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Author: Mårten Palme, Ingemar Svensson

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Income Security Programs and Retirement in Sweden

Mårten Palme and Ingemar Svensson

10.1 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 fifty-five year olds, while only Japan has higher participation rates among sixty year olds. By age sixty-five, labor force participation is higher in the United States, 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 sixty and sixty-four 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

Mårten Palme is associate professor of economics at Stockholm University. Ingemar Svensson is senior researcher at the Swedish National Social Insurance Board.

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1. These countries are Belgium, Canada, France, Italy, Germany, Japan, the Netherlands, Spain, the United Kingdom, and the United States.

programs for financing early exit from the labor market, improved economic conditions in the population, changes in economic incentives in general, and changes 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 demand for all goods, including leisure, and will, therefore, increase their 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 higher in general 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 probabilities 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 superseded by a program that replaces 60 percent of predicted earnings at age sixty. The normal retirement age is sixty-five, but the pension can be claimed from age sixty to age seventy with an actuarial reduction or increase of 6 percent for every year in advance or delay from age sixty-five.

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 in-

formation 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, date of retirement, in particular 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 and 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 10.2 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, that is, 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 10.2 also provides a descriptive analysis of the frequency of different pathways to permanent exit from the labor market. Section 10.3 reviews previous research on retirement behavior in Sweden. We present the data set in section 10.4 and show how the different measures of economic incentives are obtained in section 10.5. The empirical models and estimation results are outlined in section 10.6. Section 10.7 reports results from simulations of the estimated models. Section 10.8 concludes.

10.2 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.

10.2.1 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;* 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 forty years and the number of years with labor income in Sweden is less than thirty 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 that 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 SKr34,986, and the annual wage of an average production worker was SKr189,488.

The basic pension for a single old age pensioner is 96 percent of the BA; it is reduced to 78.5 percent 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 percent of the BA in 1983 to 55.5 percent 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 percent of the BA. In 1995, this amounted to SKr53,004 in annual pension or 28.0 percent of the annual earnings of an average production worker.

The basic pension also contains a survivor's pension. Widows receive 90 percent of a BA until they reach the age of sixty-five. If a woman is younger than fifty when her husband dies, the amount is reduced. The basic pension for widows has been income tested since 1997. Children normally receive 25 percent 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 in 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 percent of a BA. The transitional pension can be prolonged for a survivor who has the custody of children.

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 sixteen. 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. In addition to earnings and income from self-employment, the pension-rights income includes transfer payments from social insurance (such as income from sickness and unemployment insurance), the parental cash benefit, and the partial retirement pension. Three years of

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

pension-rights income greater than zero between the ages of sixteen and sixty-four 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 fifteen best years of earnings.

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

$$Y_i = 0.6 \cdot \mathrm{AP}_i \cdot \min\left(\frac{N_i}{30}, 1\right) \cdot \mathrm{BA}, \tag{1}$$

where AP_i denotes individual average pension points, BA is the basic amount, 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 SKr170,032.

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 percent of the deceased husband's ATP pension for a surviving wife and 10–15 percent (20–30 percent after the 1990 reform) for a surviving child, depending on the number of children. The widow's pension is 35 percent if there are children in the household who are eligible for a children's pension and 40 percent 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 lifelong widow's pension. For a widow born between 1930 and 1944, her survivor's ATP is reduced after age sixty-five, taking into account her own ATP. The rules vary somewhat for different birth cohorts. As for the basic pension, for women born after 1 January 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 at age sixty[3] or postponed until age seventy. If an individual chooses to withdraw from the

3. In 1998, the early retirement age was raised to sixty-one.

labor market in advance of reaching sixty-five, the amount of the monthly benefit is permanently reduced by 0.5 percent for each month of early withdrawal: For example, if an individual retires at sixty, the permanent reduction is 30 percent. If an individual decides to claim a pension later than at age sixty-five, the pension income is permanently increased by 0.7 percent for each month of postponement.

A partial retirement pension allows workers aged sixty-one 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 ten years of pension-rights earnings after age forty-five and must work at least seventeen hours per week after the reduction. As of 1 July 1994, the benefit is 55 percent 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 that earnings from an individual's entire life cycle are counted when pension income is determined, rather than only the fifteen best years; pensions are related to the real growth rate in the entire economy rather than price indexes; and changes in life expectancy also affect annual pension income (that is, 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 four-twentieths 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 one-twentieth for each successive birth cohort.

10.2.2 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: (a) blue-collar workers in the private sector; (b) white-collar workers in the private sector; (c) central government employees; and (d) 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).

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

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

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 sixty-fifth 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 fifty-five and fifty-nine. If the worker contributed to the scheme for less than thirty years after age twenty-eight, the pension was reduced proportionally. To receive any pension at all, a worker was required to contribute at least three years between ages fifty-five and fifty-nine. The 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 their 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, that are below the social security ceiling from age thirty. 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 their best three years between ages fifty-five and fifty-nine, 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.

Occupational Pensions for Private-Sector White-Collar Workers

White-collar workers in the private sector are covered by ITP, ITPK, and ITPG. The ITP is a defined-benefit 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.

The ITP is determined by a worker's earnings the year before they retire: I is 10 percent of that year's salary up to 7.5 BAs, 65 percent of the salary between 7.5 and 20 BAs, and 32.5 percent between 20 and 30 BAs. As in the STP scheme, the pension is reduced proportionally if a worker has contributed for less than thirty years since age twenty-eight. Contributions to ITP have been around 4.5 percent of gross earnings in the 1980s and 1990s.

Table 10.1 Reduction/Enhancement if ITP is Claimed in Advance/Postponed

Retirement Age	Reduction/Enhancement
60	0.739
61	0.783
62	0.831
63	0.884
64	0.942
65	1.000
66	1.076
67	1.154
68	1.241
69	1.338
70	1.448

The normal retirement age for ITP is sixty-five. Table 10.1 shows the reduction (or enhancement) if a worker starts to claim (or postpone) retirement benefits between ages sixty and seventy. Also, ITP can also be claimed before age sixty, in which case the amount of the pension is determined by an individual actuarial adjustment.

The 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 thirty. They are free to choose a company to manage their 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 fifty in 1977 and the 1940 cohort was aged thirty-seven). This implies that the ITPK pensions are, on average, larger for the younger cohorts.

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 earnings for the year before retirement. A full pension required thirty 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 sixty-five. There are several exceptions, such as military personnel, whose mandatory retirement age is fifty-five. 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 lifelong annuity. This annuity was calculated as 65 percent of 95 percent of an individual's earnings the year before they retired. This amount was not indexed and not paid out until they 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 percent of a worker's annual salary, starting from 1991, is paid to a pension fund. The pay-as-you-go is very similar to the ITP, but it is determined by average earnings during the five years preceding retirement rather than by an individual's earnings the year before retirement. It is 10 percent of this five-year average up to 7.5 BAs, 65 percent between 7.5 and 20 BAs, and 32.5 percent between 20 and 30 BAs. The pension is reduced proportionally if the requirement of thirty years of contributions to the scheme since age twenty-eight 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 sixty-fifth birthday. However, if someone retires before age sixty, the pre-1992 rules apply (i.e., no benefit 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.

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 percent of this amount below 1 BAs, 78.5 percent between 1 and 2.5 BAs, 60 percent between 2.5 and 3.5 BAs, 65 percent between 7.5 and 20 BAs, and 32.5 percent between 20 and 30 BAs. A full pension requires thirty years of employment in the local government sector between ages eighteen and sixty-five; 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 sixty-five for most local government employees, but an individual can enter retirement at age sixty or postpone it

until sixty-seven. If they retire before age sixty-five, their pension is reduced for the rest of their life by 0.3 percent per month between ages sixty-three and sixty-five, by 0.4 percent between ages sixty-two and sixty-three, and by 0.5 percent per month between ages sixty and sixty-two. The pension is increased by 0.1 percent for each month the individual decides to continue to work after age sixty-five. The rules for claiming before age sixty are very similar to those in the pension scheme for central government employees: The pension is transformed into a lifelong annuity that is paid out starting at age sixty-five.

10.2.3 Disability, Sickness, and Unemployment Insurance

Disability Insurance

The disability insurance (DI) scheme is very similar to the state old age pension during the period covered by the study.[5] 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 sixty-four. The formula for old age ATP is then applied to actual as well as assumed points between ages sixteen and sixty-four. A disability pension can be received from age sixteen. Eligibility requires certification from a physician that an individual's capacity to work is permanently reduced by at least 25 percent due to illness, physical or mental incapacity, or so forth. 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 1972 and 1991, disability pensions were also granted for labor market reasons. The requirements then were that the individual was sixty 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 considerably through successive changes in legislation in July 1993, October 1995, and January 1997.

Sickness Insurance

Sweden has universal sickness insurance covering all employees and self-employed that is financed through payroll taxes. This insurance pro-

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.

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

vides 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 spell. After the reform, 90 percent of foregone 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 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 reduced 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.

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 belongs to an unemployment benefit fund. All members of labor unions automatically belong 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 is entitled to UI compensation for 300 days up to age fifty-five 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 SKr199,650 compared to SKr272,250 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.

10.2.4 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 percent on taxable income from capital. Earned income is taxed nationally and locally. The local tax rate is determined independently by each of Sweden's 283 municipalities. Local tax rates are clustered around 31 percent. 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 point of earnings, and at 20 percent on all income above that level. In 1995, the latter tax was temporarily increased to 25 percent. 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 percent of the housing cost up to a certain ceiling and above a certain floor. It is reduced by 40 percent (45 percent at high-income levels) of income in excess of a basic pension and special supplement and by 2 percent of wealth. In 1994, about 30 percent of all old age pensioners received housing allowances, and the average amount was about SKr17,673—that is, 33

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

percent of the amount of the lowest pension from the national pension system.

10.2.5 Mandatory Retirement Rules on the Swedish Labor Market

Sweden has a normal retirement age of sixty-five.[9] Older workers are not covered by employment security legislation,[10] that is, workers older than sixty-five are not covered by seniority rules and therefore are protected the least if a firm wants to scale down. Furthermore, workers over sixty-five 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 sixty-five.

Central and local government employees automatically lose their jobs at age sixty-five. 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 sixty-five. 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.

10.2.6 Sources of Income after Retirement

As 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 had reached the normal retirement age of sixty-five in 1997 (the end of the period under study).

Table 10.2 shows the percentage share of workers in this subsample who receive their main income (more than 50 percent of their total nonlabor 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 nonlabor income.

The sources of income listed in table 10.2 can be divided into three groups. The first group consists of schemes designed to serve as old age pension programs: the state old-age pension (pathway 1), occupational pensions (pathway 2), pensions provided by the employer or severance payments (pathway 6), private pensions (pathway 7), and partial retirement benefits provided by social security (pathway 10). The second group comprises insurance programs against income loss from poor health or unemployment: DI (pathway 3), wife's supplement (pathway 5), sickness insurance (pathway 8) and UI (pathway 9). In contrast to the first group,

9. Wadensjö (1989) discusses the implications of sixty-five as a normal retirement age.

10. Less than 5 percent of employees in the Swedish labor market are not covered by a central agreement, and in which case, they are protected by employment security legislation until age sixty-seven.

Table 10.2 **Percentage Share of the Pathways to Permanent Exit From the Labor Market Showing Main Source of Income (more than 50% from the indicated source) for Cohorts Born 1927–1932, by Gender**

Pathway	Men	Women
1. State old age pension	33.70	26.99
2. Occupational pension	13.68	14.21
3. Disability pension	6.55	6.59
4. Survivor's pension	0.00	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 >50%	5.67	4.64

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

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 (pathway 4).

According to table 10.2, the second insurance group accounts 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 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 socioeconomic 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 10.3.

It is evident from table 10.3 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 than all other groups to receive their main initial income from sickness insurance or UI. A further distinct result is that employees in the public sector, both 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

Table 10.3 **Percentage Share of the Pathways to Permanent Exit from the Labor Market Showing Main Source of Income (more than 50% from the indicated source) for Cohorts Born 1927–1932, by Gender and Socioeconomic Group**

	Men					Women				
Pathway	(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	7.06	4.36	8.87	5.71	8.96	5.96	5.32	10.76	6.37	5.15
4. Survivor's pension	0.00	0.00	0.29	0.00	0.00	2.70	3.28	3.74	4.82	5.50
5. Wife's supplement	0.05	0.00	0.00	0.00	0.00	2.78	0.23	1.94	1.94	4.81
6. Severance payments from employer	0.05	1.65	0.00	0.75	0.14	0.25	3.05	0.30	0.17	1.03
7. Private pension	0.37	1.00	0.00	0.37	3.13	0.33	0.79	0.00	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

Notes: The 10.02% of the male and the 6.11% of the female subsample who are not yet retired by the end of the panel are included in pathway 1. Column (1) shows blue-collar workers in the private sector; column (2) shows white-collar workers in the private sector; column (3) shows central government employees; column (4) shows local government employees; and column (5) shows self-employed.

Table 10.4 **Percentage Shares of Main Source of Income After a Spell with Sickness or Unemployment Insurance After Permanent Exit From the Labor Market, with Sickness and Unemployment Insurance, Respectively, as Main Source of Income Before Transition (cohorts born 1927–1932)**

		Number of Years Living on First Main Income Source					
Pathway		1	2	3	4	5+	Average
		Sickness Insurance to:					
State old age pension	12.00	62.18	22.44	10.90	3.85	0.64	1.59
Occupational pension	7.07	97.28	2.72	0	0	0	1.02
Disability insurance	61.03	30.50	44.72	18.87	4.09	1.83	2.03
Survivor's pension	0.62						
Wife's supplement	0.50						
Severance payments	0.54						
Private pension	0.23						
Unemployment insurance	5.11	93.98	3.01	2.26	0	0.75	1.50
Partial retirement benefit	0.04						
Mixed sources	12.76	42.17	39.76	11.45	5.12	1.50	1.84
No. of observations	2,601						
		Unemployment Insurance to:					
State old age pension	47.64	27.94	39.69	18.54	7.05	6.79	2.26
Occupational pension	3.48	10.71	85.71	3.57	0	0	1.93
Disability insurance	20.27	7.98	57.06	31.29	3.07	0.61	2.31
Survivor's pension	0.12						
Wife's supplement	1.12						
Severance payments	0.37						
Private pension	14.18	45.61	44.74	7.89	1.75	0	1.66
Partial retirement benefit	0.25						
Mixed sources	12.56	30.69	54.46	8.91	3.96	1.98	1.92
No. of observations	804						

Note: Blank cells indicate that data is not available.

only the first main source.[11] Table 10.4 shows the percentage distributions of the second main source of income for those who initially left the labor market with sickness insurance or UI, the number of years they retain their first source, as well as the average number of years on their first main source of nonwork 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 DI as their main source of income will automatically begin receiving old age pensions at age sixty-five; these groups are excluded from the transitions listed in table 10.4.

According to table 10.4, most of those who initially had sickness-insurance benefits as their main income source receive a disability pension

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

Table 10.5 **Percentage Share of Main Source of Income after Sickness or Unemployment Insurance, and Mixed Sources of Income as Second Main Source after Permanent Exit from the Labor Market (cohorts born 1927–1932)**

		Number of Years on Second Main Income Source					
		1	2	3	4	5+	Average
Sickness Insurance to Unemployment Insurance to:							
State old age pension	29.96	89.47	2.63	7.89	0	0	1.18
Occupational pension	1.56						
Disability insurance	55.47	94.37	4.23	0	0	1.41	1.10
Wife's supplement	2.34						
Mixed sources	10.94	100	0	0	0	0	1.00
No. of observations	128						
Sickness Insurance to Mixed Sources to:							
State old age pension	28.57	45.74	35.11	12.77	6.38	0	1.80
Occupational pension	1.82						
Disability insurance	65.05	38.79	43.46	10.28	5.14	2.34	1.89
Survivor's pension	3.04						
Wife's supplement	0.30						
Unemployment insurance	1.22						
No. of observations	328						
Unemployment Insurance to Sickness Insurance to:							
State old age pension	27.27	36.67	56.67	6.67	0	0	1.70
Occupational pension	0.91						
Disability insurance	60.91	49.25	41.79	5.97	2.99	0	1.63
Wife's supplement	0.91						
Mixed sources	10.00						
No. of observations	110						
Unemployment Insurance to Mixed Sources to:							
State old age pension	73.78	37.10	51.61	8.06	3.23	0	1.77
Occupational pension	1.19						
Disability insurance	23.81	20.00	70.00	5.00	5.00	0	1.95
Sickness insurance	1.19						
No. of observations	84						

Note: Blank cells indicate that data is not available.

as their second main source. More than 70 percent of this group receive sickness insurance only one or two years before the transition to DI.

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 10.5 goes one step further and reports what happens after the

Table 10.6 **Percentage Distribution of the Number of Years after Permanent Exit from the Labor Force before Disability Insurance Becomes the Main Income Source (retirees with initial income from sickness or unemployment insurance only)**

	Number of Years					
	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	0.00	7.69	30.77	15.38	46.15	4.00
All	8.91	35.66	3.33	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 >50%	51.02	18.37	24.49	6.12	0.00	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	0.00	0.00	1.60
Unemployment insurance	10.42	64.58	25.00	0.00	0.00	2.15
No income source >50%	75.56	18.89	5.56	0.00	0.00	1.30
All	49.74	39.48	10.78	0.00	0.00	1.61

states considered in table 10.4. Most of those who switch from sickness insurance (SI) to UI or from UI to SI, ended up with DI as their main source of income. Table 10.5 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 and then started to receive their main income from DI is reported in table 10.6. It is evident that those who retire at relatively older ages make a faster transition to DI. Table 10.6 may also serve as a summary of the results previously obtained on transitions between sources of 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 10.1 shows the relation between retirement age and the average number of years before a worker receives DI as their main source of income, provided that their 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 UI- or SI-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 permanently left the labor force to a much

Fig. 10.1 Average number of years after retirement before DI becomes the main source of income; only workers with main initial source of income from insurance

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.

10.3 Research Background

Despite the importance of early retirement from the labor market, the empirical research on retirement behavior is very meager in 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 in which 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 (1994) studies to what extent changes in rules, in general, and the introduction of the partial retirement benefit, in particular, could account for the changes in retirement behavior between 1974 and 1981, or to what extent these changes rather could be attributed to changes in individual

preferences. She estimates a 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 attributed to preferences, that is, 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 (specific to Sweden) of combining work and pensions through partial benefits, and the vocational rather than medical focus of rehabilitation policy.

10.4 Data

10.4.1 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. The LINDA is a pure-register sample, that is, 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 register consists of tax-return data on all people registered as taxpayers in Sweden. The LINDA contains data from this register for each year between 1968 and 1997. For the years 1983 to 1997, the IoF includes detailed data on taxable and nontaxable 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): The 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 is compulsory.

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

The LINDA also contains data on education from the National Education Register and on employment from the National Labor Market Board 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 have reported in the mailed questionnaire 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.

10.4.2 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 to 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, that is, those who were born in 1927 were age fifty-six in 1983 and seventy in 1997; those born in 1940 were age forty-three in 1983 and fifty-seven in 1997. Third, we have restricted the sample to those who had not already permanently exited from the labor force at age fifty. Table 10.7 shows the number of individuals remaining in the sample at different stages of the selection process.

Table 10.7 Number of Individuals Remaining After Each Step in the Sample Selection

	Men	Women	Total
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 10.8 Number of Individuals Remaining in the Sample During the Period Under Study

	Men	Women	Total
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

Since LINDA is a national register sample, the attrition of the panel differ from survey panels. There are two main sources of attrition: mortality and permanent emigration. Table 10.8 shows the number of individuals remaining in the sample in different years covered by the panel.

10.4.3 Measurement of Variables

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 10.2, 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.

Table 10.9 **Difference in Years Between Age of Permanent Exit From the Labor Force Using the Earnings-From-Labor (definition 2) Measure of Retirement and Source-of-Income Definition (definition 1), by Gender and Age Group of Retirement (source-of-income definition)**

	Difference (years)						
Gender and Age	≤–3	–2	–1	0	1	2	≥3
Men							
50–55	10.67	4.94	37.58	44.27	2.23	0.32	0.00
55–60	7.89	2.12	34.66	51.56	2.46	0.81	0.50
60–65	2.75	1.24	29.26	61.73	3.87	0.60	0.55
65–70	1.24	0.13	14.76	74.06	5.66	2.02	2.15
Women							
50–55	16.47	7.72	37.83	36.80	1.19	0.00	0.00
55–60	11.34	4.96	38.46	43.54	1.10	0.53	0.08
60–65	4.47	2.26	38.76	52.98	1.14	0.14	0.26
65–70	2.84	0.69	21.86	72.03	1.81	0.60	0.17

1. *Out of the labor force full time by source of income:* An individual is considered to be out of the labor force full time if, in a particular year, they receive more than 80 percent of their income from the sources listed in table 10.2.

2. *Out of the labor force full time 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: (a) 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 or (b) 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 10.9, 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 for retirement according to the earnings-from-labor definition.

Table 10.9 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

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)—that is, on average, we will underestimate the date of retirement and the degree of underestimation is positively correlated to the date of retirement.

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 percent 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 percent of his income from labor. For the majority of individuals in our sample, one BA is larger than 20 percent of income. If, due to the timing of retirement during the year, earnings fell between 20 percent 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, that is, they have several years with earnings from labor below one BA but exceeding 20 percent 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 on the income of other members of the household, which is probably more common. 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 observations: the figure of 16.47 percent for women who retired between ages fifty and fifty-five in the ≤–3 column corresponds to only sixty-three observations.

Moreover, table 10.9 shows that a considerable share of the individuals who retire after age sixty-five, 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 simultaneously 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 (i.e., leave the labor force) and the decision to claim a benefit are separate. Table 10.9 shows that almost 10 percent of the men who retired between ages sixty-five and seventy 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, pri-

marily women, leave the labor force without immediately claiming full benefits from any of the programs considered in table 10.2. Also, some individuals, primarily men, remain in the labor market part time 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.

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 importantly, 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 10.5.5) 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. The same strategy is used for measuring lifetime earnings for the spouse.

Our data set does not contain any direct information that specifies to which occupational pension scheme each individual belongs. Given the importance of occupational pension schemes, this is, of course, essential information. However, as described in section 10.2, 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 socioeconomic 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 their socioeconomic 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

Table 10.10 Classification of Individuals into Pension Schemes

	Men		Women		Total	
	Number	%	Number	%	Number	%
Private sector						
Blue-collar	6,188	39.62	3,137	21.17	9,325	30.64
White-collar	4,972	31.83	2,614	17.64	7,586	24.92
Government employees						
Central	2,110	13.51	2,348	15.84	4,458	14.65
Local	2,349	15.04	6,721	45.35	9,070	29.80
All	15,619	100.00	15,165	100.00	30,439	100.00

Table 10.11 Number of Observations at Different Education Levels (%)

Level	Description	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 ≤2 years	20.06	33.06
4	Upper secondary school ≥3 years; sixth form of comprehensive school (U.K.); senior high school (U.S.)	14.61	4.71
5	Post-upper secondary school ≤2 years; junior college (U.S.), e.g., nursing school	7.35	9.03
6	Post-upper secondary school ≥3 years, e.g., business administration, engineering or medicine, and PhDs	10.96	9.33

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 10.10.

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 10.11 gives a short description of each education level along with the percentage share of observations in each category.

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

10.5 Construction of Incentive Measures

10.5.1 Definitions of the Incentive Measures

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

1. Benefit accrual,
2. Effective tax or subsidy rate,
3. Peak value, and
4. Option value.

Benefit accrual measures the increase in pension wealth that a worker gains by postponing retirement and the claiming of benefits for one year. The present value of a worker's pension wealth at year t if he retires at age r is defined as

$$\text{SSW}(r, t) = \sum_{s=r}^{\text{max age}} \delta^{s-t} E_t B(s, r), \tag{2}$$

where δ is the discount factor and $E_t B(s, r)$ is the expected benefit at age s if the worker retires at age r. The expected benefit is defined as

$$\begin{aligned} E_t B(s, r) = {} & p(s \mid t) q(s \mid t) \text{BM}(s, r) + p(s \mid t)[1 - q(s \mid t)] \text{BS}(s, r) \\ & + [1 - p(s \mid t)] q(s \mid t) \text{S}(s, r, t), \end{aligned} \tag{3}$$

where $\text{BM}(s, r)$ is the worker's pension benefit at age s if they are married and retire at age r; $\text{BS}(s, r)$ is the worker's pension benefit at age s if they are not married and retire at age r; $\text{S}(s, r)$ is 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; and $q(s \mid t)$ is the probability of the spouse surviving at age s conditional on survival at age t. The value $\text{S}(s, r, t)$ depends on the spouse at time t as well as the retirement age r, while $\text{BM}(s, r)$ and $\text{BS}(s, r)$ are not dependent on t, since we assume perfect foresight about wages.

The benefit accrual at age t is defined as

$$\text{ACCR}(t) = \sum_{s=t+2}^{\text{man age}} \delta^{s-t} E_t B(s, t + 2) - \sum_{s=t+1}^{\text{max age}} \delta^{s-t} E_t B(s, t + 1). \tag{4}$$

The effective-tax-or-subsidy-rate measure relates benefit accrual to the net wage if the worker stays in the labor market one additional year, that is,

$$\text{TS}(t) = -\frac{\text{ACCR}(t)}{\text{W}(t + 1)}, \tag{5}$$

where $\text{W}(t + 1)$ 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, that is,

$$\text{PEAK}(t) = \max_{r=t+2, t+3, \ldots .71} \left[\sum_{s=r}^{\text{max age}} \delta^{s-t} E_t B(s, r) - \sum_{s=t+1}^{\text{max age}} \delta^{s-t} E_t B(s, t + 1) \right]. \tag{6}$$

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 they value 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

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

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

$$\text{OPT}(t) = V(t, r^*) - V(t, t + 1), \tag{7}$$

where r^* is the optimal retirement age; that is, 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
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 that options 3 and 4 are dominated by 1 and 2, they can be disregarded, as we do in our model.

10.5.2 Sources of Income after Retirement

As pointed out in section 10.2, 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 DI and from UI and SI, in particular, are signifi-

cantly higher compared to the old age pension alternative. However, as explained in section 10.2, 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 or not 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 that 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, also 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 for 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; SSW from the old age pension system, which is available without any requirements regarding health status or unemployment, is denoted SSW_{OAP}. A worker's SSW, if they are 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 their SSW can be written

$$SSW = SSW_{OAP} + p(SSW_{LI} - SSW_{OAP}). \tag{8}$$

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 to account for different systems with a probability assigned to eligibility for each of them. However, as noted in section 10.2, considering all permutations of the main source of income over time resulted in 677 different

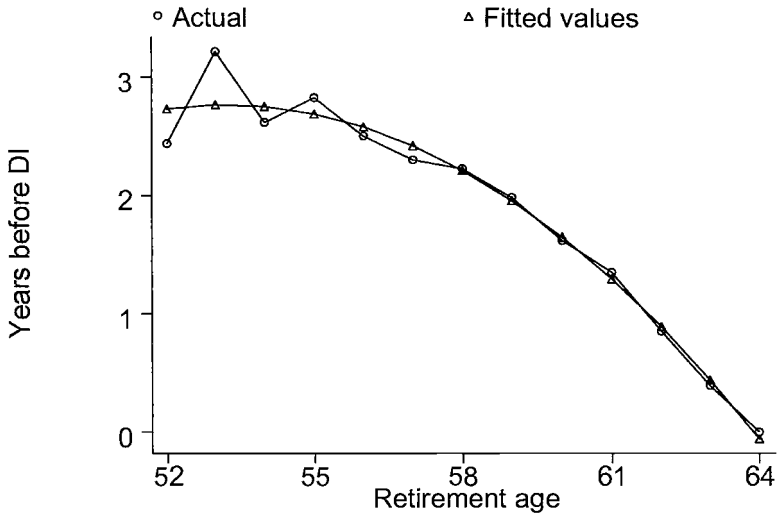

Fig. 10.2 Fitted values from regressing the average number of years with sickness or unemployment insurance as the main source of income before DI becomes the main source on a quadratic function in retirement age along with actual sample averages

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 10.2, 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 10.2 that the replacement rates for SI and UI are quite similar, particularly for workers who have an insured income below both the social security and the UI 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 most likely to initially finance their retirement from insurance. Thus, the accuracy in predicting income after retirement it is not likely to be impaired if, when choosing between SI and UI, the "right" insurance program is not used.

As shown in figure 10.1, the length of the time before the transition to DI is highly dependent on a worker's age when they permanently leave 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 UI or SI before the transition to DI. In figure 10.2, predicted values from a regression of the average number of years with SI or DI before DI on a quadratic function of retirement age are added to the data shown in figure

Table 10.12 **Probit Estimates of Probability of Getting Disability, Sickness, or Unemployment Insurance Benefits**

	Men		Women	
	β	β/s_β	β	β/s_β
Age	0.444	7.71	0.088	45.69
Age^2	–0.003	–6.20	0.00	0.00
Occ2	–0.253	–13.37	–0.255	–0.03
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
Intercept	–17.03	–10.28	–6.853	–59.70
Controls for counties	Yes		Yes	
Pseudo R^2	0.0761		0.0717	

Notes: Occ = socioeconomic group; Elev = education level.

10.1. 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 SI or UI with a replacement rate of 80 percent during the number of years predicted by the quadratic function and, after that point, shifts to DI as their main source of income. Beginning at age sixty-five, 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.

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, for 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 socioeconomic groups, marital status, and indicators for the twenty-five different counties in Sweden. The results from the probit regression are shown in table 10.12.

13. As there are very few observations on retirement before age fifty-four and as the estimated function actually increases between retirement ages fifty-two and fifty-three, we used 2.75 years up to age fifty-four. After that age, we applied the quadratic function.

10.5.3 Calculating Retirement Income Components and Income Taxes

Calculations of the incentive measures for the individuals in the sample require calculating the old age pension, DI, SI, and UI 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—that is, the state basic and supplementary pension (ATP) and the four main occupational-pension schemes. Compared to income taxes, for example, 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 their 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 administers 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 that 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 postreform 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 nonretired. We used a third degree polynomial to model the marginal tax rates in the prereform income tax system and three linear segments for the postreform 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 seventy-one. 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 10.4, that is, 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 1 January 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 1 January 2000, but none thereafter.

10.5.4 Sample Estimates of Different Incentives Measures

Tables 10.13–10.16 report the sample distribution of the incentive measures by age. Table 10.13 shows SSW, benefit accrual, and the tax or subsidy rate, that is, benefit accrual as a share of labor earnings minus payroll and income taxes in the individual's last year of work. Table 10.14 reports the peak value and option value distributions for men. Tables 10.15 and 10.16 list the corresponding distributions for women. In addition to the median, the tenth and ninetieth percentiles of the distribution are given for the benefit accrual, peak value, and option value measures.

Benefit accrual exhibits a marked increase at age fifty-seven. This is due to the rule in the STP scheme that at least three years of work between ages fifty-five and fifty-nine are required in order to be eligible for the STP pension. The increase is also more marked 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 fifty-nine. This may be explained by the way the pension schemes for central and local government employees are constructed (see section 10.2). 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.

Table 10.13 **Social Security Wealth, Benefit Accrual, and Tax or Subsidy Rates for Men, by Age (1995 SKr; CPI used as deflator)**

		Accrual					
Last Age of Work	SSW Median	Median	10th Percentile	90th Percentile	SD	Tax Subsidy Rate Median	Previous Volume
55	1,067,750	14,863	–14,914	47,384	71,558	0.225	0.231
56	1,103,079	15,260	–15,693	53,690	72,946	0.220	0.221
57	1,145,999	38,432	–8,627	127,339	86,832	0.072	0.056
58	1,230,600	10,210	–18,052	45,075	76,746	0.250	0.153
59	1,278,554	11,004	–20,526	109,772	100,362	0.249	0.146
60	1,332,801	–2,452	–31,416	39,160	77,248	0.330	0.350
61	1,369,422	–11,171	–37,200	26,246	72,601	0.392	0.358
62	1,402,465	–19,918	–46,657	13,460	59,917	0.457	0.253
63	1,427,187	–28,814	–63,317	–5,090	58,197	0.520	0.290
64	1,447,386	–24,106	–59,611	–4,044	53,811	0.478	0.313
65	1,471,473	–23,631	–90,149	–7,890	58,009	0.177	0.036
66	1,500,672	–31,293	–72,891	–19,904	39,608	0.232	0.085
67	1,525,269	–39,412	–74,802	–29,946	27,395	0.291	0.128
68	1,545,787	–47,679	–83,300	–38,275	25,987	0.359	0.169
69	1,561,635	–56,298	–100,704	–46,628	24,605	0.440	0.193
70	1,571,791						

Note: SD = standard deviation.

Table 10.14 **Forward-Looking Incentive Measures (peak value and option value) for Men, by Age (1995 SKr; CPI used as deflator)**

	Option Value				Peak Value			
Last Age of Work	Median	10th Percentile	90th Percentile	SD	Median	10th Percentile	90th Percentile	SD
55	45,950	15,156	79,966	29,275	111,968	2,283	310,487	167,153
56	39,521	12,921	69,369	26,296	102,906	4,108	280,804	156,075
57	33,227	11,155	60,132	23,560	99,200	3,822	254,886	146,097
58	19,618	3,877	46,890	21,475	34,187	–14,539	210,786	138,783
59	12,822	1,656	36,711	18,752	20,638	–18,041	176,940	126,933
60	4,688	–1,798	19,721	13,949	–727	–30,358	83,890	98,434
61	1,768	–2,810	12,560	11,557	–10,308	–36,314	46,448	84,042
62	–38	–3,895	7,866	9,380	–19,595	–45,173	21,454	69,578
63	–1,316	–5,441	4,480	7,992	–28,504	–61,698	–1,070	61,668
64	–727	–5,080	2,968	6,501	–23,711	–55,125	–2,489	51,264
65	–1,033	–8,973	1,457	6,194	–23,624	–90,065	–7,876	52,730
66	–2,149	–6,211	–413	4,362	–31,287	–72,446	–19,893	39,478
67	–3,394	–6,652	–1,874	2,748	–39,412	–74,802	–29,946	27,395
68	–4,609	–8,248	–3,113	2,443	–47,679	–83,300	–38,275	25,987
69	–5,862	–9,800	–4,380	2,276	–56,298	–100,704	–46,628	24,605

Notes: SD = standard deviation. Parameter values for option value measure $\beta = 0.97$, $\gamma = 0.75$, and $k = 4.7$.

Table 10.15 **Social Security Wealth, Benefit Accrual, and Tax or Subsidy Rate for Women, by Age (1995 SKr; CPI used as deflator)**

		Accrual				
Last Age of Work	SSW Median	Median	10th Percentile	90th Percentile	SD	Tax Subsidy Rate Median
55	827,876	13,359	–4,465	33,588	27,906	0.174
56	861,445	13,758	–5,362	34,854	29,790	0.170
57	898,823	19,745	–2,612	71,591	36,585	0.111
58	945,692	12,815	–7,463	35,116	34,400	0.171
59	981,653	16,637	–19,034	115,672	65,566	0.132
60	1,039,325	5,127	–21,227	39,044	35,988	0.253
61	1,071,957	–2,507	–26,163	31,383	32,331	0.328
62	1,095,325	–11,511	–34,581	23,540	30,403	0.420
63	1,113,421	–16,910	–49,134	15,471	32,297	0.495
64	1,126,691	–14,378	–45,515	23,469	33,250	0.443
65	1,143,643	–12,733	–76,788	7,313	43,044	0.186
66	1,143,224	–16,525	–54,609	–4,154	26,593	0.204
67	1,144,681	–20,105	–43,002	–12,120	18,995	0.231
68	1,137,244	–25,737	–45,050	–18,568	16,415	0.275
69	1,137,490	–32,298	–47,004	–21,987	17,032	0.324
70	1,158,467					

Note: SD = standard deviation.

Table 10.16 **Forward-Looking Incentive Measures (peak value and option value) for Women, by Age (1995 SKr; CPI used as deflator)**

	Option Value				Peak Value			
Last Age of Work	Median	10th Percentile	90th Percentile	SD	Median	10th Percentile	90th Percentile	SD
55	55,472	31,397	78,714	19,403	107,531	3,356	280,500	125,036
56	50,667	28,052	72,457	18,227	97,138	2,522	258,400	116,511
57	45,767	24,544	66,102	17,016	88,609	2,547	239,264	108,763
58	39,903	20,487	58,841	15,699	56,027	–2,275	205,810	100,545
59	34,936	17,085	52,382	14,368	43,210	–11,355	182,714	92,363
60	28,565	12,420	44,776	12,835	10,656	–19,482	107,011	66,102
61	24,400	9,976	39,244	11,537	–275	–25,322	74,868	53,948
62	20,704	7,937	33,919	10,177	–9,347	–34,069	51,408	47,330
63	17,598	5,996	29,139	8,934	–15,506	–47,250	34,902	42,157
64	14,823	4,935	24,545	7,541	–12,558	–42,778	28,088	37,060
65	11,896	3,265	20,120	6,390	–12,290	–75,789	7,746	43,266
66	9,574	2,502	15,913	5,053	–16,523	–53,451	–4,115	26,639
67	7,146	1,622	11,744	3,857	–20,090	–43,002	–12,098	19,004
68	4,693	893	7,663	2,689	–25,723	–45,015	–18,539	16,407
69	2,316	454	4,040	1,611	–32,298	–47,004	–21,987	17,061

Notes: SD = standard deviation. Parameter values for option value measure $\beta = 0.97$, $\gamma = 0.75$, and $k = 1.25$.

The forward-looking incentive measures, peak value and option value, show—although on different levels—a similar pattern as they both decrease over the observed ages. However, the quantiles of the option value measure evolve more smoothly over the ages, which is not surprising given the way in which it is calculated. The ninetieth percentiles of the peak value fall considerably between ages fifty-nine and sixty, which, again, reflects the makeup of the pension schemes for central and local governments employees.

The last column in table 10.13 gives the tax or 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 their working career. As can be seen in the table, the tax rates are somewhat higher in the data set 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 sixty-three since this type of insurances entails more generous replacement rates 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 fifty-six is definitely related to the way this pension scheme is constructed, which is less marked in the present data set that comprises individuals from all occupational pension schemes. Third, the data set now used encompasses the prereform income tax system up until 1991 with substantially higher marginal tax rates. This difference may explain the somewhat higher tax rates after age sixty-three. Finally, the results from the present data set 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.

10.6 Empirical Model and Results

10.6.1 Empirical Specification

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

$$(9)\quad R_{it} = \delta_0 + \delta_1 \mathrm{ACC}_{it} + \delta_2 \mathrm{SSW}_{it} + \delta_3 \mathrm{AGE}_{it} + \delta_4 \mathrm{PREARN}_{it} + \delta_5 \mathrm{EARN}_{it} + \delta_6 \mathrm{PREARN}_{it} \cdot \mathrm{EARN}_{it}\, \delta_7 \mathrm{SPEARN}_{it} + \beta' X_{it} + v_{it},$$

where ACC_{it} is the measure of accrual at time t; SSW_{it} is the net present value of SSW 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

SSW discounted back to time t; and X is a set of personal characteristic variables, including marital status, education level (1–6),[14] socioeconomic group (1–4),[15] and indicators for each of Sweden's twenty-five counties (cf. section 10.4 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 SSW 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. Therefore we expect the sign on ACC to be negative. As explained in section 10.5, 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 10.2, 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 STP 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, for example, 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.

10.6.2 Sample Characteristics

Since only workers older than age fifty 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.

Table 10.17 reports means and standard deviations of most of the variables included. To save space, we exclude descriptive statistics of the twenty-five county dummies.

14. The education levels are described in table 10.11.
15. The socioeconomic groups are explained in table 10.10.

Table 10.17 **Means and Standard Deviations of the Variables Included in the Sample Used in Estimations (monetary values in SKr; 1997 prices deflated by the CPI)**

	Men		Women	
	Mean	SD	Mean	SD
Retired	0.055	0.228	0.060	0.238
Benefit accrual	15,196	83,856	13,769	37,361
Peak value	107,746	170,984	104,804	128,149
Option value	37,044	35,893	48,365	24,210
SSW	1,265,103	437,801	933,227	325,278
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	0.406	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	0.354	0.466	0.499
Married	0.754	0.431	0.723	0.448
Log lifetime earnings (spouse)	24.01	15.08	23.58	15.43
SSW (spouse)	940,866	762,528	1,050,550	805,860

Notes: SD = standard deviation. For the option value measure, we use $\beta = 0.97$, $\gamma = 0.75$, and $k = 4.7$ for the male subsample and $\beta = 0.97$, $\gamma = 0.75$, and $k = 1.25$ for the female subsample.

10.6.3 Estimation Results

The results from the probit regression on retirement decisions are shown in table 10.18 for men and table 10.19 for women. Each of the tables shows six different specifications. The three accrual measures described in section 10.5.1 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 model specification, we tested for joint significance of the main groups of variables included—that is, the incentive variables and the additional variables for the workers' economic situation, education level, socioeconomic group, family income, and county of residence. The results show that all these groups are significantly different (on the 5 percent level) from zero in all specifications.

We estimated the parameters in the option value measure by a grid search in which the maximum of the log likelihood from the M2 model was

Table 10.18 Results from Probit Regressions on Individual Retirement Decision (men)

	Accrual		Peak Value		Option Value	
	M1	M2	M1	M2	M1	M2
ACCR/10^6	–0.21	–0.09	–0.93	–0.92	–5.11	–6.74
	(–2.08)	(–0.81)	(–10.12)	(–9.94)	(–9.39)	(11.42)
1 million change	–0.02	–0.01	–0.07	–0.07	–0.36	–0.49
SSW/10^6	0.55	0.57	0.34	0.35	0.31	0.24
	(10.81)	(10.99)	(6.41)	(6.43)	(5.50)	(4.16)
1 million change	0.04	0.04	0.02	0.03	0.02	0.02
Lifetime earnings	–2.60	–2.51	–2.76	–2.80	–2.43	–2.55
	(–1.81)	(–1.73)	(–1.92)	(–1.92)	(–1.71)	(–1.76)
Lifetime earnings^2	0.02	0.01	0.11	0.011	0.10	0.12
	(0.30)	(0.14)	(1.45)	(1.39)	(1.31)	(1.58)
Predicted earnings	–0.41	–0.57	1.47	1.40	1.26	1.59
	(–0.26)	(–0.36)	(0.93)	(0.87)	(0.80)	(1.00)
Predicted earnings^2	–0.08	–0.07	–0.09	–0.09	–0.08	–0.10
	(–1.79)	(–1.76)	(–2.14)	(–2.16)	(–1.91)	(–1.94)
Lifetime · Predicted	0.35	0.37	0.13	0.15	0.12	0.08
	(2.34)	(2.39)	(0.91)	(0.96)	(0.83)	(0.53)
(Lifetime · Predicted)^2	–0.01	–0.01	–0.01	–0.01	–0.01	–0.01
	(–2.90)	(–2.87)	(–1.78)	(–1.77)	(–1.62)	(–1.33)
Education2	0.21	0.21	0.22	0.22	0.22	0.22
	(6.63)	(6.55)	(6.91)	(6.85)	(6.92)	(6.91)
Education3	0.18	0.18	0.18	0.18	0.18	0.19
	(10.70)	(10.47)	(11.19)	(10.99)	(11.23)	(11.24)
Education4	0.12	0.12	0.13	0.14	0.14	0.15
	(6.09)	(5.92)	(6.87)	(6.75)	(6.88)	(7.04)
Education5	0.10	0.09	0.12	0.12	0.12	0.12
	(3.90)	(3.59)	(4.71)	(4.44)	(4.75)	(4.73)
Education6	0.04	0.04	0.07	0.07	0.07	0.07
	(1.56)	(1.42)	(2.50)	(2.41)	(2.46)	(2.59)
Occupation2	–0.19	–0.19	–0.17	–0.17	–0.17	–0.17
	(–10.83)	(–10.60)	(–9.77)	(–9.53)	(–9.68)	(–9.16)
Occupation3	0.02	0.02	0.03	0.03	0.03	0.03
	(1.01)	(1.11)	(1.38)	(1.46)	(1.42)	(1.62)
Occupation4	–0.18	–0.19	–0.18	–0.19	–0.18	–0.19
	(–8.84)	(–8.90)	(–8.68)	(–8.78)	(–8.82)	(–8.90)
Age	0.12		0.11		0.11	
	(38.26)		(38.39)		(33.28)	
Married	–0.11	–0.11	–0.05	–0.06	–0.04	–0.02
	(–2.37)	(–2.51)	(–1.21)	(–1.29)	(–0.93)	(–0.47)
Lifetime earnings (spouse)	0.02	0.02	0.03	0.04	0.02	0.03
	(1.67)	(1.95)	(2.45)	(2.77)	(2.11)	(2.63)
Lifetime earnings (spouse)^2	–0.01	–0.01	–0.01	–0.01	–0.01	–0.01
	(–1.70)	(–1.97)	(–2.51)	(–2.83)	(–2.16)	(–2.68)
SSW (spouse)/10^6	0.04	0.04	0.04	0.04	0.03	0.03
	(3.26)	(3.37)	(3.01)	(3.11)	(2.98)	(3.01)
Indicators for age	No	Yes	No	Yes	No	Yes
Indicators for counties	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.1593	0.1813	0.1621	0.1841	0.1612	0.1844
Log-likelihood	–24,654	–24,011	–24,571	–23,928	–24,599	–23,920

Notes: Results based on 15,619 individuals and 127,390 observations. Numbers in parentheses are *t*-values.

Table 10.19 Results From Probit Regressions on Individual Retirement Decision (women)

	Accrual		Peak Value		Option Value	
	M1	M2	M1	M2	M1	M2
ACCR/10^6	–1.00	–0.81	–1.42	–1.29	–23.4	–24.0
	(–4.06)	(–0.34)	(–10.39)	(–9.69)	(–20.43)	(–21.67)
1 million change	–0.08	–0.01	–0.10	–1.70	–1.87	–1.87
SSW/10^6	0.35	0.44	0.07	0.13	–0.47	–0.48
	(7.28)	(8.93)	(1.27)	(2.16)	(–7.13)	(–7.14)
1 million change	0.03	0.04	0.01	0.01	–0.03	–0.04
Lifetime earnings	–5.87	–5.67	–4.68	–4.60	–6.31	–6.22
	(–3.18)	(–2.94)	(–2.47)	(–2.34)	(–3.39)	(–3.25)
Lifetime earnings^2	0.33	0.28	0.40	0.36	0.66	0.65
	(4.22)	(3.32)	(5.07)	(4.34)	(7.32)	(6.80)
Predicted earnings	4.21	4.27	5.94	6.02	5.53	8.82
	(2.52)	(2.44)	(3.50)	(3.38)	(3.56)	(3.56)
Predicted earnings^2	–0.20	–0.23	–0.19	–0.22	–0.07	–0.08
	(–3.05)	(–3.24)	(–3.05)	(–3.20)	(–1.26)	(–1.47)
Lifetime • Predicted	0.14	0.21	–0.19	–0.12	–0.46	–0.46
	(0.79)	(1.12)	(–1.06)	(–0.66)	(–2.85)	(–2.68)
(Lifetime • Predicted)^2	–0.00	–0.00	–0.00	–0.00	–0.00	–0.00
	(–1.80)	(–1.76)	(–0.37)	(–0.38)	(0.04)	(0.19)
Education2	0.05	0.04	0.06	0.05	0.09	0.08
	(2.14)	(1.63)	(2.27)	(1.80)	(3.44)	(2.96)
Education3	0.06	0.06	0.07	0.06	0.09	0.09
	(3.88)	(3.53)	(4.15)	(3.87)	(5.72)	(5.52)
Education4	0.06	0.05	0.07	0.06	0.11	0.09
	(1.99)	(1.43)	(2.23)	(1.70)	(3.32)	(2.78)
Education5	–0.01	–0.01	–0.00	–0.00	0.04	0.05
	(–0.45)	(–0.54)	(–0.07)	(–0.05)	(1.74)	(1.80)
Education6	–0.09	–0.11	–0.08	–0.09	–0.02	–0.04
	(–3.21)	(–3.61)	(–2.75)	(–3.04)	(–0.82)	(–1.10)
Occupation2	–0.12	–0.12	–0.11	–0.11	–0.03	–0.03
	(–5.22)	(–4.97)	(–5.12)	(–4.93)	(–1.48)	(–1.29)
Occupation3	–0.04	–0.12	–0.04	–0.04	–0.02	–0.01
	(–1.57)	(–4.97)	(–1.81)	(–1.52)	(–0.67)	(–0.42)
Occupation4	–0.13	–0.02	–0.13	–0.13	–0.21	–0.21
	(–7.14)	(–1.10)	(–7.27)	(–6.82)	(–11.34)	(–10.95)
Age	0.15		0.14		0.09	
	(51.92)		(50.07)		(24.64)	
Married	0.27	0.29	0.29	0.32	0.32	0.35
	(4.37)	(4.51)	(4.61)	(4.87)	(4.96)	(5.28)
Lifetime earnings (spouse)	0.01	0.00	0.01	0.00	0.00	0.00
	(0.54)	(0.33)	(0.30)	(0.12)	(0.27)	(0.04)
Lifetime earnings (spouse)^2	–0.01	–0.00	–0.00	–0.01	–0.02	–0.02
	(–0.93)	(–0.71)	(–0.66)	(–0.48)	(–0.67)	(–0.43)
SSW (spouse)/10^6	–0.01	–0.01	–0.01	–0.01	–0.02	–0.02
	(–0.60)	(–0.71)	(–0.58)	(–0.68)	(–1.12)	(–1.23)
Indicators for age	No	Yes	No	Yes	No	Yes
Indicators for counties	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.1736	0.1977	0.1762	0.2004	0.1828	0.2083
Log-likelihood	–23,615	–22,926	–23,540	–22,850	–23,351	–22,624

Notes: Results based on 14,820 individuals and 123,979 observations. Numbers in parentheses are *t*-values.

used as a value function. Although the log-likelihood function for men was shown to be very flat with respect to γ and k, a maximum was found at $\beta = 0.97$, $\gamma = 0.75$, and $k = 4.7$. These parameter values were then used to obtain the estimates presented in table 10.18. 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 $\div 10^6$ at –4.28 [–4.56] for the M1 and –4.98 [–5.36] for the M2 specification, respectively), but slightly larger estimates for the SSW variable (coefficient $\div 10^6$ at 0.43 [7.28] for the M1 and 0.41 [6.86] 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 10.19 we used $\beta = 0.97$, $\gamma = 0.75$, 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 SSW variable are, in general, significantly positive, and those for the different accrual measures are, as expected, significantly negative. There are, however, some exceptions to this pattern. In the male sample, the benefit accrual measure is not significantly different from zero in the M2 specification. In the female sample, the variable for SSW of the spouse is insignificant in all specifications, and the variable for the individual's own SSW is significant with an unexpected sign in both specifications including the option value measure.

The magnitude of the effect from the economic incentive variables is hard to quantify from the parameter estimates alone. According to the results of the implied probability effect of changing the incentive measure by SKr1 million, the effect appears to be very small. It should be kept in mind, however, that (as is evident from table 10.17) the average probability of retirement is fairly low in the sample (0.055 for men and 0.060 for women)—that is, 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 10.7).

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 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. Considering the design of many of the pension schemes, for example, the STP scheme in which three years of earnings between ages fifty-five and fifty-nine 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 lower in the male subsample for the M1 specification, but higher for the M2 specification and in the female subsample. In the female subsample, the measure of SSW 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 10.18 and 10.19 alone is the extent to which the economic incentive measures capture the observed pattern of retirement behavior. Figure 10.3 shows 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. Our interpretation of this result is that the economic incentive measures do not fully capture the age pattern of retirement. The spike at age sixty-five tells us that collective agreements on retirement ages, as described in section 10.2.5, have considerable influence on retirement behavior.

10.7 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 beginning at age sixty-three rather than age sixty. The actuarial adjustments of pension levels, within both the public and occupational pension systems, start from age sixty-eight rather than sixty-five. Moreover, the probabilities for 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 sixty if it is claimed at the normal retirement age of sixty-five. The pension could be claimed beginning at age sixty or delayed until age seventy. There is a 6 percent actuarial reduction for each year of retirement before age sixty-five and a 6 percent increase for each year retirement is delayed after age sixty-five. Since there is no labor

16. We use the strategy for predicting future earnings described in section 10.5.

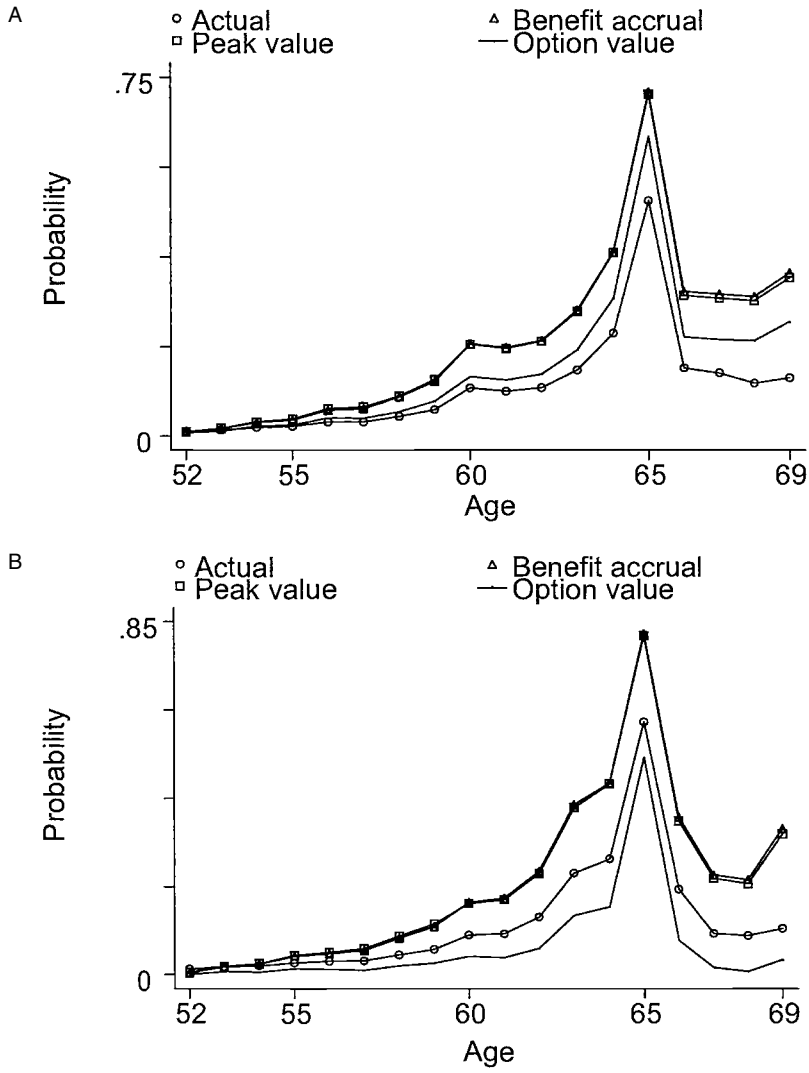

Fig. 10.3 The implied probability effect of the age dummies from the M2 specification with different incentive measures along with the actual hazard rate out of the labor force by age: *A,* men; *B,* women

market insurance, a worker who decides to retire before age sixty receives no income until age sixty.

Figure 10.4 compares the sample median SSW by age, under the three policy alternatives: the actual and the two hypothetical policies for males and females. For males, it can be seen that there is a substantial difference between the actual system and the two hypothetical schemes. At age sixty,

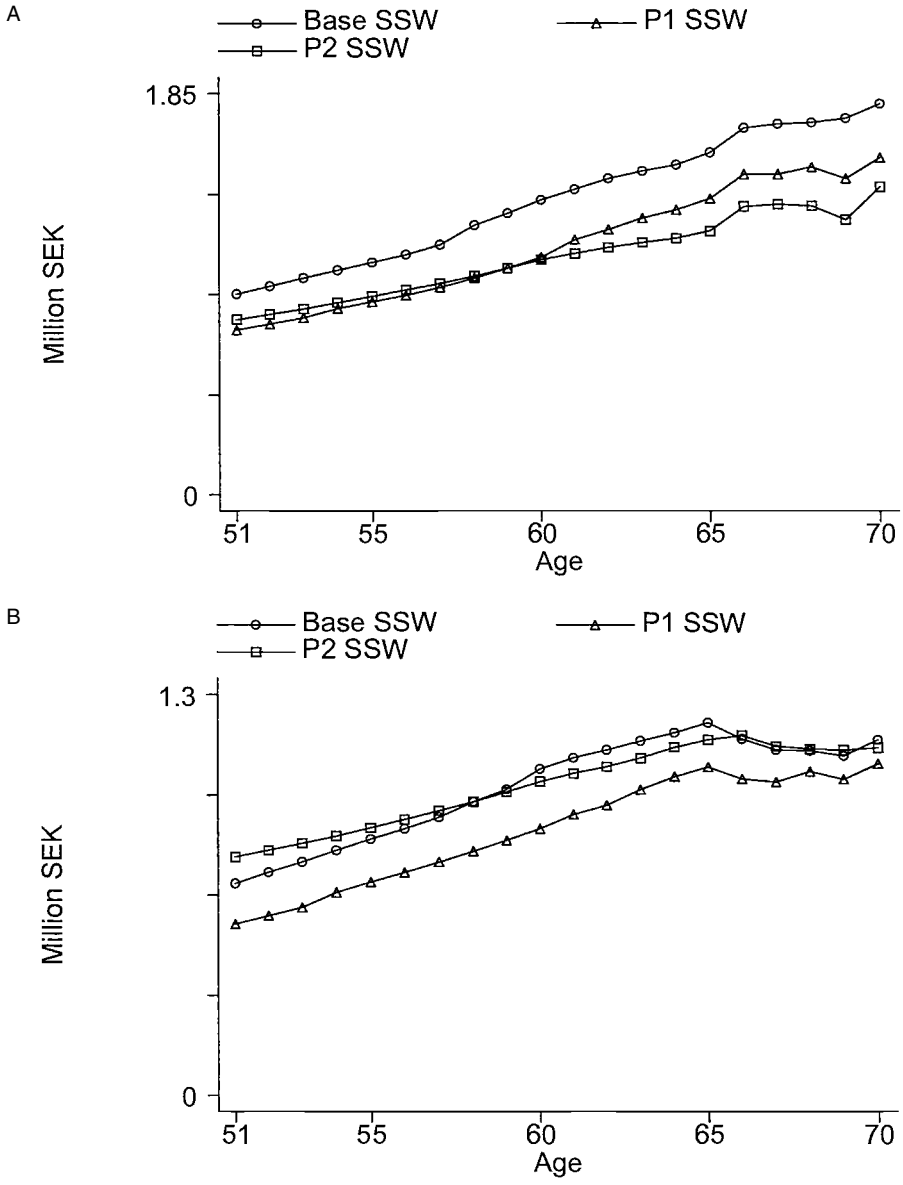

Fig. 10.4 Median social security wealth; actual and simulated under policy alternatives 1 and 2, respectively: *A*, men; *B*, women

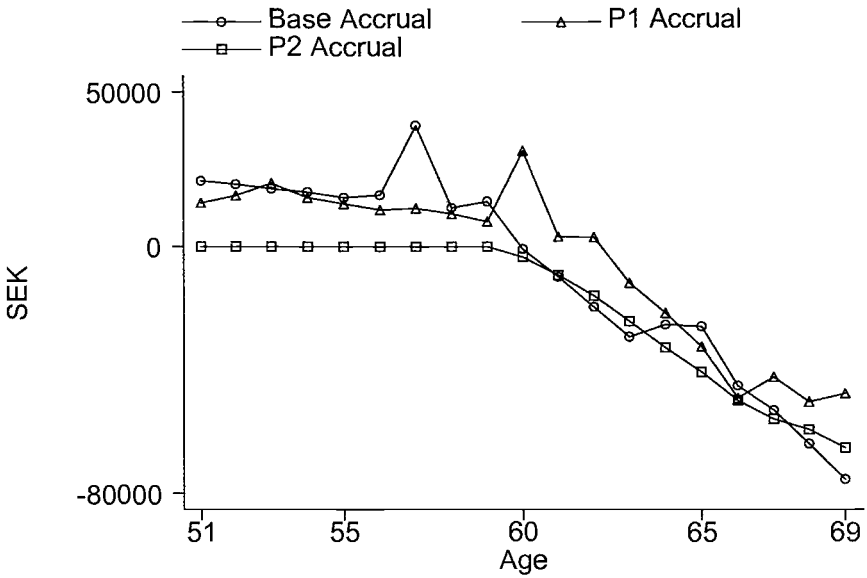

Fig. 10.5 Median benefit accrual; actual and simulated under policy alternatives 1 and 2, respectively, men

the SSW is about 20 percent lower under both policy alternatives. As regards the first policy alternative, this difference is due to delaying of all benefits, and in the case of the second policy alternative, it is due to the abolition of labor market insurance and a reduction in replacement rates.

For females, panel B shows that the median SSW is very similar under the actual and 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 sixty, there is no reduction for being temporarily out of the labor force before age sixty, as there is in the actual system. For both males and females, all differences are counteracted by progressive income taxes and housing allowances.

Figures 10.5 to 10.7 show the three alternative measures of accrual by age under the different policy alternatives. Figure 10.5 shows that there are two spikes in the benefit accrual of working: the first one is for working during one's fifty-seventh 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 fifty-ninth year (due to the rule that pension benefits could not be claimed until age sixty). 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 sixty under the second policy alternative. Finally, it can be seen that benefit accrual is zero up to

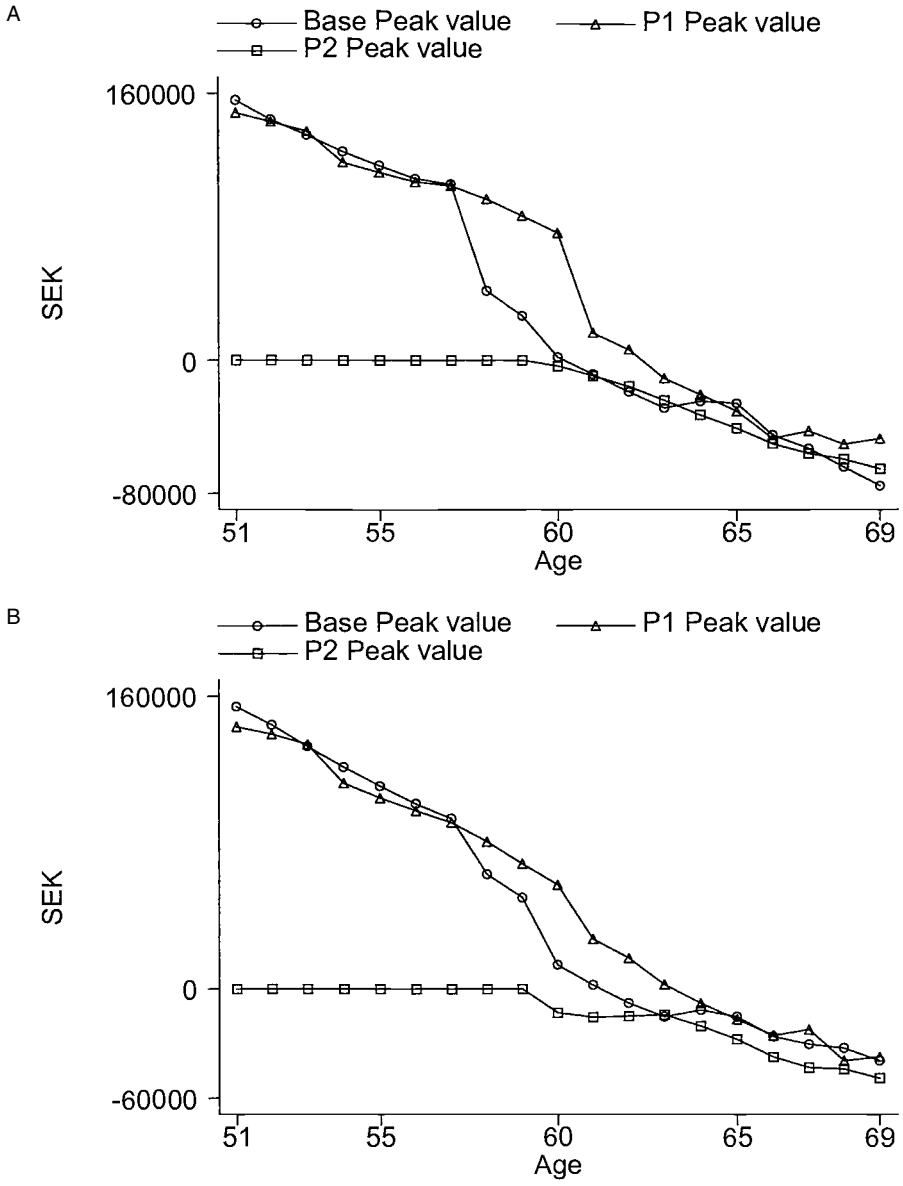

Fig. 10.6 Median peak value; actual and simulated under policy alternatives 1 and 2, respectively: *A*, men; *B*, women

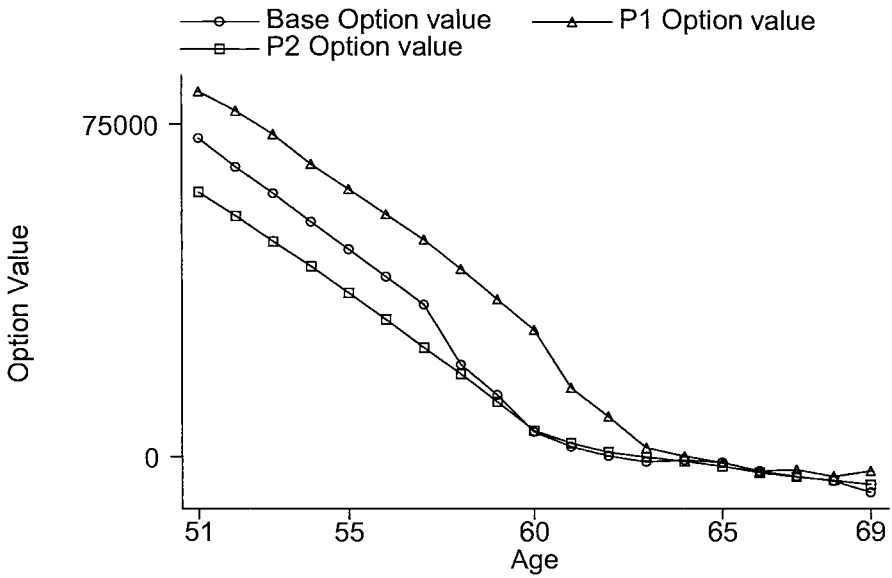

Fig. 10.7 Median option value; actual and simulated under policy alternatives 1 and 2, respectively, men

age sixty under the second policy alternative, since earnings before age sixty do not affect the benefit after retirement under this policy alternative. The 6 percent actuarial adjustment under the second policy alternative is not enough to generate positive benefit accrual after age fifty-nine.

The peak value measures under the different policy alternatives, shown in figure 10.6 for men and 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 sixty.

The median option value measure in figure 10.7 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.

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 overparameterized 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

Table 10.20 **Average Retirement Rates and Retirement Ages in Simulations**

	Baseline		Policy 1		Policy 2	
Model	Retirement Rate	Retirement Age	Retirement Rate	Retirement Age	Retirement Rate	Retirement Age
Men						
S1 and benefit accrual	0.0577	62.60	0.0461	63.40	0.0447	63.52
S2 and benefit accrual	0.0577	62.57	0.0463	63.37	0.0447	63.50
S3 and benefit accrual	0.0577	62.57	0.0246	65.33	0.0447	63.50
S1 and peak value	0.0576	62.60	0.0480	63.24	0.0526	62.91
S2 and peak value	0.0577	62.57	0.0483	63.20	0.0529	62.88
S3 and peak value	0.0577	62.57	0.0264	65.12	0.0529	62.88
S1 and option value	0.0577	62.57	0.0457	63.44	0.0507	63.10
S2 and option value	0.0577	62.57	0.0461	63.37	0.0529	62.92
S3 and option value	0.0577	62.57	0.0269	65.07	0.0529	62.92
Women						
S1 and peak value	0.0626	61.97	0.0593	62.15	0.0730	61.37
S2 and peak value	0.0625	61.95	0.0590	62.14	0.0724	61.38
S3 and peak value	0.0625	61.95	0.0288	64.36	0.0724	61.38

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

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 use 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 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 10.20 shows the predicted average retirement rate and age for each policy alternative and each simulation. Figures 10.8–10.19 show predicted hazard rates out of the labor force and cumulative distribution 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.

It is evident from table 10.20 and the figures that most models predict the largest effect on retirement behavior from the first policy alternative. The

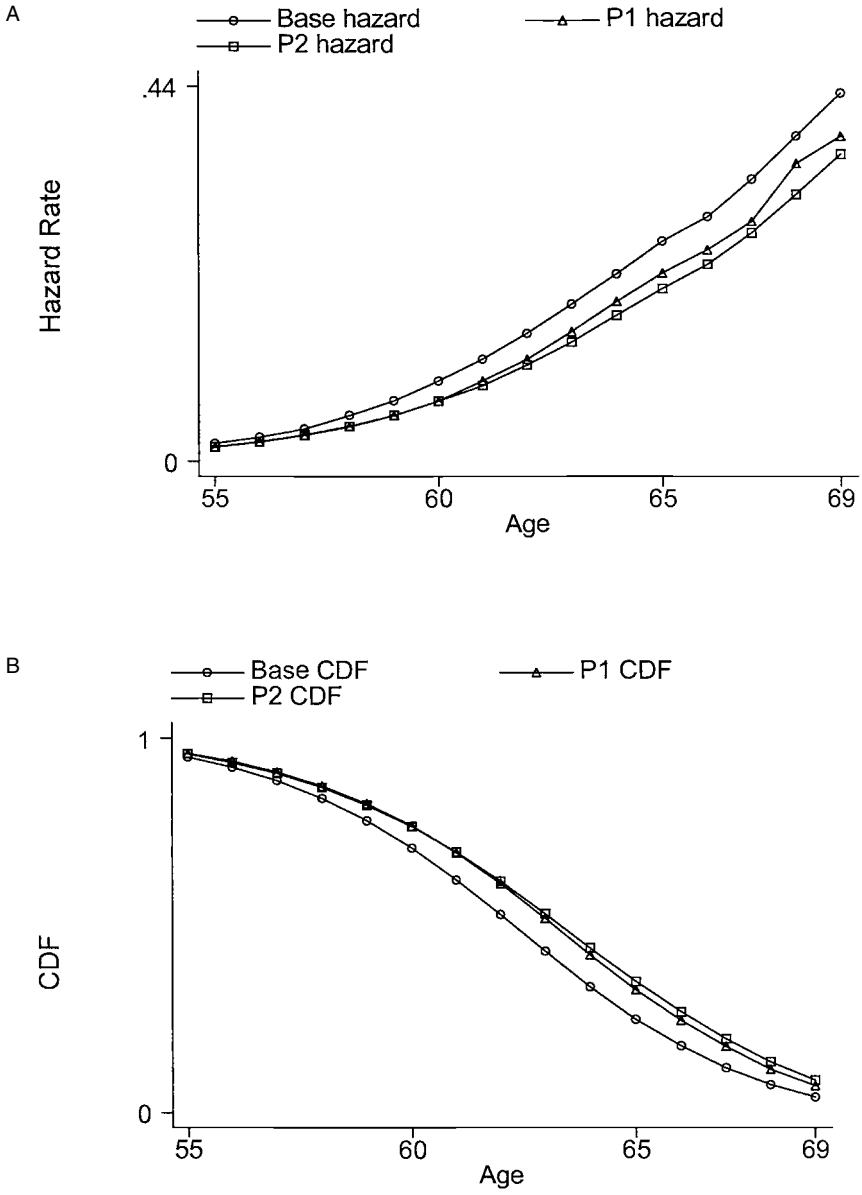

Fig. 10.8 S1 using benefit accrual estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

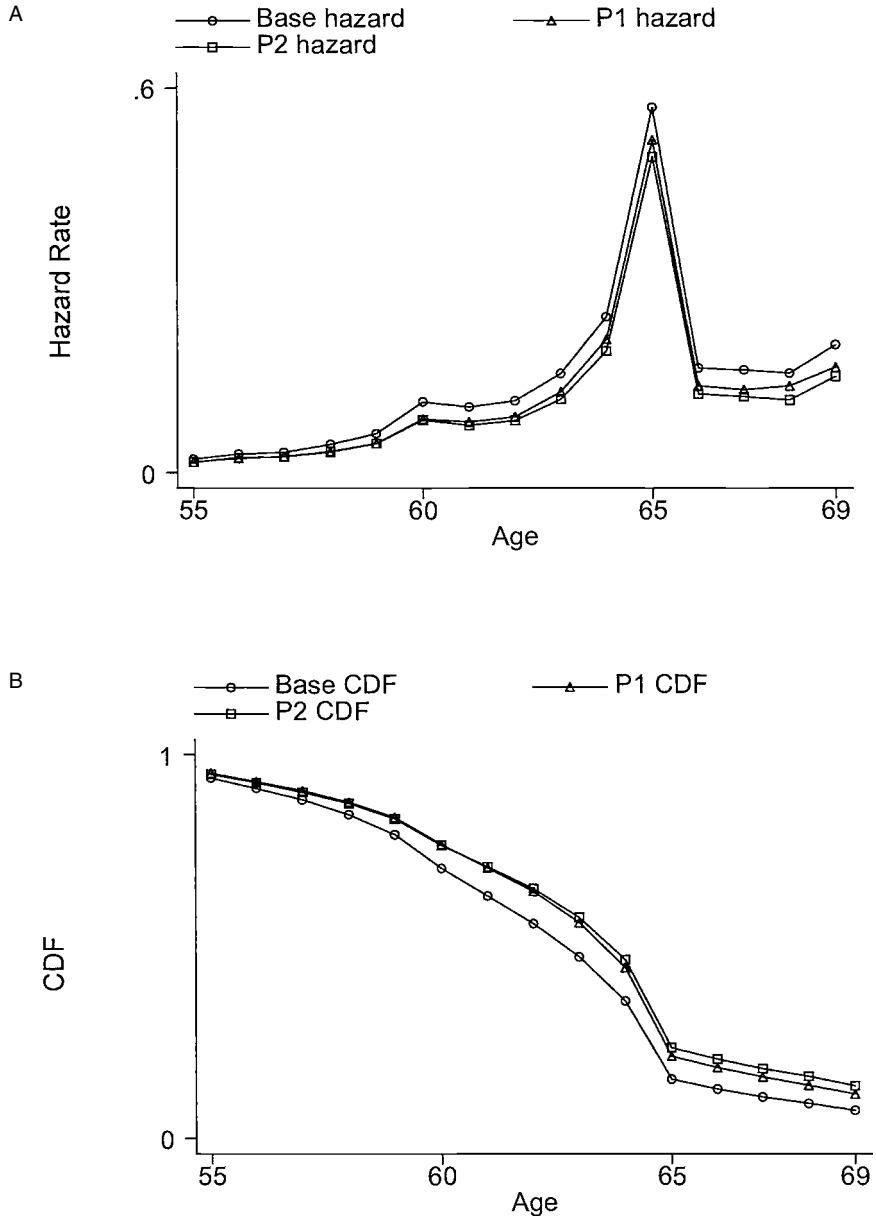

Fig. 10.9 S2 using benefit accrual estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

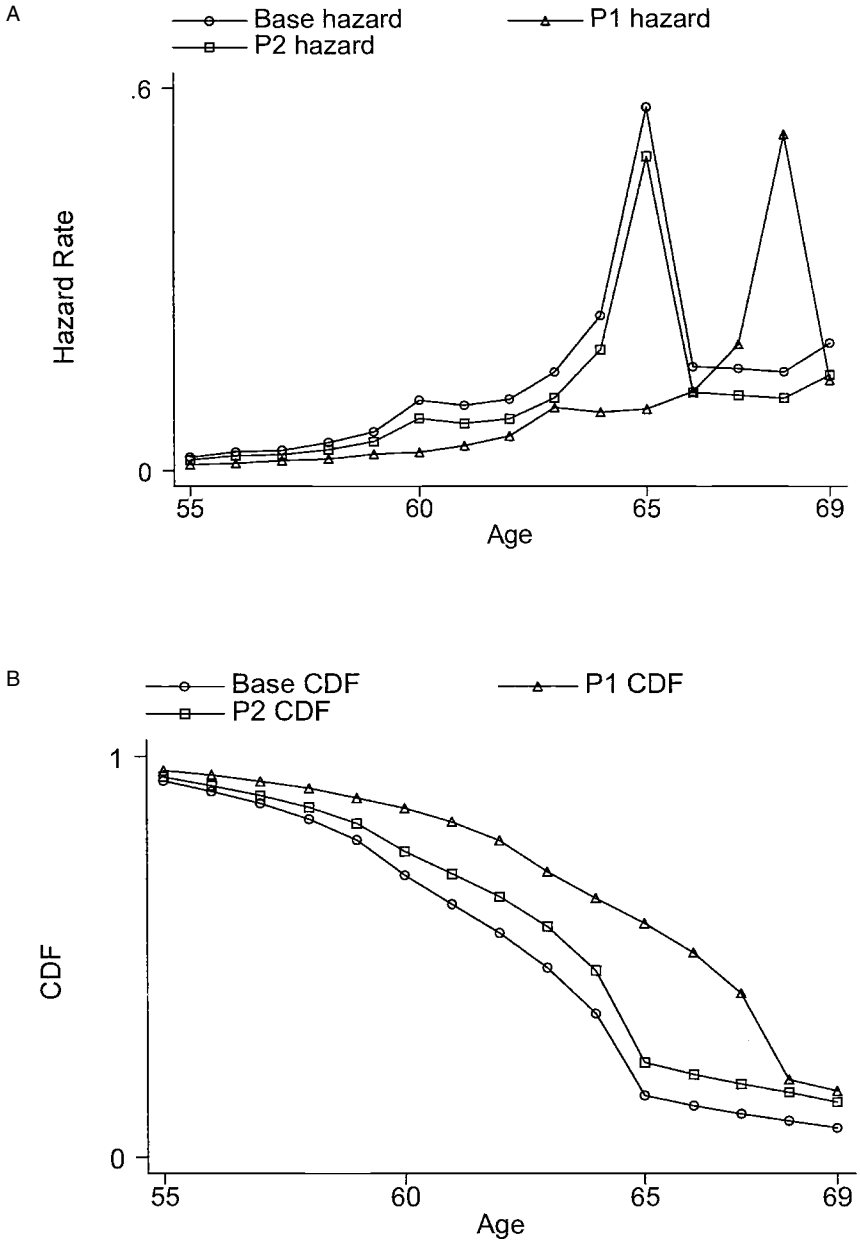

Fig. 10.10 S3 using benefit accrual estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

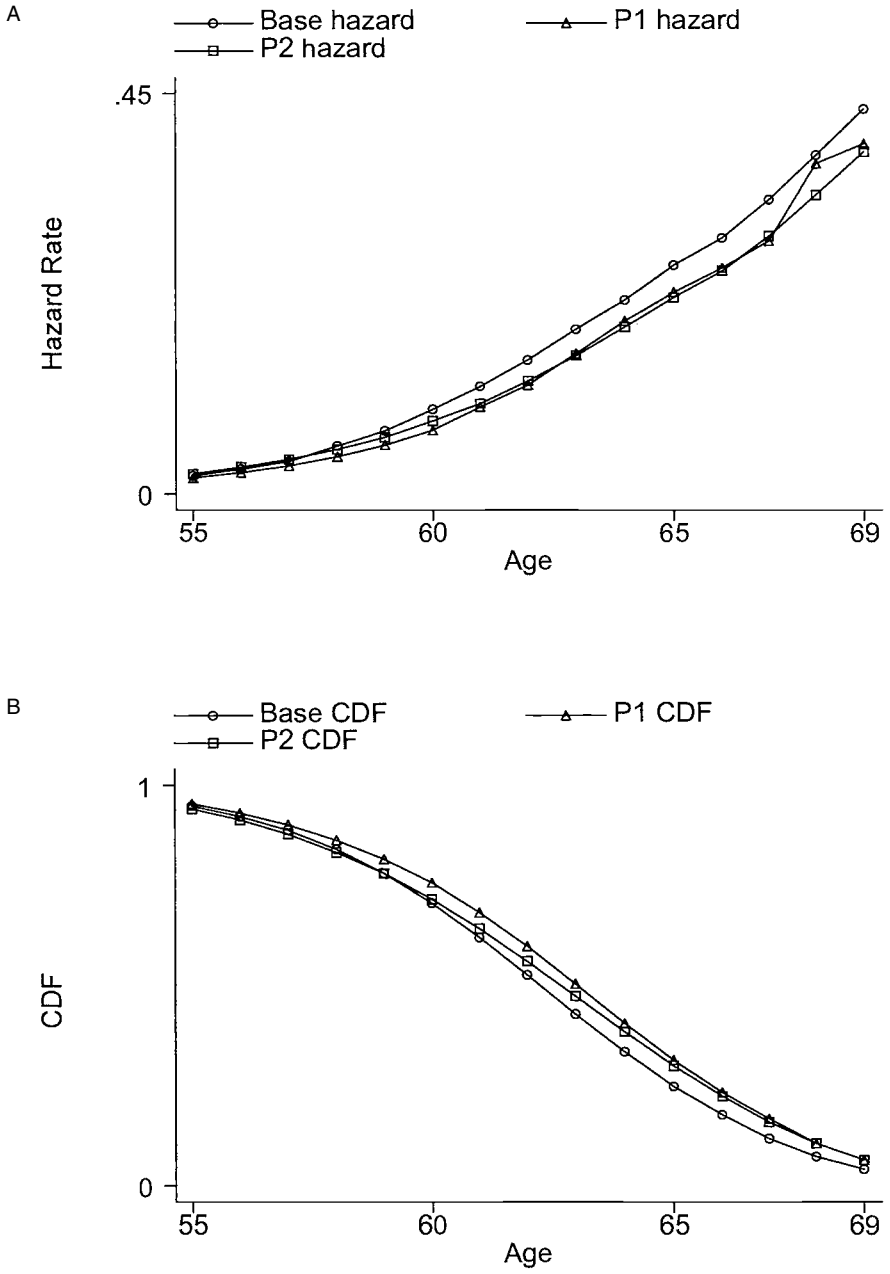

Fig. 10.11 S1 using peak value estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

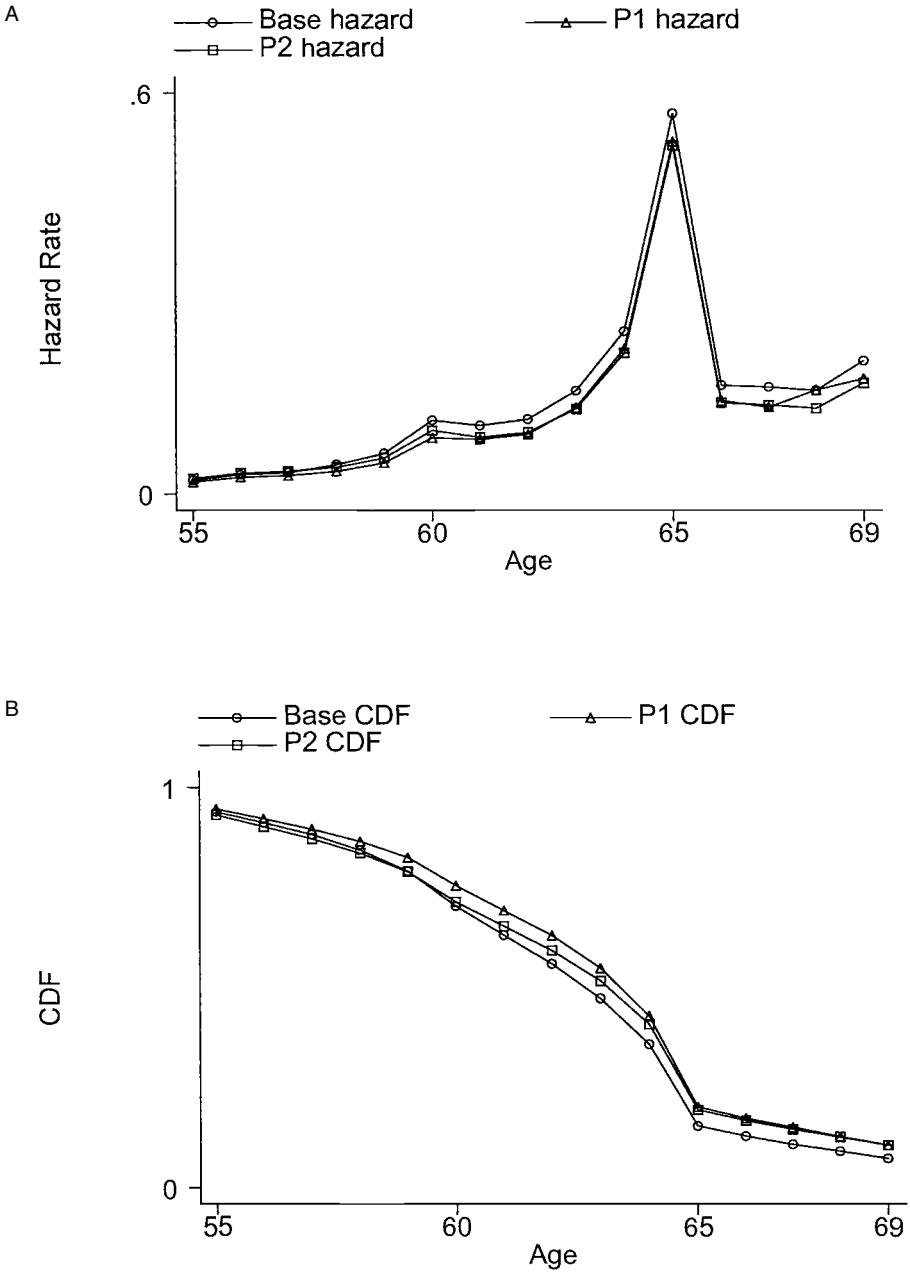

Fig. 10.12 S2 using peak value estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

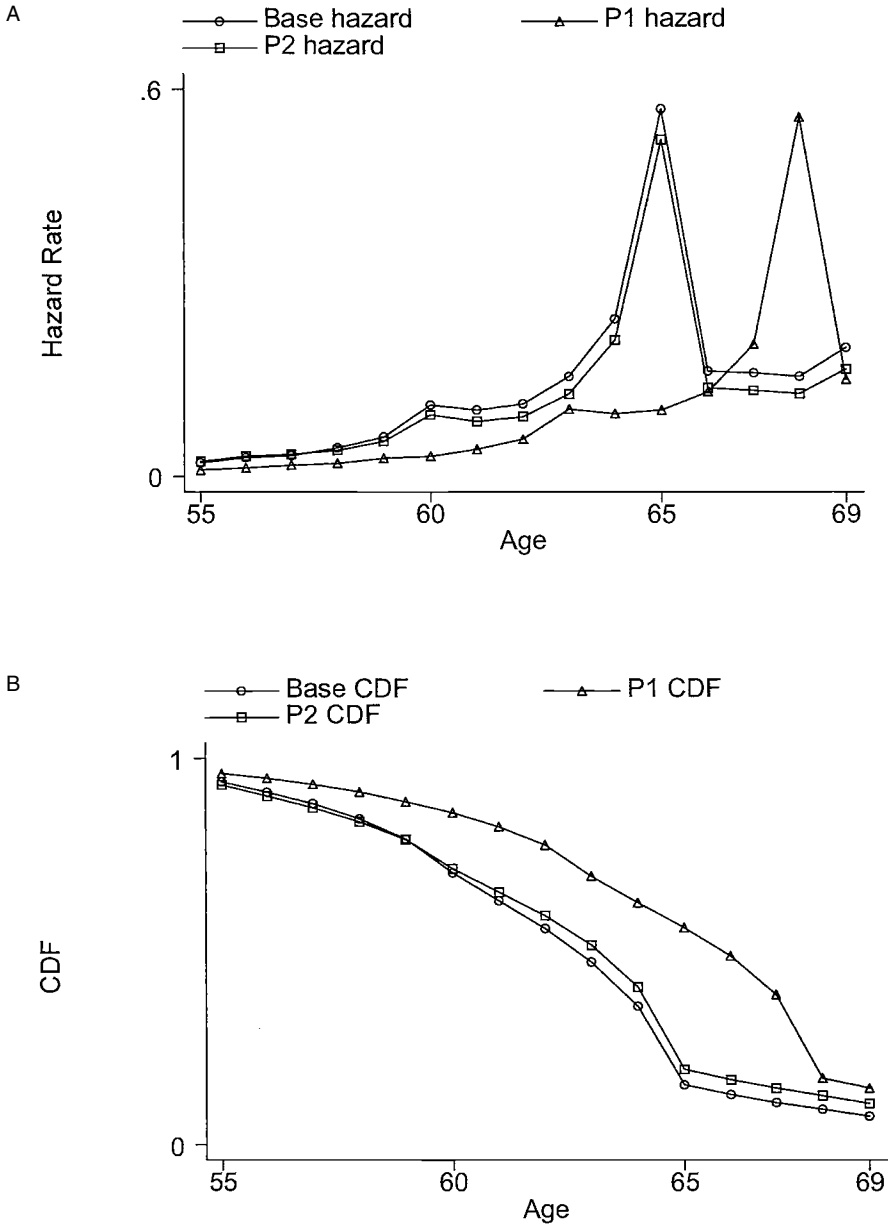

Fig. 10.13 S3 using peak value estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

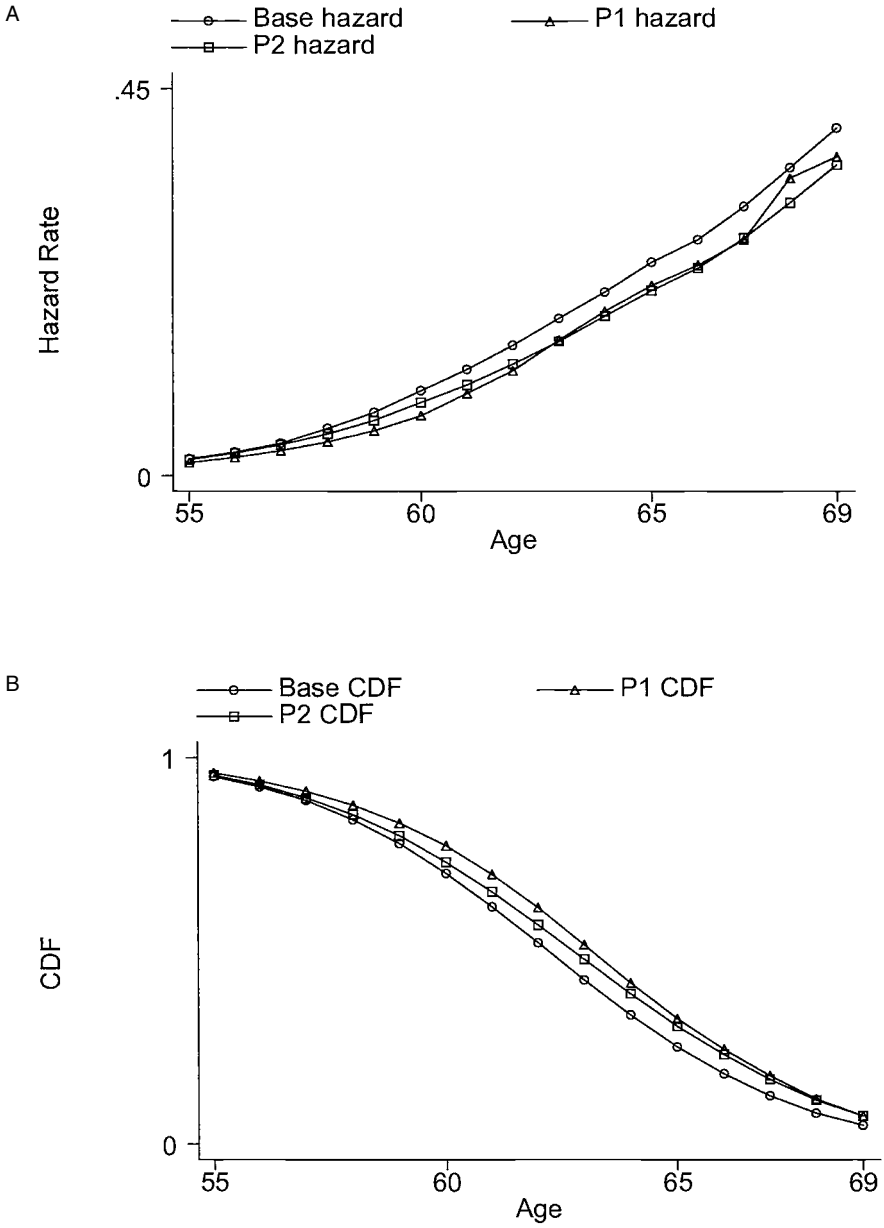

Fig. 10.14 S1 using option value estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

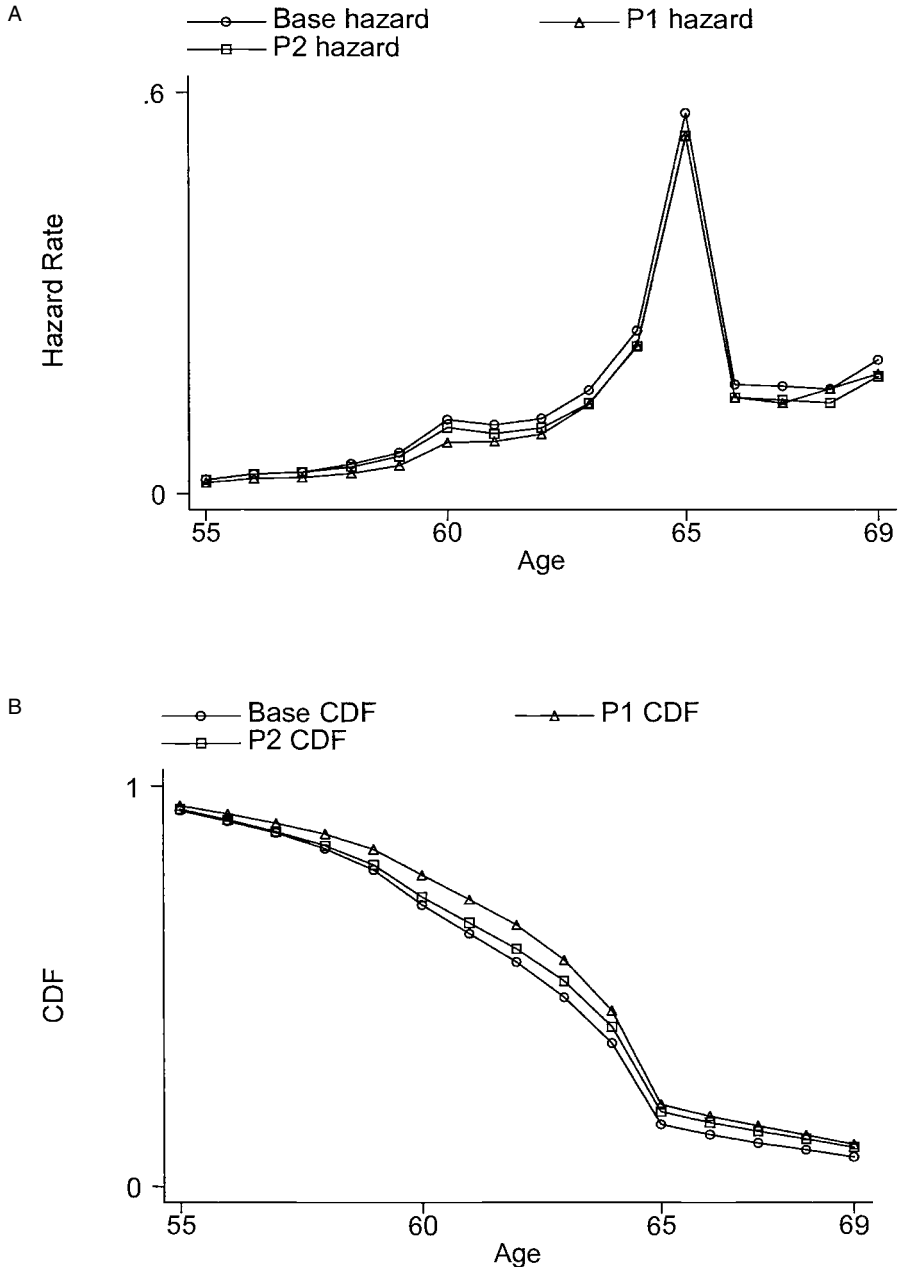

Fig. 10.15 S2 using option value estimates, men: *A,* predicted hazard rates; *B,* predicted CDF

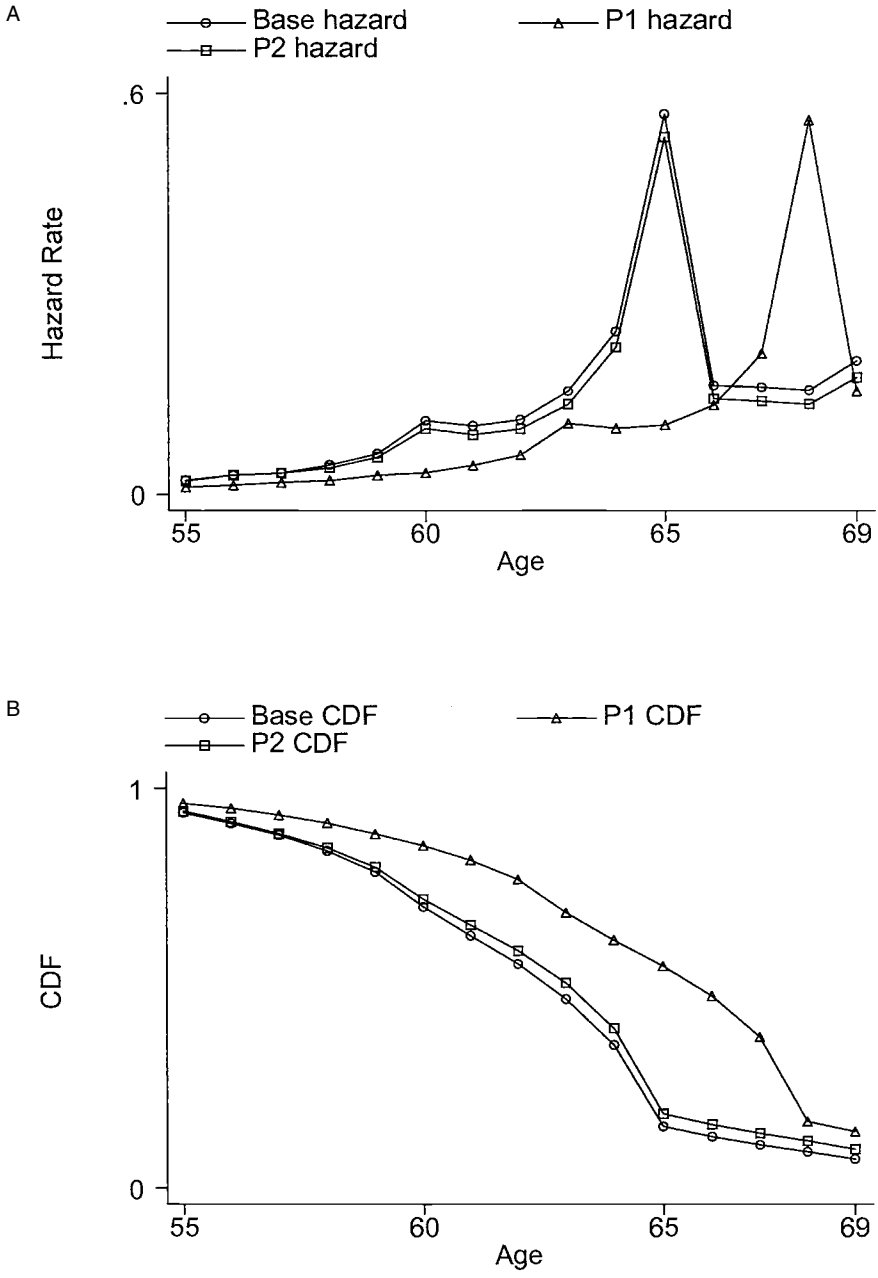

Fig. 10.16 S3 using option value estimates, men: *A*, predicted hazard rates; *B*, predicted CDF

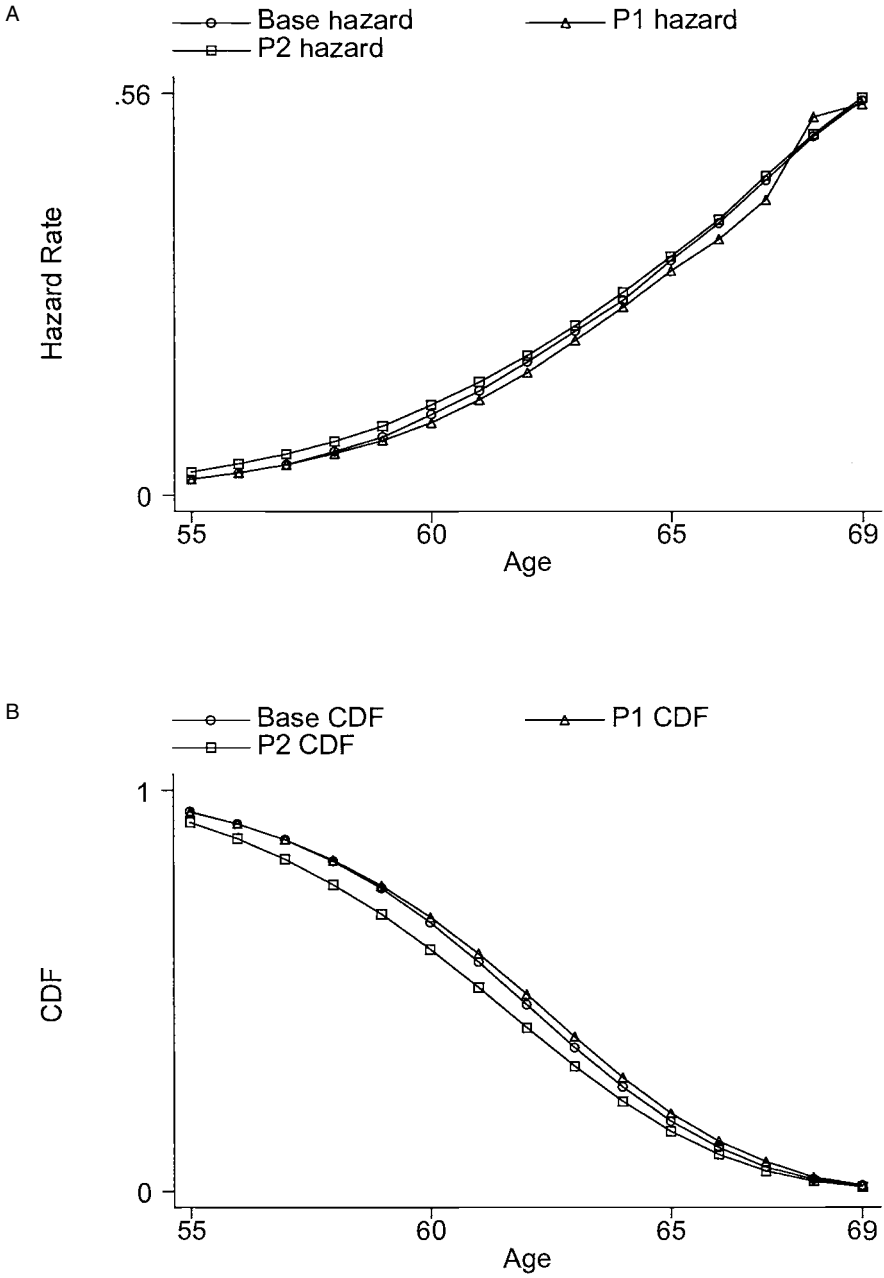

Fig. 10.17 S1 using peak value estimates, women: *A,* predicted hazard rates; *B,* predicted CDF

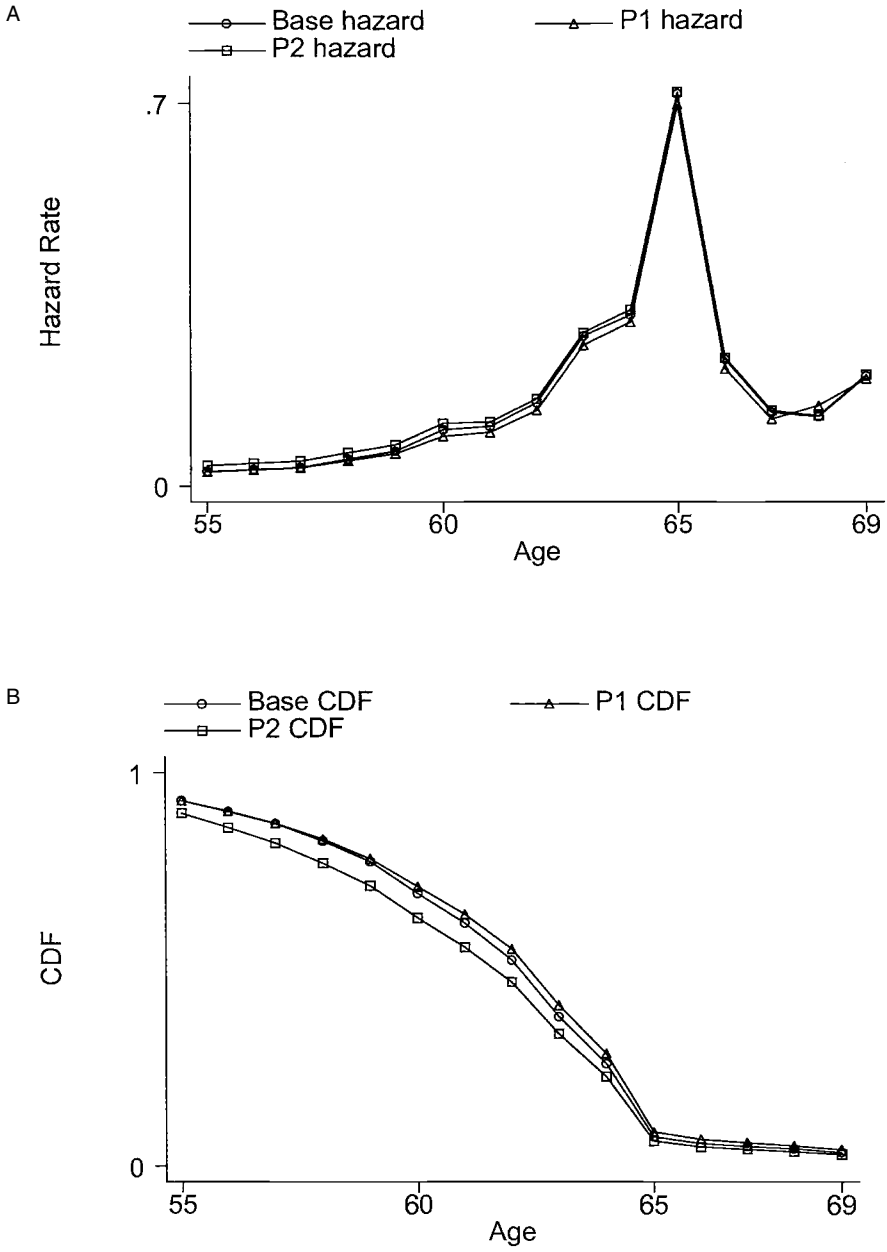

Fig. 10.18 S2 using peak value estimates, women: *A*, predicted hazard rates; *B*, predicted CDF

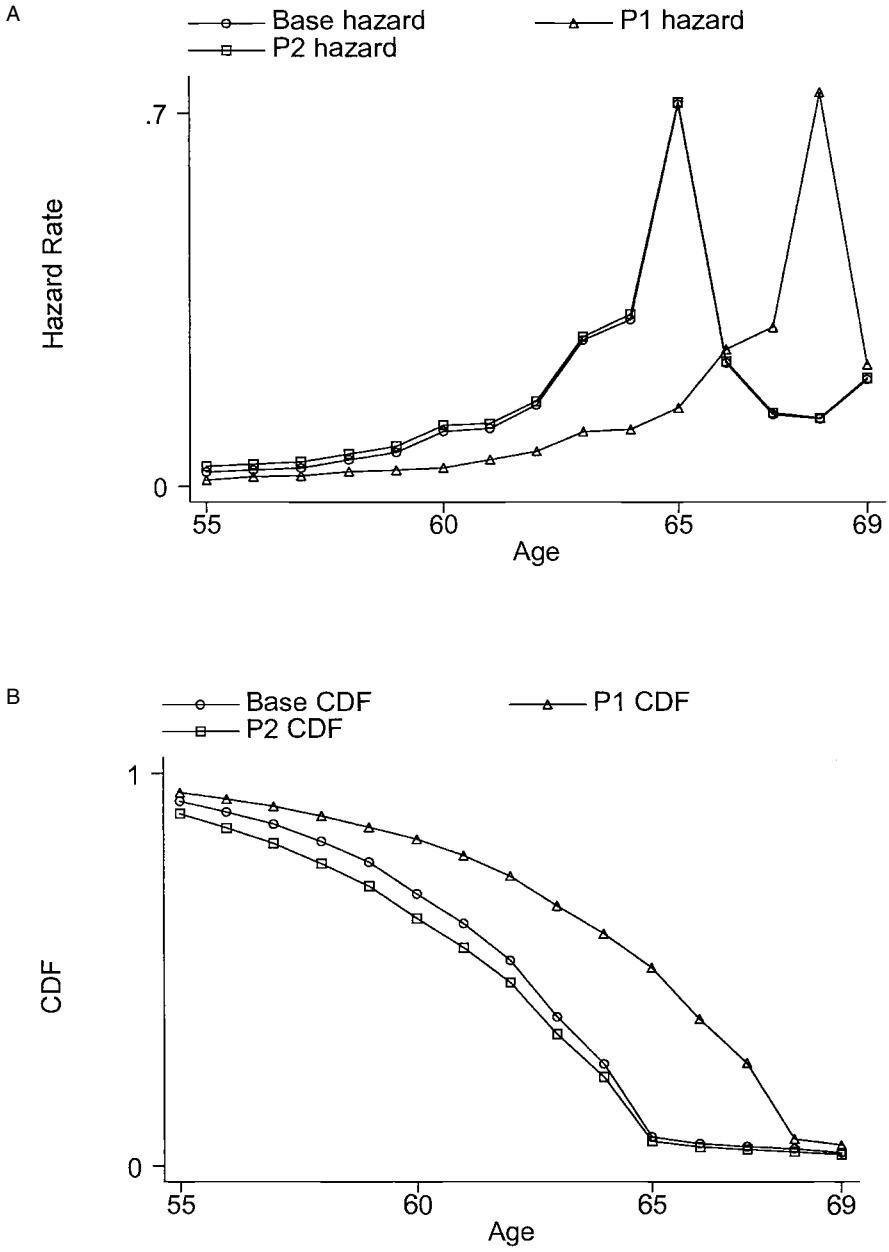

Fig. 10.19 S3 using peak value estimates, women: *A,* predicted hazard rates; *B,* predicted CDF

exception from this pattern is the models using the benefit accrual measure. For the peak and option value measures, the predicted delay in average retirement age is between 0.63 and 0.87 years for first policy alternative for the S1 and S2 simulations, compared to between 0.31 and 0.53 for the second policy alternative.

The predictions of average delay in retirement for the S3 simulation are between 2.50 and 2.76 for the first policy alternative. The difference of these predictions vis-à-vis those of S1 and S2 shows that there is a large element of uncertainty in the predictions from all our models. There are two different sources of this uncertainty.

The first source regards the extent to which spikes at ages sixty and sixty-five in the hazard rates for retirement can be attributed to economic incentives or institutional arrangements on the labor market. For the spike at age sixty, it is likely that it can be attributed largely to economic incentives. In most pension plans, pensions can be claimed starting from age sixty. It is also the case that most workers have fulfilled the requirements for number of years of contributions to the plan at age sixty. For the second spike at age sixty-five, however, it is likely that it can be attributed largely to the collective agreements on retirement age between the unions and the employers' confederation on the labor market. Thus, to some degree, determining the extent to which the reform proposal on delayed eligibility age also includes delayed retirement age in the collective agreements is a matter of interpretation of the reform proposal.

The second source of uncertainty is the extent to which the dummy variable specification for the way age affects retirement reflects changes in preferences for being retired due to aging (primarily through changes in health status) or the extent to which it reflects unmeasured economic incentives from the income security system. If it is primarily due to changes in preferences due to aging, the lower bound is a better prediction of the outcome. However, without detailed data on changes in health status, it is not possible to disentangle these effects.

The results in the female sample can be seen in figures 10.29–10.34 and in table 10.20. The simulations of the first policy reform show that there is a smaller predicted behavioral effect of the reform for women than for men. In S1 and S2, there is only, on average, a 0.18 or 0.19 years delay of retirement due to the reform. The big effect in S3 shows that the uncertainty of the predictions is even greater for females compared to males.

For the second policy alternative, there is an effect toward earlier retirement in the female sample. The background to this result contains several different elements. First of all, most pension plans in Sweden have a linear reduction in the replacement rates if the worker has contributed less than thirty years to the plan. This is binding for a large share of the women studied here, but a much smaller share of the men. Since the pension under the second policy alternative is determined as a fraction of earnings at age

sixty, the SSW is actually lower for a large share of the female sample, compared to the baseline policy. This can be seen for the median SSW in figure 10.6. The effect through the SSW of the spouse is reduced, or actually reversed, since the coefficient estimates of the spouse's SSW were insignificant (with the unexpected sign) in the female sample. Finally, since there are no actuarial adjustments before age sixty under the second policy alternative, the effect through the peak value accrual measure under the baseline policy is thus reduced under the second policy alternative. This explains the higher hazard rates to retirement under the second policy alternative before age sixty.

10.8 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 applies in particular to the male sample. The results also show that the forward-looking accrual measures, the peak and option value measures, work somewhat 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 would 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, changes in preferences for leisure by age, collective agreements on normal retirement ages in the labor market, or social norms regarding retirement, is an open question to be explored in further research.

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