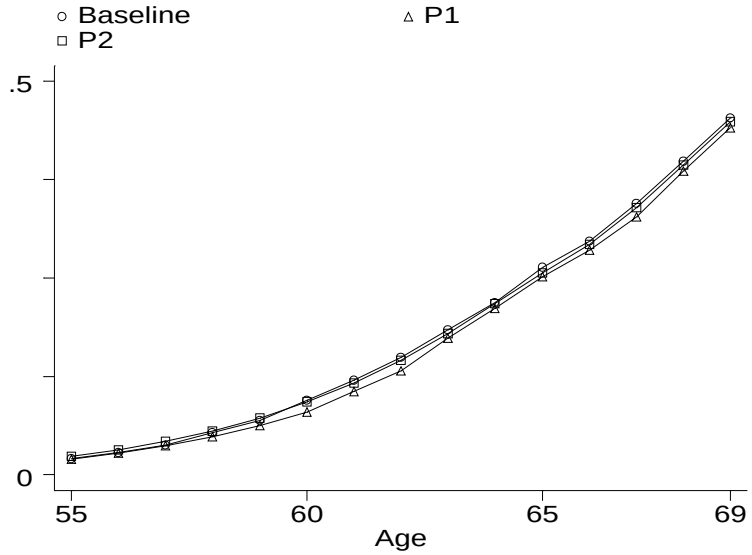

Figure 17: Predicted hazard rate; S1 using peak value estimates; men.

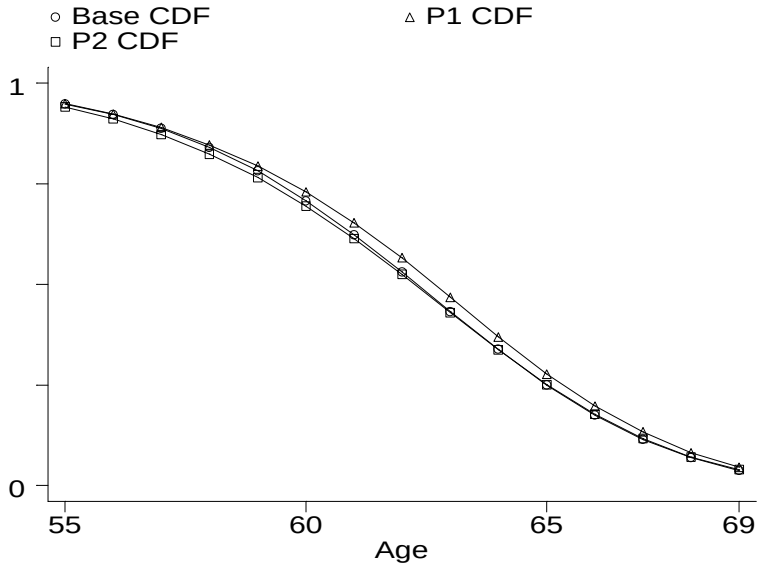

Figure 18: Predicted CDF; S1 using peak value estimates; men.

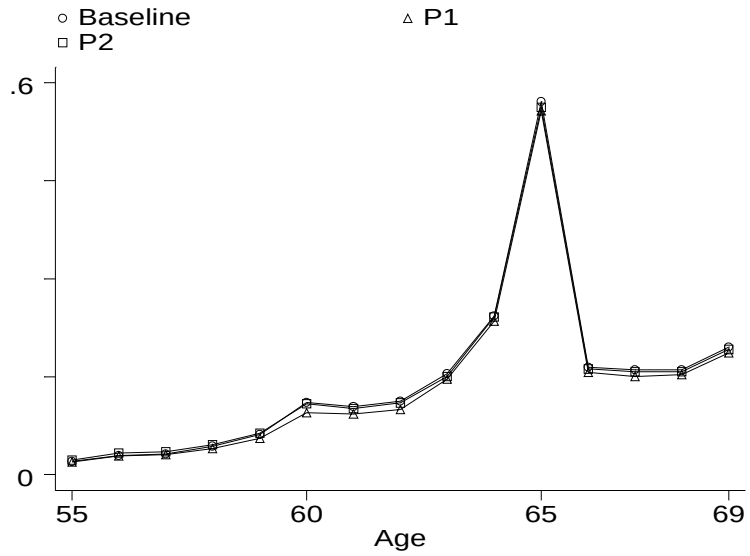

Figure 19: Predicted hazard rates; S2 using peak value estimates; men.

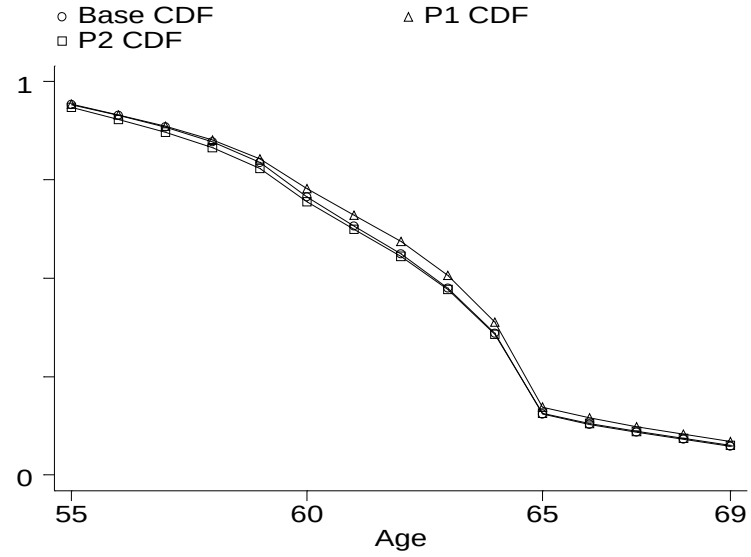

Figure 20: Predicted CDF; S2 using peak value estimates; men.

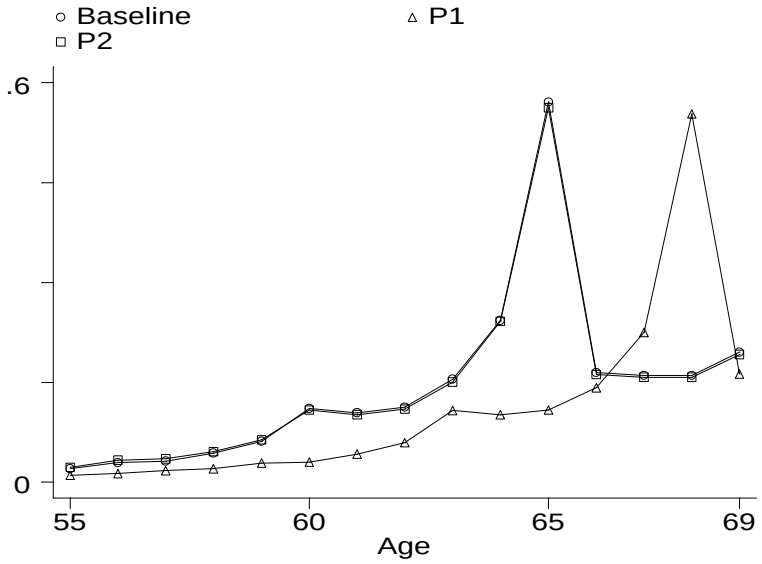

Figure 21: Predicted hazard rates; S3 using peak value estimates; men.

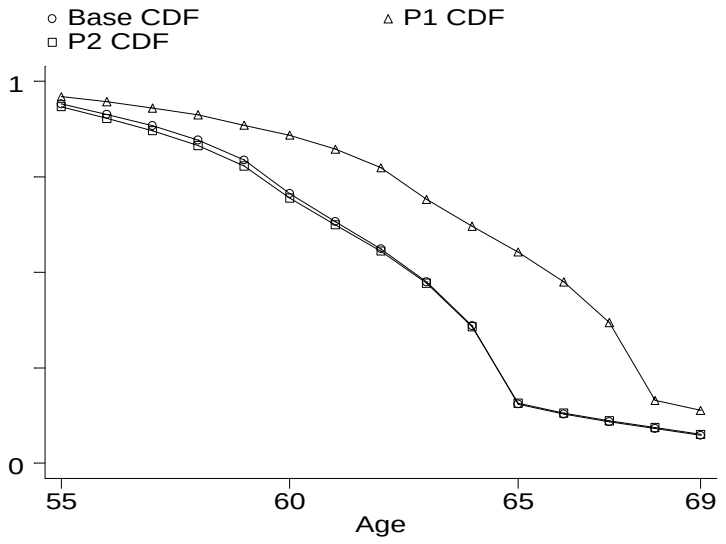

Figure 22: Predicted CDF; S3 using peak value estimates; men.

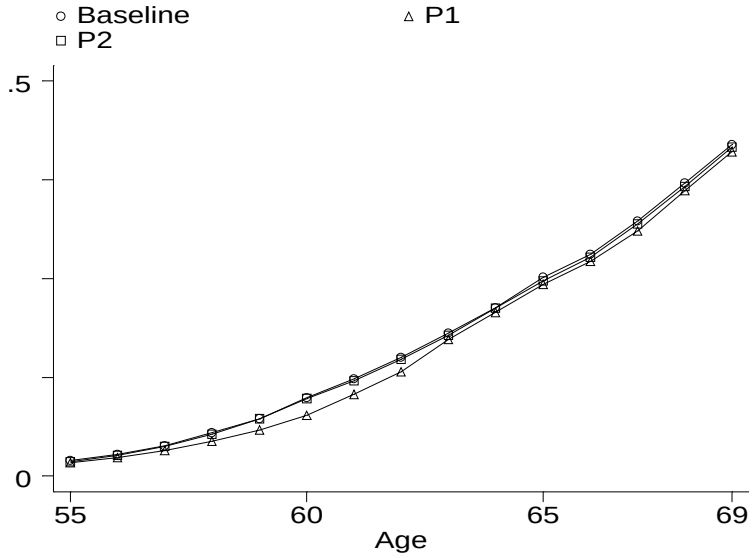

Figure 23: Predicted hazard rates; S1 using option value estimates; men.

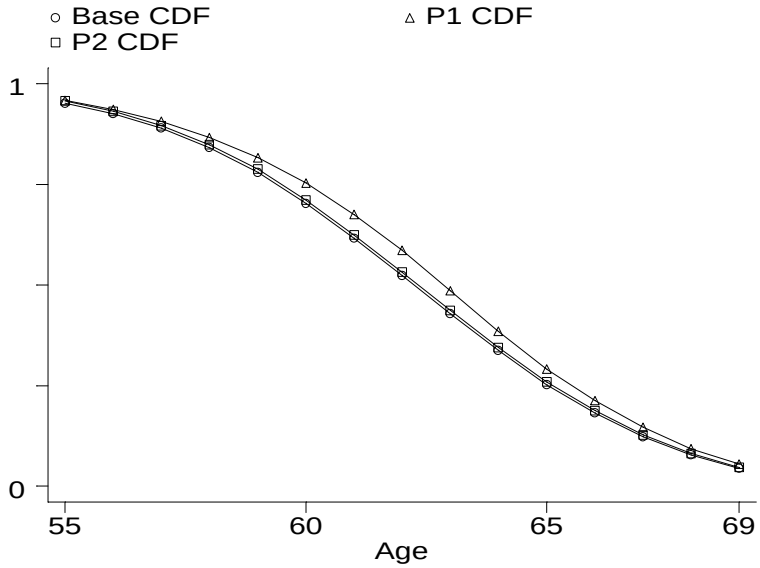

Figure 24: Predicted CDF; S1 using option value estimates; men.

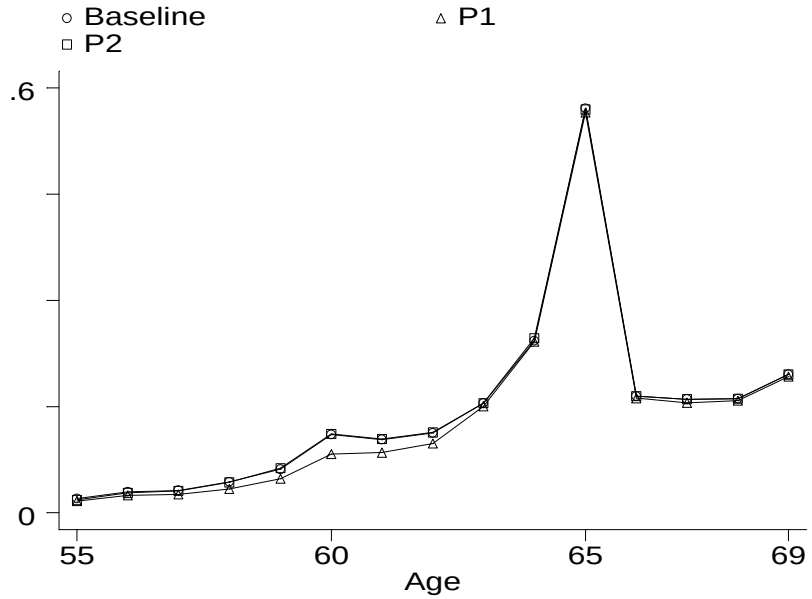

Figure 25: Predicted hazard rates; S2 using option value estimates; men.

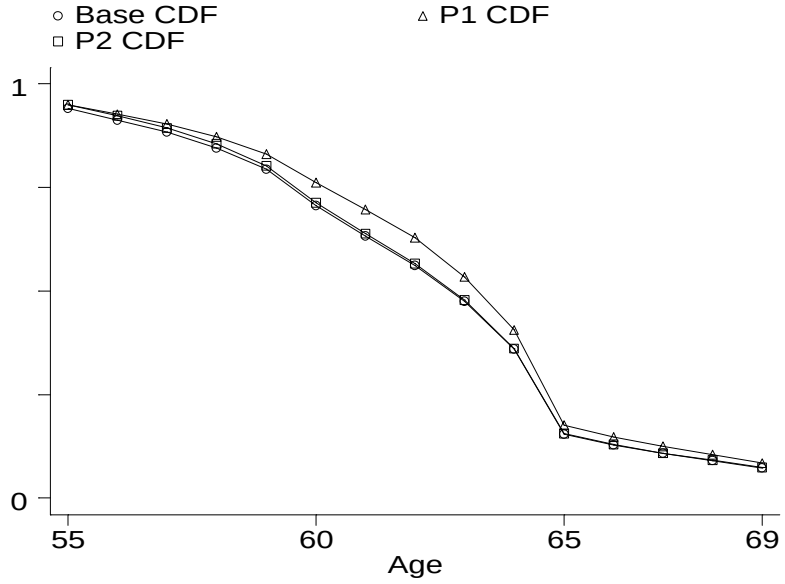

Figure 26: Predicted CDF; S2 using option value estimates; men.

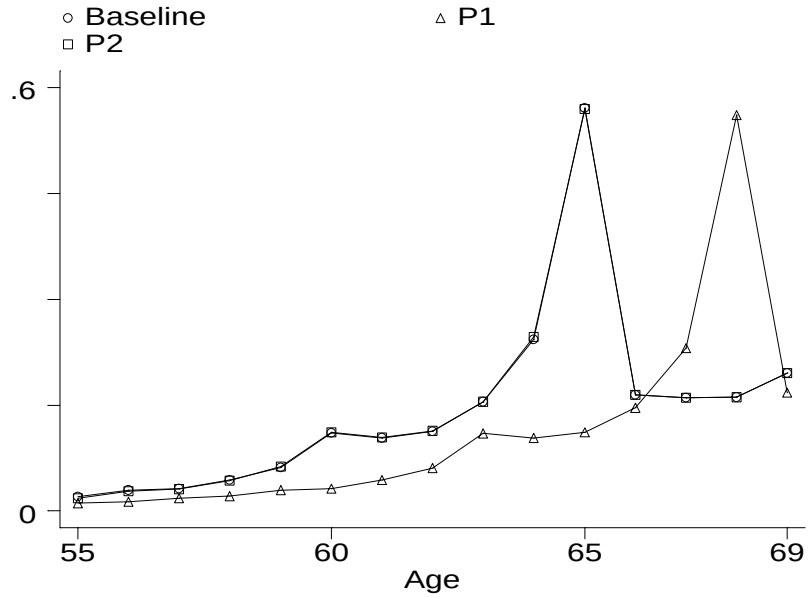

Figure 27: Predicted hazard rates; S3 using option value estimates; men.

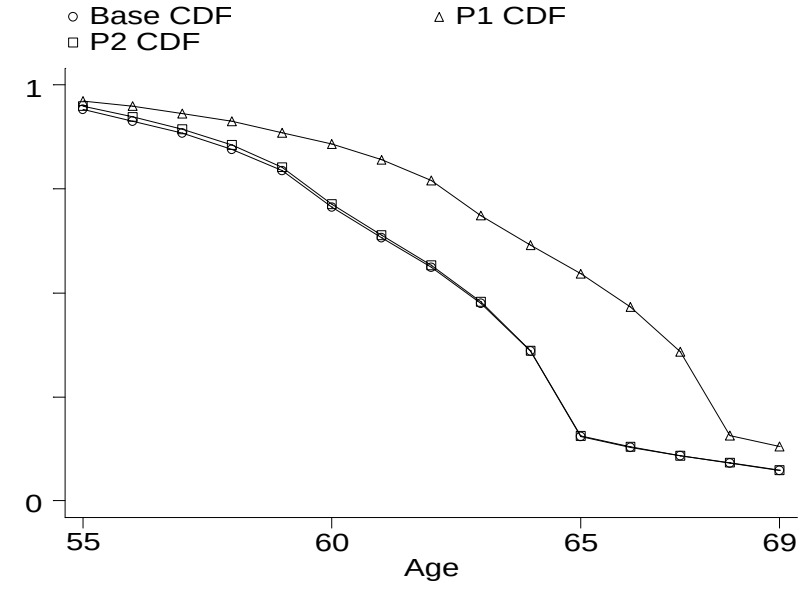

Figure 28: Predicted CDF; S3 using option value estimates; men.

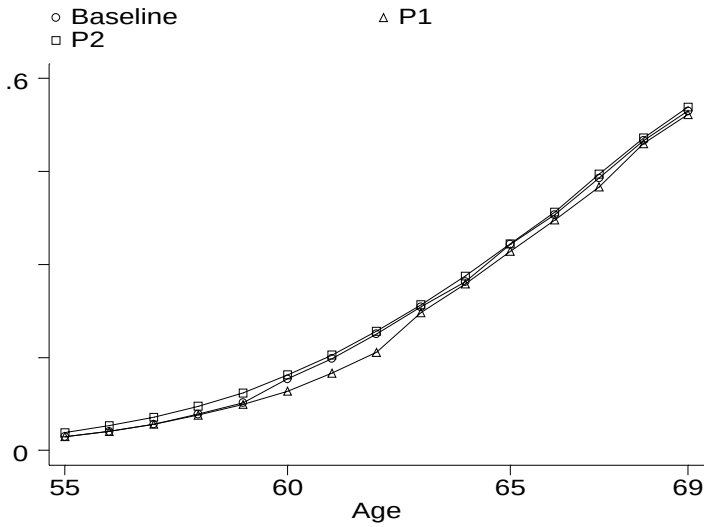

Figure 29: Predicted hazard rates; S1 using peak value estimates; women.

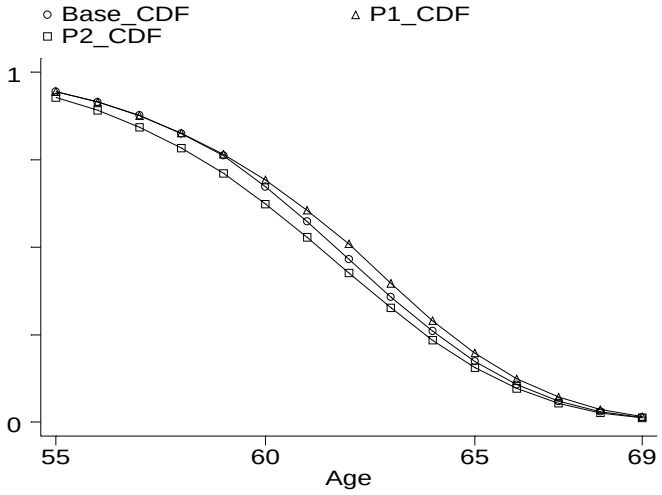

Figure 30: Predicted CDF; S1 using peak value estimates; women.

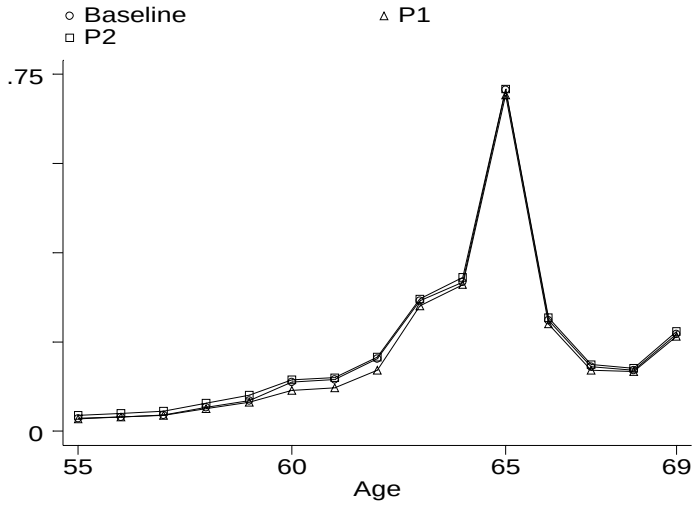

Figure 31: Predicted hazard rates; S2 using peak value estimates; women.

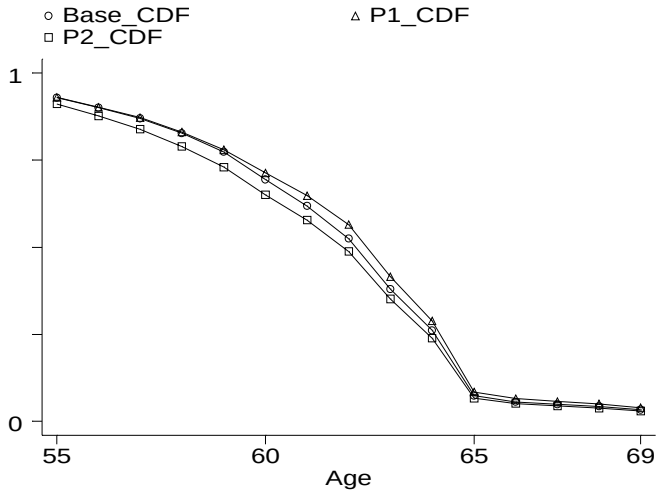

Figure 32: Predicted CDF; S2 using peak value estimates; women.

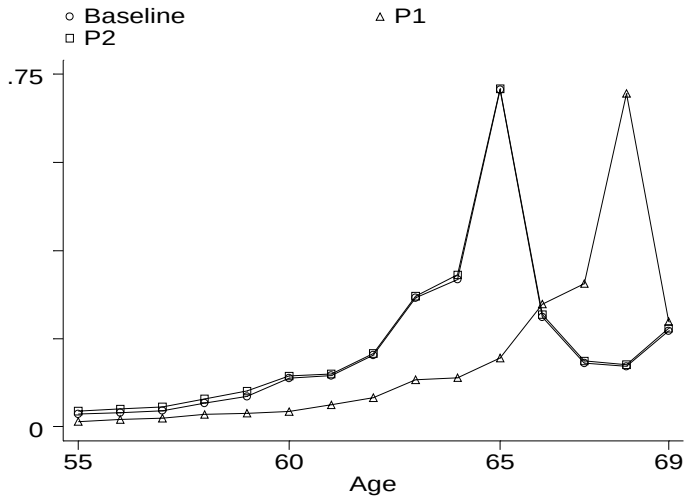

Figure 33: Predicted hazard rates; S3 using peak value estimates; women.

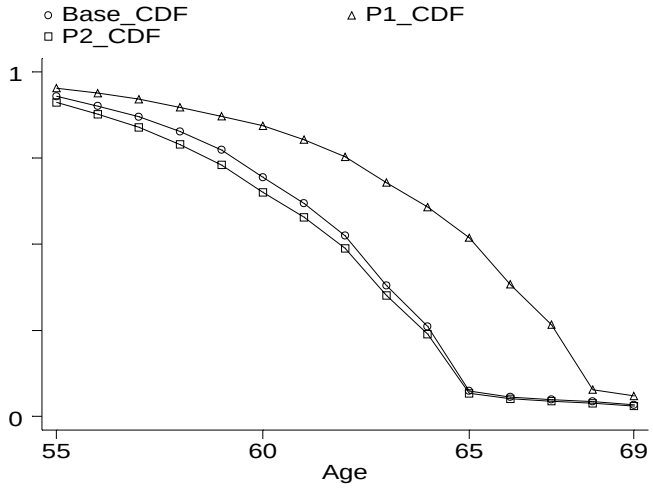

Figure 34: Predicted CDF; S3 using peak value estimates; women.

8 Conclusions

The results of the econometric analysis in our study support the notion that economic incentives matter for the retirement decision. The parameter estimates for the economic incentive variables were in general significantly different from zero with the expected signs. This analysis has also shown that forward looking accrual measures, the peak and option value measures, work better than the one-year benefit accrual measure, since they give a better fit to the data.

Our simulations of two hypothetical policy reforms showed that there might be a substantial effect on labor force participation from changing the economic incentives of retirement. However, there is a large element of uncertainty in such predictions in the sense that the lower bound on the predictions, where the one-year age group dummies were maintained, predicted much lower labor force participation rates compared to the upper bound on the predictions, where the age dummies were shifted by three years. The extent to which the age indicator variables capture features of income security programs which are unmeasured by the economic incentive variables, and/or non-linearities in preferences for leisure by age, collective agreements on normal retirement ages on the labor market or social norms regarding retirement, is an open question - to be explored in further research.

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