Volume Title: Social Security Programs and Retirement Around the World: Disability Insurance Programs and Retirement

Volume Author/Editor: David A. Wise, editor

Volume Publisher: University of Chicago Press

Volume ISBNs: 0-226-26257-X, 978-0-226-26257-4 (cloth); 978-0-226-26260-4 (e-ISBN)

Volume URL: http://www.nber.org/books/wise14-1

Conference Date: September 26–28, 2013

Publication Date: January 2016

Chapter Title: Pathways to Retirement and the Role of Financial Incentives in Sweden

Chapter Author(s): Per Johansson, Lisa Laun, Mårten Palme

Chapter URL: http://www.nber.org/chapters/c13333

Chapter pages in book: (p. 369 – 410)

9

Pathways to Retirement and the Role of Financial Incentives in Sweden

Per Johansson, Lisa Laun, and Mårten Palme

9.1 Introduction

In the absence of a state early retirement scheme, the disability insurance (DI) program in Sweden is by far the most common pathway for labor market exit for those who exit before age sixty-five. In the early 1990s, the share of the age group sixty to sixty-four receiving DI was around 35 percent for both men and women. Although this share has decreased considerably following a series of reforms of eligibility rules, still about 17 percent of men and 25 percent of women in this age group receive DI. This is a larger share than in most other comparable countries (see, e.g., Wise 2012).

In Jönsson, Palme, and Svensson (2012), it was shown that historical changes in eligibility rules affected utilization of the DI program. However, an outstanding question is to what extent general changes in DI stringency will lead to increased labor force participation. This depends on the economic incentives induced by the old-age pension scheme and the DI program as well as on how people react to economic incentives in their retirement decisions. If the generosity in benefits is very similar in the old-age and DI programs or if people are not very sensitive to economic incentives in their

Per Johansson is a researcher at the Institute for Evaluation of Labour Market and Education Policy and professor of econometrics at Uppsala University. Lisa Laun is a researcher at the Institute for Evaluation of Labour Market and Education Policy. Mårten Palme is professor of economics at Stockholm University.

We are grateful for comments from Peter Skogman Thoursie and Olof Åslund and seminar participants at the ISS NBER meetings. Lisa Laun gratefully acknowledges financial support from the Swedish Research Council for Health, Working Life and Welfare, FORTE (dnr 2013-0209). Per Johansson gratefully acknowledges financial support from the Swedish Research Council for Health, Working Life and Welfare, FORTE (dnr 2013-2482). For acknowledgments, sources of research support, and disclosure of the authors' material financial relationships, if any, please see http://www.nber.org/chapters/c13333.ack.

retirement decisions, the effect of changes in the stringency of DI acceptance will lead to only very small changes in labor force participation rates. Conversely, if differences in economic incentives between the two schemes are very large and if people are very sensitive to these differences there will be comparatively large effects on labor force participation rates.

In this chapter we use an option value model (see Stock and Wise 1990) to estimate the effect of economic incentives on retirement behavior of older workers in Sweden. We consider two different pathways to retirement: the old-age pension path and the social insurance path. The latter includes unemployment insurance (UI), sickness insurance (SI), and DI, but we focus on the incentives provided by the DI program. We use data including the entire Swedish population between ages fifty and sixty-nine and estimate the model on the observed retirement behavior between 2001 and 2008. We use the estimated model to simulate the employment effect of different policy regimes for DI acceptance.

This chapter extends several aspects of the previous literature on how economic incentives affect retirement through the DI pathway using Swedish data (see, e.g., Palme and Svensson 2004; Skogman Thoursie 1999; Laun and Wallenius, forthcoming). The main contributions are that we use better data and model the Swedish income security programs relevant for the timing of labor market exit in a more detailed manner than previous studies. This allows us to make more precise inferences. The simulation exercises translate changes in DI screening stringency to economic incentives. This allows us to study how DI screening stringency affects retirement behavior, which has not been done in the previous literature.

We find that there is a significant effect of economic incentives on retirement. Our results also suggest that there is important between-group heterogeneity: the quintile group with the most inferior health status, as well as the low educated, respond more strongly on economic incentives. The simulation exercises, however, show that the effects of economic incentives, through changes in the stringency of DI admittance, overall are quite small.

The chapter is organized as follows. Section 9.2 gives a brief overview of Sweden's income security systems, describes recent developments in DI rates and employment among older workers and, finally, describes different pathways for exit from the Swedish labor market. Section 9.3 presents our data and the empirical approach. Section 9.4 presents the estimation results from the econometric models. Section 9.5 discusses the outcomes from the policy simulations. Section 9.6 concludes.

9.2 Background

9.2.1 Sweden's Social Security and Income Security Systems

In this section we describe the institutional details of Sweden's income security systems that we account for in this chapter. We consider both the public system as well as the centrally bargained plans. We also describe the

simplifications we made in the calculations of the incentive measure. The empirical analysis includes individuals between ages fifty and sixty-nine during the period 2001 to 2008, that is, born between 1932 and 1958. We only describe the rules that applied to these cohorts.

The Old-Age Pension System

Sweden recently went through a major reform of its public old-age pension system. The old system was a pay-as-you-go defined benefit pension system, whereas the new system is a mixture of a notional defined contribution pay-as-you-go pension system and a fully funded pension scheme with individual accounts. The new pension system was implemented in 1999 and the first payments were made in 2001. The new system is phased in by cohort. Cohorts born before 1938 are completely in the old pension system. The 1938 cohort receives their pension to 4/20 from the new system and to 16/20 from the old system. Each successive cohort until the 1953 cohort receives an additional 1/20 from the new system and 1/20 less from the old system. The 1954 cohort receives their pension completely from the new pension system. Since we include individuals born between 1932 and 1958, we include those who are completely in the old system, different mixtures of the systems, as well as those who are completely in the new system.

The prereform old-age pension system consists of two main parts: a basic pension and an income-related supplementary pension. All Swedish citizens permanently living in Sweden are entitled to a basic pension, which is 96 percent of one basic amount (BA)[1] for singles and 78.5 percent for married. The BA is an indexation unit that price adjusts the Swedish income security system. It is politically determined, but has followed the Consumer Price Index (CPI) very closely. There is also a supplementary pension (ATP), which is determined by the average of the fifteen best years in the individual's income history up to 7.5 BA.[2] It is linearly reduced if the person contrib-

1. One BA was SEK 45,900/USD 6,600 in 2010.

2. From 1996 the ceiling was 7.5 increased price base amounts and from 2001 the ceiling is 7.5 income base amounts. The increased price base amount follows the prices in the economy, and the income base amount follows incomes. This means than the income price base amount is higher than the price base amount and, accordingly, the increased price base amount. The pensionable income is the annual income from labor earnings and public transfer systems below the social security ceiling of 7.5 price base amounts. To simplify calculations, we only account for the pensionable income that comes from labor earnings and the collection of disability benefits, but no other public transfer systems. The benefit level from the ATP is determined in several steps. First, the pension points for each year are calculated as the pensionable income above one price base amount divided by the current year price base amount. Since the social security ceiling is 7.5 price base amounts, the maximum number of pension points that can be collected each year is 6.5. Thereafter, the average pension points is calculated as the average of the individual's fifteen best years in terms of pension points collected. Finally, the individual's ATP pension income is calculated by applying the formula

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

where AP_i is the average pension points, BA is the price base amount, and N_i is the number of years with pension-rights income greater than zero.

uted less than thirty years to the scheme. The normal retirement age for both the basic and the supplementary pension is sixty-five, but both could be claimed in advance with a 0.5 percent actuarial reduction per month of early withdrawal from age sixty-one and delayed with an actuarial addition of 0.7 percent for each month of delay until age seventy. Individuals with no, or low, ATP are entitled to a special supplement of 56.9 percent of a BA, reduced on a one-to-one basis against the supplementary pension.

In the new public pension system contributions amount to 18.5 percent of pensionable income, of which 16 percent is credited to a notional defined contribution scheme and 2.5 percent is credited to a financial defined contribution scheme. In the calculations, we disregard the financial defined contribution scheme and attribute the full 18.5 percent to the notional defined contribution scheme. Therefore, we also do not describe the financial scheme but refer to Hagen (2013) for a detailed description.

In the notional defined contribution scheme, individuals collect notional pension rights based on their annual pensionable income and the annual contributions are used to finance current pension benefits in a pay-as-you-go system. The pensionable income is the total wage and public transfer income minus a 7 percent general pension contribution paid by all employees.[3] The maximum pensionable income is 7.5 income base amounts. Annual pensionable income must exceed a threshold of 42.3 percent of the price base amount to yield pension rights. The new pension system is based on the life-income principle and pension rights are accumulated from age sixteen or from year 1960. Accumulated pension rights are adjusted annually according to an income index reflecting the average wage growth. In this chapter, we assume an average wage growth of 1.6 percent throughout the period.

There is no normal pension age in the new public pension system, but the minimum age of withdrawal is sixty-one. Pension benefits at the age of retirement are calculated as the accumulated pension rights divided by an annuity divisor that is determined by average life expectancy for the given cohort at the given retirement age and an imputed real return of 1.6 percent. If the current year contributions are too small to cover the pension payments, an automatic balance mechanism is activated. In this chapter, we assume that funds are enough to finance the pension payments and disregard the automatic balance mechanism (for further details, see Hagen [2013]).

For individuals with no or low earnings, the new pension system also contains a means-tested pension supplement that replaced the universal basic pension and the special supplement in the old pension system from January 1, 2003. For cohorts born from 1938 onward, the so-called guaranteed pension amounts to 2.13 income base amounts minus public pension benefits if public pension benefits are smaller than 1.26 income base amounts. If public

3. The general pension contribution was introduced in 1999 and amounted to 6.95 percent in 1999 and 7 percent from 2000 onward.

pension benefits are larger than 1.26 income base amounts, the guaranteed pension is 0.87 income base amounts minus 48 percent of the public pension benefits that exceed 1.26 income base amounts. This implies that the guaranteed pension is phased out for individuals with public pension benefits above 3.07 income base amounts.

For those born before 1938, the rules for guaranteed pension are slightly different. For these cohorts, both public pension benefits and occupational pension benefits are taken into account. Given the sum of public and occupational pension (P), the formulas for the guaranteed pension benefits are:

$$P \times 1.5174 - 0.1193 - P, \quad \text{if } 0.25 < P < 1.354 \text{ income BA}$$

$$P \times 1.343 + 0.1168 - P, \quad \text{if } 1.354 \leq P < 1.529 \text{ income BA}$$

$$P \times 2.17 + (P - 1.51) \times 0.6 - P, \quad \text{if } 1.529 \leq P \leq 3.16 \text{ income BA.}$$

The Disability Insurance System

Before 2003, disability insurance was part of the old public pension system. Benefits were calculated in the same way as old-age pension, consisting of the basic pension and an income-related ATP supplement. As for old-age pension, the basic pension amounted to 96 percent of the basic amount for a single and 78.5 percent for a married disability pensioner. The special supplement for disability benefits was substantially larger than for old-age pension, however, at 112.9 percent of a basic amount, reduced on a one-to-one basis against the supplementary pension.

The supplementary pension in the old disability insurance system was based on an "assumed" income. The assumed income was calculated as the most favorable outcome from two different calculations. The first one was the average income of the two best out of the last four years before retirement. The second was the average income of half of the years during which the individual had positive pension points. The assumed income was used in the same formula as for old-age pension, but was not subject to the actuarial reduction for withdrawal in advance. The number of contribution years was calculated as the sum of the actual number of contribution years and the number of years between retirement and age sixty-four. If this sum was lower than thirty, benefits were reduced in the same way as for the old-age pension.

Since 2003, the disability insurance system is part of the social insurance system. Benefits are based on the assumed income, which is calculated as the average of the three highest annual earnings up to 7.5 income base amounts during the time frame immediately preceding labor force exit. The time frame is eight years for individuals below age forty-seven, seven years for individuals between ages forty-seven and fifty, six years for individuals between ages fifty and fifty-three, and five years for individuals above age fifty-three. Disability benefits amount to 64 percent of the assumed income. Individuals with low assumed income receive a guaranteed level of

disability benefits (amounting to 2.4 income BAs). Individuals also collect pension points and pension rights during periods with disability benefits. The collection is based on the total assumed income, not only on the benefit payments, during the years until age sixty-five. At age sixty-five, individuals are transferred from the disability insurance system to the public pension system, with no reduction in public pension benefits due to early withdrawal.

The eligibility rules for the DI have been changed on several occasions since the early 1970s.[4] Since the early 1990s there have been a series of reforms leading to more stringent rules for DI admittance. In 1991 the right to receive DI for long-term unemployed workers older than age sixty was abolished, and in 1997 the right to DI for labor market reasons combined with health reasons was abolished. In 2003 the eligibility rules were further tightened. The rules changed so that the ability to work should be tested against the entire labor market, not just the job that the insured worker was on when applying for DI. Finally, in 2008 a number of changes affecting eligibility were implemented. Most importantly, eligibility now required permanent disability.

Occupational Pension Plans, Taxation, and Means-Tested Benefits

In addition to the public pension system, the most important pension schemes on the Swedish labor market are the occupational pension plans. Sweden has a highly unionized labor market. More than 90 percent of the labor market is covered by central agreements. These agreements contain, among other things, pension benefits and supplementary disability insurance. There are four main programs: one for white-collar workers in the private sector, one for blue-collar workers in the private sector, one for central government employees and, finally, one for local government employees. A main motivation for all these programs is to ensure earnings above the social security ceiling at 7.5 BA. Palme and Svensson (1999, 2004) give a detailed description of these programs. We also provide a detailed description of the rules that applied during our period of study in the appendix.

The option value of delaying retirement also depends on taxes. During the period under study there has been a tax bracket creep in the state income tax system, but also an introduction of an earned income tax credit in 2007. The details of the tax system during this period are described in the appendix. We further account for means-tested benefits, which are also described in the appendix.

9.2.2 The Development of Disability Rates and Employment

The DI program is one of the most important programs in Sweden's income security system. Figure 9.1 shows the participation in the DI program since the early 1960s by different age groups for males and females,

4. The institutional changes are described and their employment effects are analyzed in Karlström, Palme, and Svensson (2008) and Jönsson, Palme, and Svensson (2012).

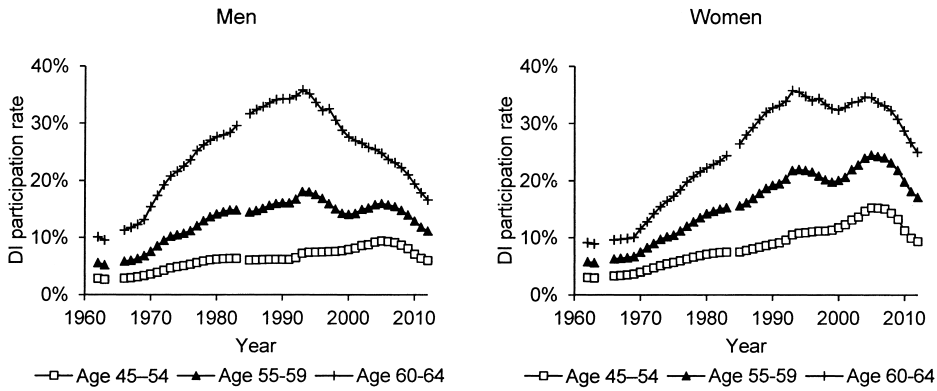

Fig. 9.1 DI participation rates by age and gender, 1962–2012

respectively. Figure 9.1 shows that there are huge variations in the participation rates, in particular for the age group sixty to sixty-four. This partially reflects the fact that, as described in section 9.2.1, the DI program has served somewhat different purposes over the period under study. In the 1970s and 1980s it was, for example, possible to get DI for labor market reasons. Older long-term unemployed workers were eligible for DI first for health reasons in combination with labor market reasons and then for labor market reasons alone. The decline in the DI participation rate reflects several changes in eligibility rules.

A key question in the study of how DI affects the labor market is, of course, to what extent the DI participation rate affects employment and labor supply. Figure 9.2 presents the development of employment along with the share receiving DI for each age and gender group. The development for females is affected by a strong trend toward higher female labor force participation in all age groups during the period under study. For males in all age groups, however, it is apparent that there is a relationship between employment and DI participation: when the DI participation rate increased from the early 1960s until the mid-1990s there was a trend toward a lower employment rate in this group. Likewise, when DI participation declined in the 1990s, there was an increase in the employment rate in this age group.

9.2.3 The Social Insurance Pathway to Retirement

Although the disability insurance program is by far the most common pathway for labor force exit for those who do not use old-age pensions, it is common that the insured worker starts his or her exit route in another program, such as unemployment insurance (UI) or sickness insurance (SI).[5] Although these are different programs with different requirements and

5. See Palme and Svensson (2004) for a detailed analysis of different exit routes from the Swedish labor market.

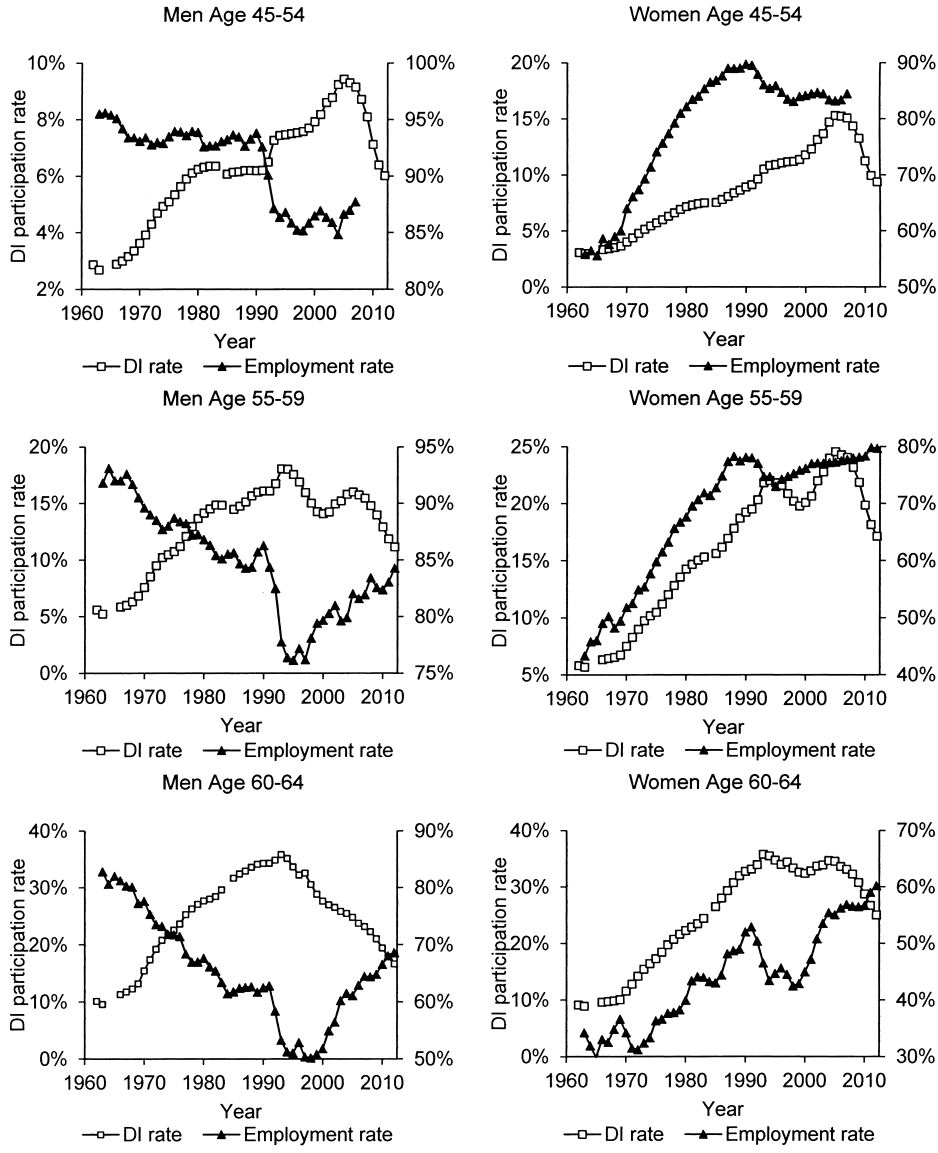

Fig. 9.2 DI participation rates and employment rates by age and gender, 1962–2012

regulations, the financial incentives in the programs are quite similar. In the option value calculations, we only model the incentives in the disability insurance program and let them represent the financial incentives in all of these programs as a simplification. In the definition of retirement we consider labor force exit through any of these insurance systems, or a combina-

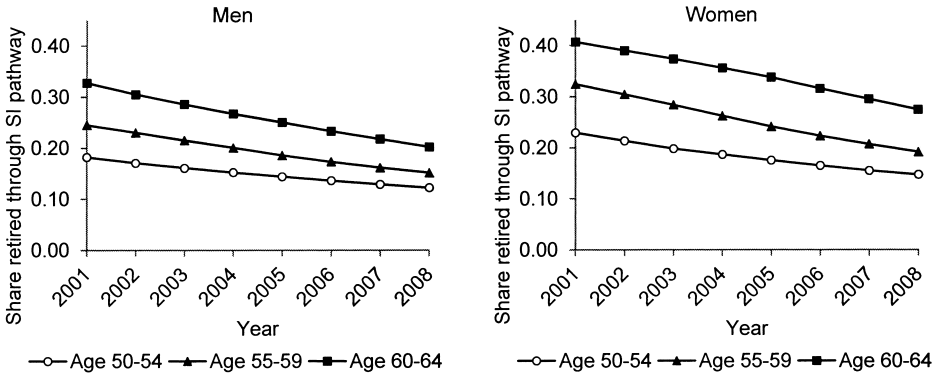

Fig. 9.3 Share retired through the social insurance pathway by age and gender, 2001–2008

tion of them, and label it the "social insurance pathway." In the empirical analysis we study retirement behavior between 2001 and 2008. Section 9.3 describes the data we use, the definition of retirement, and the pathways we consider in more detail. However, we will in this section give a brief overview of how the prevalence of the social insurance pathway has changed over time and how this prevalence differs within different population groups.

Figure 9.3 shows the share of individuals in the age groups fifty to fifty-four, fifty-five to fifty-nine, and sixty to sixty-four who have retired through the social insurance pathway between 2001 and 2008 among men and women, respectively. The social insurance pathway has been more commonly used among women than men in all age groups throughout the studied period. For both men and women, however, the share of the population who has retired through the social insurance pathway has decreased substantially over the studied period. The share has decreased from over 30 percent to about 20 percent among men in the age group sixty to sixty-four and from about 40 percent to less than 30 percent among women in the same age group between 2001 and 2008.

Figure 9.4 shows the share of individuals ages fifty to sixty-four in different education groups who have retired through the social insurance pathway between 2001 and 2008 among men and women, respectively. Retiring through the social insurance pathway is much more common in low-education groups among both men and women. The share of women retiring through the social insurance pathway is higher than for men in all education groups. The decrease in the use of the social insurance pathway over time is apparent for all education groups.

Figure 9.5 reveals that the higher disability rates among the low educated are also reflected in lower employment rates in the age group fifty to sixty-nine for males and females, respectively. The figure also shows that there is

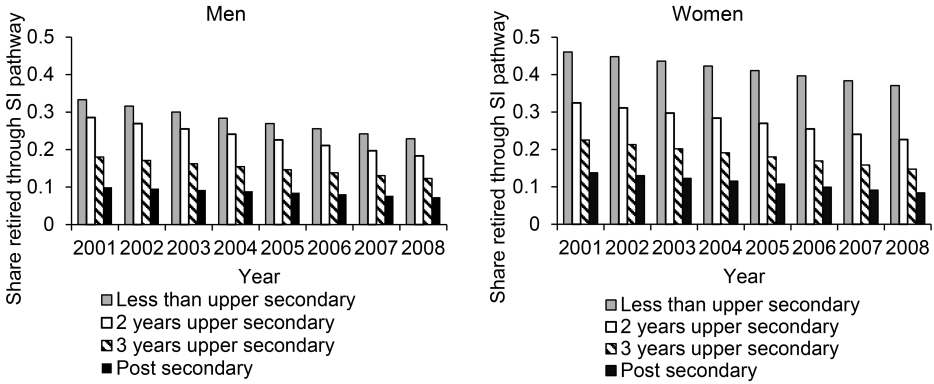

Fig. 9.4 Share retired through the social insurance pathway ages fifty to sixty-four by education and gender, 2001–2008

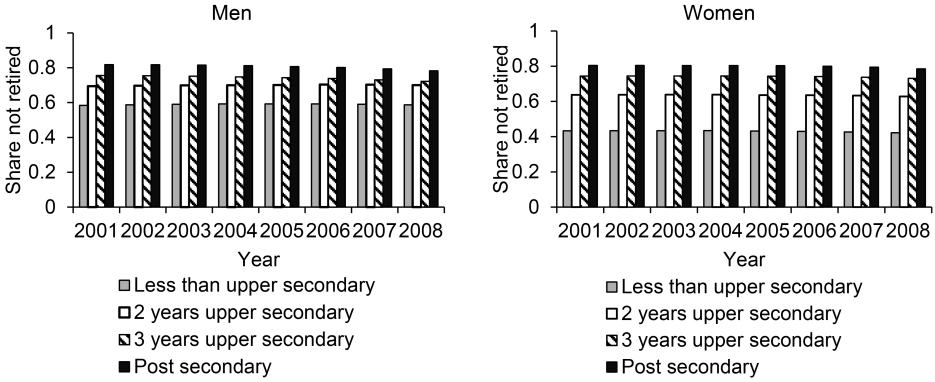

Fig. 9.5 Labor force participation ages fifty to sixty-nine by education and gender, 2001–2008

a much larger difference in employment by education group among women than men. Employment is almost twice as high—around 40 percent compared to almost 80 percent—for college-educated women compared to those with only compulsory schooling. The corresponding figures for men are 80 versus 60 percent, that is, the difference is that low-educated women work substantially less than the corresponding group among men.

Figure 9.6 shows the share of individuals ages fifty to sixty-four in different health quintiles who have retired through the social insurance pathway between 2001 and 2008 among men and women, respectively. The construction of the health measure is explained in section 9.3.3. The first quintile is the group with the most inferior health status. It is not surprising that the figure shows that the individuals in this group are most likely to retire through the social insurance pathway and that this likelihood decreases as

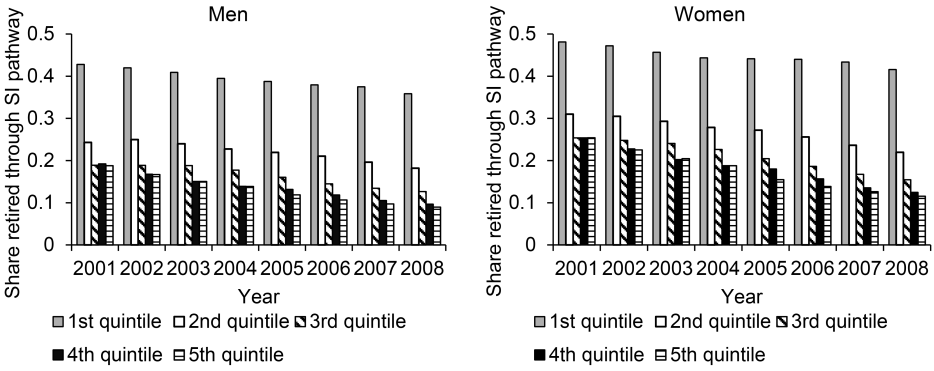

Fig. 9.6 Share retired through the social insurance pathway ages fifty to sixty-four by health and gender, 2001–2008

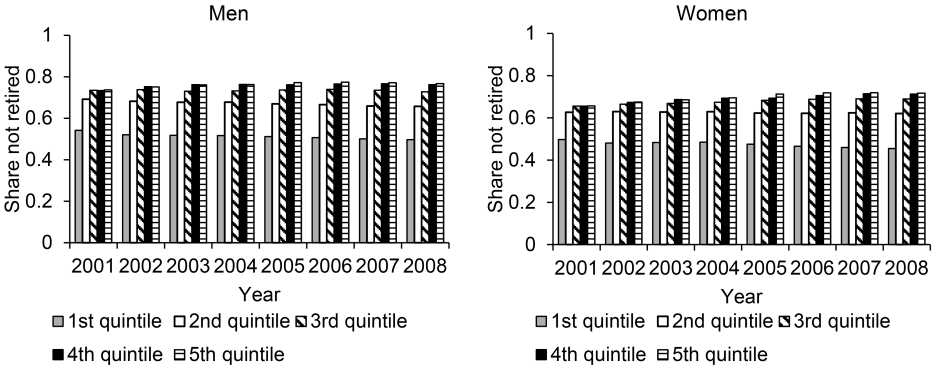

Fig. 9.7 Labor force participation ages fifty to sixty-nine by health and gender, 2001–2008

health improves across the quintiles.[6] It is interesting to note that the difference between the first quintile group and the other groups increases over time as the stringency in DI admittance increases. The likelihood to receive DI in the lowest health quintile is almost unchanged over time.

Figure 9.7 shows that the pattern from figure 9.6 on the probability of retiring through the social insurance pathway is repeated for labor force participation rates by health quintile in the age group fifty to sixty-nine for both men and women. The figure also shows that the increased labor force participation rate is primarily attributed to the groups with a good health status both among men and women.

6. As we explain in section 9.3.3, the health measure is improving over time due to more data. From 2005 we also have the drug prescription register, which improves the health index primarily for the highest quintiles.

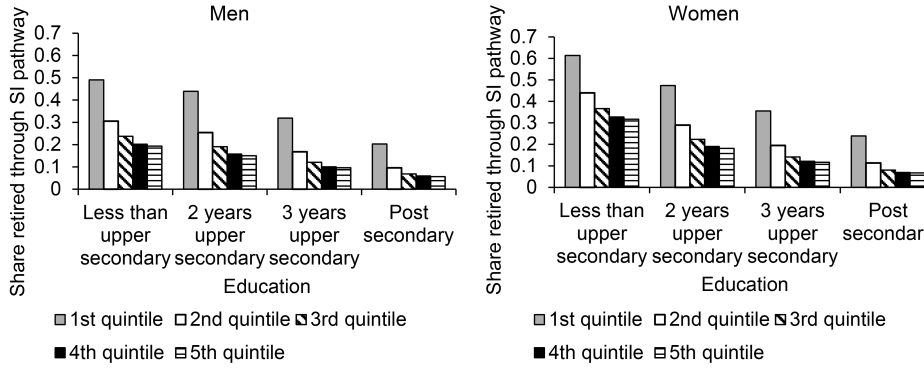

Fig. 9.8 Share retired through the social insurance pathway ages fifty to sixty-four by health and education, combined over the period 2001–2008

Finally, figure 9.8 shows the share of individuals who retired through the social insurance pathway in the age group fifty to sixty-four by health quintile and education group, combined over the entire period 2001–2008. The figure shows that the pattern across health quintiles seen in figure 9.6 is stable within education groups. It also shows that the pattern across education groups is stable within health quintiles, that is, the fact that the low educated are more likely to retire through the social insurance pathway is not only attributed to inferior health.

9.3 Data and Empirical Approach

9.3.1 Data and Definition of Retirement

We use data collected from different administrative registers including the entire Swedish population between ages fifty and sixty-nine. The registers were matched using the unique personal identification number (*personnummer*). Data on earnings by source of income along with different demographic characteristics are collected from the national tax register. We use the tax authority definition of spouse as either cohabiting or formally married (*samtaxerad*). This allows us to identify and match information on spousal income and demographic characteristics. Information on educational attainments is collected from the national education register. In section 9.3.3, we provide information about the registers used for obtaining individual measures of health status.

We use information on income from labor to define the year of labor force exit. In each year, a worker is defined as employed if labor earnings from employment or self-employment exceed one basic amount (BA), which corresponds to SEK 45,900 or USD 6,600 in 2010. A worker is defined as

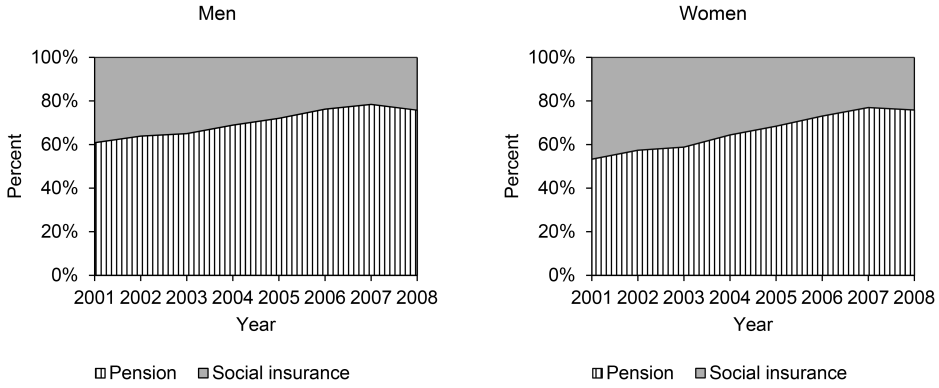

Figure 9.9 Pathways to retirement ages fifty to sixty-nine by gender, 2001–2008

retired in the year after the last observation of employment, if it is followed by at least two years of nonemployment. For a worker who is not observed in the data during the second year after the last year of employment, one year of nonemployment is sufficient to be defined as retired. The retirement age is the age in the last year of employment. An individual who is employed in the last year of observation has no retirement age. We have data of the Swedish population until 2010. Because of the way we define retirement, we are able to study retirement behavior until the year 2008. About 11.5 million person-year observations are included in the empirical analysis.

9.3.2 Pathways to Retirement

We consider two main pathways to retirement: the social insurance pathway and the old-age pension pathway. The pathway to retirement is defined on the basis of main income source during the years after the exit from the labor force and before age sixty-four. For each of these years we define the pathway from the largest income source. We then assign the pathway with most years to the individual. The social insurance pathway includes the total income from the sickness, disability, and unemployment insurances. The pension pathway includes the total income from occupational pension and public pension. A worker that retires at age sixty-five or later is assigned to the pension pathway, since eligibility for most social insurance benefits ceases at age sixty-five.

Figure 9.9 shows the pathways to retirement for men and women, respectively, during 2001–2008. The figure includes all individuals who retire between age fifty and sixty-nine during the period. The figure shows that the importance of the pension pathway has steadily increased for both men and women over the studied period. Although the pension pathway was less common among women than men in the beginning of the period, the impor-

tance of the pension pathway has increased more rapidly among women. By 2008, the pension pathway accounts for about 80 percent of all labor force exits in the age group fifty to sixty-nine among both men and women.

9.3.3 The Measurement of Health

We construct four different variables measuring health. The first one is the number of days the individual receives inpatient care during the year, that is, hospital care that requires the patient to stay overnight at the hospital. This information is available for the years 1986–2010 from the National Swedish Patient Register (see Socialstyrelsen 2009b). The second variable consists of the number of days receiving outpatient care during the year. This includes hospital care that does not require the patient to stay overnight at the hospital. The information for this variable comes from the National Swedish Patient Register and is available for the period 2001–2010.[7] The third variable consists of the total value of drug prescriptions to the individual during the year obtained from the National Prescription Register, available for the period 2005–2010. Finally, the fourth variable is subsequent mortality, which is available from the 1960s in the Cause of Death Register (see Socialstyrelsen 2009a).[8]

In a second step, we use these four variables to construct a health index for all individuals included in our sample. For each year, we create a health index based on the first principal component of the available health variables that year. We include the yearly values and two lags of inpatient care, outpatient care, and drug prescriptions, as well as two leads of mortality.

Figure 9.10 shows the average health percentile by age for men and women averaged for the years between 2001 and 2008. Men are on average in a higher health quintile than women, and health declines with age for both men and women. At older ages, however, the health of women is very similar to the health of men.

9.3.4 Option Value Calculations

We use the option value measure (see Stock and Wise 1990) for the economic incentive to remain in the labor force. The option value uses the value function measuring the utility for a particular individual at a particular age t for retiring at a particular age r as:

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

7. The coverage of the outpatient care register is not complete during the first years of the period and increases for each year. However, since we construct a health index for each year separately, this is not a concern. The information contained in the register helps dividing individuals into health quintiles, and the increased coverage of the register over time may lead to better measures of health during the later years.

8. Johansson, Laun, and Laun (2014) uses ex post mortality to analyze changes in screening stringency in Sweden's DI program.

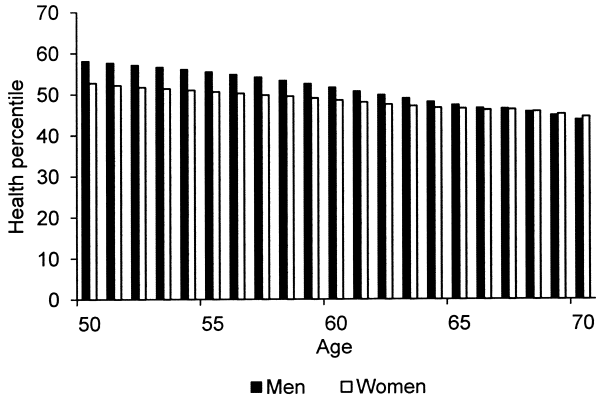

Fig. 9.10 Average health percentile by age for men and women

where $Y(s)$ is income from labor at age s, $B(s, r)$ is income from the income security system at age s if retiring at age r, β is the subjective discount rate $1/(1 + \delta)$, k reflects the marginal utility of leisure, and γ measures the marginal utility of consumption; *probalive*$(s|t)$ gives the probability of being alive at age s given survival until age t. The option value is then defined as the difference between the utility of retiring at age $t + 1$ compared to the utility of retiring at the optimal age r^*, the age yielding the highest utility value, that is,

$$\text{OVSS}(t) = V(t, r^*) - V(t, t + 1).$$

We do not estimate the parameters δ, k, and γ, but assign values similar to those that have been obtained in previous studies (see, primarily, Gruber and Wise 2004). We have chosen to set the subjective discount rate (δ) to 3 percent, k to 1.5, and γ to 0.75.

The income from the income security system depends, in addition to the retirement age, on how the individual leaves the labor force. As mentioned above, we consider two pathways to retirement: the social insurance pathway and the pension pathway. There is a possible endogeneity problem related to assigning a possible pathway to retirement for each individual in our sample. If we assign the more generous DI pathway to all, although we know that this is not an available option for a large share of the sample, it will appear as the individuals in the sample do not react on the more generous incentives to retire than they actually face and we will consequently underestimate the effect of economic incentives on retirement. If we instead assign the DI pathway when we observe that he or she has access to it, we will, of course, overestimate the effect of economic incentives.

To handle this endogeneity problem we use a probabilistic approach. This means that we calculate a weighted sum of the option value measure for the two pathways that we consider, that is,

$$\text{OVinclusive} = \text{DIweight} * \text{OVDI} + (1 - \text{DIweight})\text{OVSS},$$

where the OVDI is the option value measure for the DI pathway and OVSS is the option value for the old-age pension pathway; DIweight captures the likelihood that the DI path is available to the individual. These are determined based on the "stock estimator." The weight for the DI pathway is determined by the share of individuals between ages fifty and sixty-four who have exited through the social insurance pathway in each year, gender, and education group. The pathway probabilities were thus shown in figure 9.4.

In the data, the social insurance pathway includes income from the disability, sickness, and unemployment insurances. The major source, however, is disability insurance, with about 75 percent of the person*year observations including only disability benefits. Those who exit from the labor market through unemployment or sickness insurance switch, in most cases, to disability insurance after some time (see Palme and Svensson [2004] for a detailed analysis of different pathways). To simplify, we will only consider the economic incentives in disability insurance for the social insurance pathway.

The pension pathway consists of occupational pensions and the public old-age pension system. In the option value calculations, in addition to benefits from these two pension systems, we also take housing supplements as well as the special housing allowance for old-age pensioners, the so-called old-age support into account (see the appendix). For both pathways, we calculate the option value net of income taxes.

To make earnings backcasts and forecasts, we use earnings data for the entire population of Sweden during 1985–2010. Using an earnings equation as a function of age, age squared, and individual fixed effects, we backcast earnings to age twenty-three and forecast earnings until age seventy. That is, we assume that a worker starts working and collecting pension rights at age twenty-three. The option value is expressed in EUR 10,000 (2011).

We do not account for spouse or survivor benefits, but treat all individuals as if they were singles. Most of the financial incentives in the Swedish systems apply to the individual and not the household and the differences that do exist between married and singles are relatively minor.

Figure 9.11 shows the averages of the three different option value measures by age for men and women, respectively. The figure reveals some interesting features. First, it can be seen that the option value for the old-age pension pathway has a much steeper negative slope than the option value for the DI pathway and the weighted average reflected in the inclusive option value. This reflects the fact that the economic loss of retiring early is much larger for those who only have access to the old-age pathway. Second, it can be seen that the inclusive option value is as expected between the option value measures for the two main pathways, but much closer to the graph for the old-age pathway. This is because the weights, as reported in figure

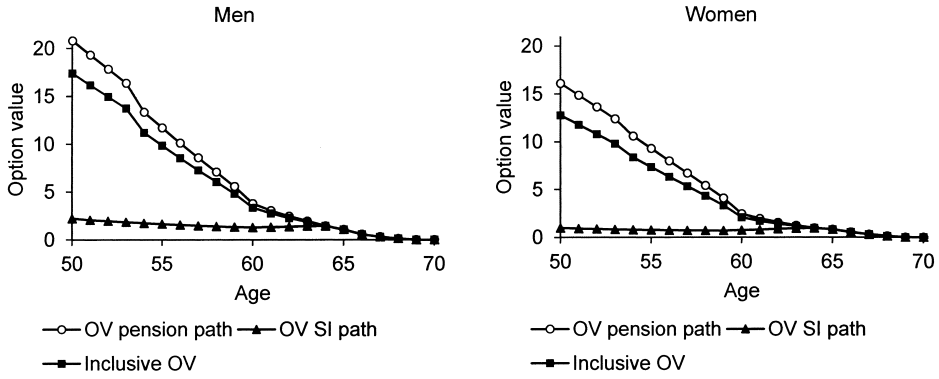

Fig. 9.11 Mean option value by age, gender, and pathway to retirement, 2001–2008

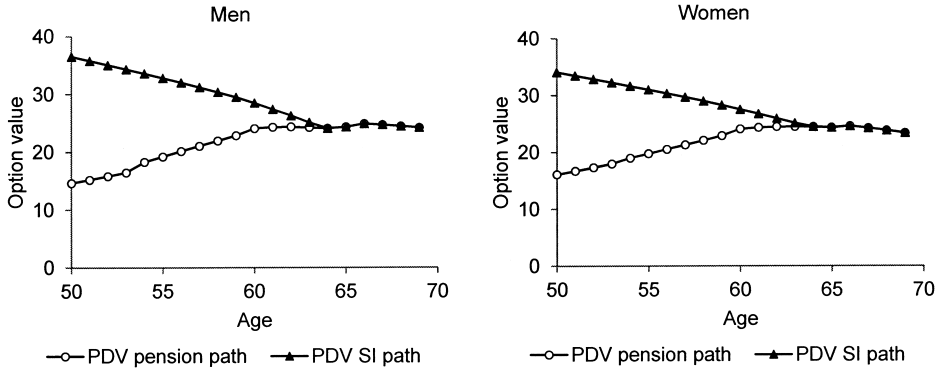

Fig. 9.12 Social security wealth (PDV) by age, gender, and pathway to retirement, 2001–2008

9.4, are larger for the old-age pension pathway. It should be noted, however, that these figures are based on a cross section and thus affected by sample attrition by age.

As a background to the option value figures, figure 9.12 shows the average social security wealth by age and pathway to retirement for men and women, respectively. It can be seen that the social security wealth for the DI pathway declines with retirement age, since the value of the DI payments that one gives up by delaying retirement exceeds the expected value of increases in the size of the benefits from longer work history. However, for the old-age pension pathway it increases up to age sixty, the minimum age for early withdrawal, and then reaches a horizontal phase. This suggests that, on average, the present value of the benefit payment one has to give up by remaining in the labor force is equal to the increase in the size of the future benefits from delaying retirement.

We use the following reduced form probit model to estimate the effect of economic incentives in the income security programs on retirement choice:

$$R_{it} = \delta_0 + \delta_1 \text{OVinclusive}_{it} + \delta_3 \text{AGE}_{it} + \delta_4 \text{HEALTH}_{it} + \delta_5 X_{it} + \varepsilon_{it},$$

where AGE_{it} represents the individual's age either by a linear variable or by indicators for each age, HEALTH_{it} is the individual health index and, finally, X_{it} is a vector of additional individual observable characteristics.

9.4 Results

9.4.1 Main Estimates

This section presents the results from the reduced-form retirement choice models. The estimates are obtained using probit models and are presented in three main sets. Tables 9.1A and 9.1B show the overall results for the entire sample. Tables 9.2A, 9.2B, 9.2C, and 9.2D describe sample heterogeneity in response to economic incentives with respect to health status and, finally, tables 9.3A and 9.3B show heterogeneity of the result with respect to differences in educational attainments.

The results for the coefficient of the option value variable should be interpreted as the effect of a 10,000-euro (measured in 2012 prices) change in the utility difference between retiring at a given age compared to retiring at the optimal age on the probability of retiring. The effect of a one standard deviation change in the option value measure is given in square brackets below the coefficients. In addition, all results are presented in a second version of the tables (9.1B, 9.2B, and 9.3B), where the coefficients are presented as the estimated response to a 1 percent change in the utility value of delaying retirement by one year.

Table 9.1A shows the results from eight different specifications. The first column shows the results when we, alongside the option value measure for retirement incentives and a linear age variable, have included dummy variables for each health quintile with the first quintile, and those with worse health status being the excluded category. As expected, there is a negative sign on the coefficient estimate for the option value measure. Thanks to an exceptionally large sample size, the precision of the estimate is impressively high and the estimate is highly significant. The magnitude of the estimate suggests that a 10,000-euro increase in the inclusive option value measure would lead to a 0.12 percentage point reduction in the retirement rate. The estimates also shows that those in the highest health quintile are on average about 1.6 percentage points less likely to exit the labor force compared to the quintile group with worse health status.

The second column in table 9.1A reports results from a specification where the linear age variable has been replaced by a more flexible specification with

Table 9.1A **Effect of inclusive OV on retirement**

	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OV inclusive	–0.0012***	–0.0020***	–0.0006***	–0.0015***	–0.0012***	–0.0020***	–0.0006***	–0.0015***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	[–0.0118]	[–0.0176]	[–0.0057]	[–0.0133]	[–0.0118]	[–0.0177]	[–0.0059]	[–0.0134]
Health quint 2	–0.0105***	–0.0109***	–0.0105***	–0.0109***				
(second lowest)	(0.0001)	(0.0001)	(0.0001)	(0.0001)				
Health quint 3	–0.0137***	–0.0142***	–0.0138***	–0.0142***				
	(0.0001)	(0.0001)	(0.0001)	(0.0001)				
Health quint 4	–0.0153***	–0.0158***	–0.0154***	–0.0159***				
	(0.0001)	(0.0001)	(0.0001)	(0.0001)				
Health quint 5	–0.0159***	–0.0164***	–0.0161***	–0.0165***				
(highest)	(0.0001)	(0.0001)	(0.0001)	(0.0001)				
Health index					–0.0002***	–0.0002***	–0.0002***	–0.0002***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age	0.0070***		0.0071***		0.0070***		0.0071***	
	(0.0000)		(0.0000)		(0.0000)		(0.0000)	
Age dummies		Included		Included		Included		Included
Female			0.0048***	0.0040***			0.0046***	0.0038***
			(0.0001)	(0.0001)			(0.0001)	(0.0001)
Married			0.0072***	0.0070***			0.0071***	0.0069***
			(0.0001)	(0.0001)			(0.0001)	(0.0001)

(*continued*)

Table 9.1A (continued)

	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spouse works			–0.0162***	–0.0149***			–0.0162***	–0.0149***
			(0.0001)	(0.0001)			(0.0001)	(0.0001)
Sector dummies			Included	Included			Included	Included
Two years upper			–0.0016***	–0.0012***			–0.0016***	–0.0012***
secondary			(0.0001)	(0.0001)			(0.0001)	(0.0001)
Three years upper			–0.0052***	–0.0044***			–0.0052***	–0.0044***
secondary			(0.0001)	(0.0001)			(0.0001)	(0.0001)
Postsecondary			–0.0109***	–0.0092***			–0.0109***	–0.0092***
			(0.0001)	(0.0001)			(0.0001)	(0.0001)
Observations	11,575,057	11,575,057	11,575,057	11,575,057	11,575,057	11,575,057	11,575,057	11,575,057
Mean ret. rate	0.0519	0.0519	0.0519	0.0519	0.0519	0.0519	0.0519	0.0519
Mean of OV	7.2557	7.2557	7.2557	7.2557	7.2557	7.2557	7.2557	7.2557
Std. dev. of OV	6.9829	6.9829	6.9829	6.9829	6.9829	6.9829	6.9829	6.9829

Note: Standard errors in parentheses, clustered by individual.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 9.1B Effect of percent gain in inclusive OV on retirement

	Specification			
	(1)	(2)	(3)	(4)
Percent gain in OV	–0.0104***	–0.0444***	0.0043***	–0.0315***
	(0.0003)	(0.0005)	(0.0003)	(0.0005)
Linear age	X		X	
Age dummies		X		X
Health quintiles	X	X	X	X
Other Xs			X	X
Observations	11,575,057	11,575,057	11,575,057	11,575,057
Mean ret. rate	0.0519	0.0519	0.0519	0.0519
Mean of % gain in OV	0.3145	0.3145	0.3145	0.3145
Std. dev. of % gain in OV	0.3311	0.3311	0.3311	0.3311

Note: Standard errors in parentheses, clustered by individual.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

age dummies for each one-year age group. The results seem to be quite robust to this change. The coefficient estimate changes from –0.0012 to –0.0020, a change on the fourth decimal. The specification shown in columns (3) and (4) corresponds to those in the first and second columns, but we now also include controls for a number of observable demographic characteristics potentially correlated with the inclusive option value measure. The result for the inclusive option value measure in the specification in the fourth column does not change much compared to the one in column (2). However, the estimate in the third column is substantially smaller in absolute value compared to the corresponding one in column (1). The estimates for the demographic variables show, for example, that women on average retire earlier, since they have an about 0.5 percentage point higher retirement rate than men. The estimates of the dummy variables for the different education levels indicate large differences in the timing of the exit from the labor market between different educational groups: the group with college or university education has on average about a 1.1 percentage point lower retirement rate compared to those with compulsory education only.

The models shown in the fifth through the eighth columns of table 9.1A correspond to the ones shown in the first four columns with the difference that the dummy variables for the five health quintiles are replaced by a linear variable in the health index used for constructing the quintile groups. The estimates of the inclusive option value measure for these alternative specifications are very similar to the corresponding original ones.

To sum up, the results from the eight specifications shown in table 9.1A all give negative and significant estimates of the inclusive option value measure,

that is, estimates show that economic incentives matter for the timing of the exit from the labor market. The preferred specification, which includes the most flexible specification in age and health differences together with controls for demographic variables shown in the fourth column, suggests that a 10,000-euro change in the inclusive option value would lead to a 0.15 percent change in the retirement rate. Since the average retirement rate is 5.19 percent in the age group under study, this implies that retirement would change by 2.9 percent. Table 9.1A also shows that a one standard deviation change in the option value would translate into a 1.34 percent lower retirement rate. The result in table 9.1B for this specification shows that a 1 percent increase in the option value would lead to a 3.15 percentage point reduction in the retirement rate.

Tables 9.2A and 9.2B show the same results as in tables 9.1A and 9.1B, but the sample is now divided by health quintile. For obvious reasons, we now only include the health index linearly as a control variable. The results reveal that the group with worse health status, the first quintile, reacts strongest on economic incentives. The coefficient estimates decrease monotonically across the five groups. However, if one relates the estimates to the average retirement rates in the groups, it can be seen that the percentage change is very similar in all groups. This is also true for the results of the response to the percentage change in the option value presented in table 9.2B.

Tables 9.2C and 9.2D present the results corresponding to results displayed in table 9.2A and 9.2B, but in which we instead have estimated a more restrictive model. Here the heterogeneous effects are estimated by adding an interaction between the option value and the linear health index to the regression model. In contrast to tables 9.2A and 9.2B, the marginal effects are decreasing with the level of health. Although statistically significant, the magnitude of the estimated heterogeneous effect is small.

Tables 9.3A and 9.3B show the results when the sample is divided into four groups by educational attainment. The first group includes individuals that have not obtained any education beyond the compulsory level, the second group consists of those with vocational education in addition to compulsory schooling, the third group consists of those who graduated from an academic track in their secondary education, and finally, the fourth group are those with college or university education. The specifications correspond to the first four specifications in table 9.1A, that is, all specifications include dummy variables for health quintiles; the specifications in the first and third columns includes linear controls for age, while those in the second and fourth columns use age dummies, and the specifications in the third and fourth columns include controls for the demographic characteristics shown in table 9.1B.

Although the estimates vary somewhat between the four different specifications, it seems that the low-education groups react more strongly on economic incentives in their retirement behavior. This result emerges more

Table 9.2A **Effect of inclusive OV on retirement by health quintile**

	Obs.	Mean ret. rate	Mean of OV	Std. dev. of OV	Specification (1)	(2)	(3)	(4)
OV: Quintile 1 (worst health)	1,700,751	0.0814	5.7588	5.9693	–0.0022***	–0.0034***	–0.0010***	–0.0024***
					(0.0001)	(0.0001)	(0.0001)	(0.0001)
					[–0.0144]	[–0.0216]	[–0.0068]	[–0.0154]
OV: Quintile 2	2,254,529	0.0568	6.6553	6.4598	–0.0016***	–0.0025***	–0.0008***	–0.0019***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
					[–0.0136]	[–0.0201]	[–0.0068]	[–0.0150]
OV: Quintile 3	2,477,592	0.0476	7.3671	6.9350	–0.0011***	–0.0018***	–0.0005***	–0.0014***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
					[–0.0112]	[–0.0168]	[–0.0052]	[–0.0126]
OV: Quintile 4	2,560,048	0.0426	7.9134	7.3947	–0.0008***	–0.0014***	–0.0004***	–0.0011***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
					[–0.0091]	[–0.0140]	[–0.0043]	[–0.0110]
OV: Quintile 5 (best health)	2,582,137	0.0414	8.0067	7.4514	–0.0007***	–0.0012***	–0.0003***	–0.0009***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
					[–0.0081]	[–0.0128]	[–0.0035]	[–0.0098]
Linear age					X		X	
Age dummies						X		X
Other Xs							X	X

Note: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 9.2B **Effect of percent gain in inclusive OV on retirement by health quintile**

	Obs.	Mean ret. rate	Mean % OV	Std. dev. % OV	Specification (1)	(2)	(3)	(4)
OV: Quintile 1 (worst health)	1,700,751	0.0814	0.2474	0.2764	–0.0196*** (0.0013)	–0.0700*** (0.0017)	0.0070*** (0.0012)	–0.0453*** (0.0017)
OV: Quintile 2	2,254,529	0.0568	0.2865	0.3026	–0.0162*** (0.0009)	–0.0579*** (0.0012)	0.0034*** (0.0008)	–0.0404*** (0.0012)
OV: Quintile 3	2,477,592	0.0476	0.3189	0.3284	–0.0091*** (0.0007)	–0.0420*** (0.0010)	0.0049*** (0.0006)	–0.0296*** (0.0009)
OV: Quintile 4	2,560,048	0.0426	0.3445	0.3541	–0.0047*** (0.0006)	–0.0312*** (0.0008)	0.0050*** (0.0005)	–0.0230*** (0.0008)
OV: Quintile 5 (best health)	2,582,137	0.0414	0.3489	0.3574	–0.0031*** (0.0006)	–0.0278*** (0.0009)	0.0058*** (0.0005)	–0.0200*** (0.0008)
Linear age					X		X	
Age dummies						X		X
Other Xs							X	X

Note: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 9.2C **Effect of inclusive OV on retirement with health index interaction**

	Specification			
	(1)	(2)	(3)	(4)
OV	–0.0003***	–0.0012***	0.0003***	–0.0007***
	(2.44e–05)	(2.59e–05)	(2.30e–05)	(2.53e–05)
	[–0.0026]	[–0.0104]	[0.0029]	[–0.0063]
OV*health index	–1.86e–05***	–1.58e–05***	–1.76e–05***	–1.53e–05***
	(4.42e–07)	(4.33e–07)	(4.06e–07)	(4.05e–07)
Health index	–0.000149***	–0.000164***	–0.000156***	–0.000169***
	(2.28e–06)	(2.43e–06)	(2.20e–06)	(2.35e–06)
Linear age	X		X	
Age dummies		X		X
Other Xs			X	X
Observations	11,575,057	11,575,057	11,575,057	11,575,057
Mean ret. rate	0.0519	0.0519	0.0519	0.0519
Mean of OV	7.2557	7.2557	7.2557	7.2557
Std. dev. of OV	6.9829	6.9829	6.9829	6.9829

Note: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 9.2D **Effect of percent gain in inclusive OV on retirement with health index interaction**

	Specification			
	(1)	(2)	(3)	(4)
OV	0.0131***	–0.0239***	0.0254***	–0.0121***
	(0.0005)	(0.0006)	(0.0005)	(0.0006)
OV*health index	–0.0005***	–0.0004***	–0.0004***	–0.0004***
	(9.75e–06)	(9.95e–06)	(8.66e–06)	(9.11e–06)
Health index	–0.0002***	–0.0002***	–0.0002***	–0.0002***
	(2.22e–06)	(2.39e–06)	(2.12e–06)	(2.29e–06)
Linear age	X		X	
Age dummies		X		X
Other Xs			X	X
Observations	11,575,057	11,575,057	11,575,057	11,575,057
Mean ret. rate	0.0519	0.0519	0.0519	0.0519
Mean of OV	0.3145	0.3145	0.3145	0.3145
Std. dev. of OV	0.3311	0.3311	0.3311	0.3311

Note: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 9.3A **Effect of inclusive OV on retirement by education group**

	Obs.	Mean ret. rate	Mean of OV	Std. dev. of OV	Specification (1)	(2)	(3)	(4)
OV: < upper secondary	2,634,666	0.0709	4.4487	4.5582	–0.0019***	–0.0042***	–0.0011***	–0.0036***
					(0.0001)	(0.0001)	(0.0001)	(0.0001)
					[–0.0109]	[–0.0226]	[–0.0062]	[–0.0195]
OV: 2 years upper secondary	3,541,791	0.0519	5.9837	5.1799	–0.0015***	–0.0034***	–0.0015***	–0.0037***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
					[–0.0104]	[–0.0222]	[–0.0105]	[–0.0243]
OV: 3 years upper secondary	3,104,564	0.0455	8.4283	7.0607	–0.0003***	–0.0008***	–0.0002***	–0.0008***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
					[–0.0029]	[–0.0070]	[–0.0023]	[–0.0069]
OV: Post secondary	2,294,036	0.0385	10.8562	9.3225	–0.0003***	–0.0005***	–0.0002***	–0.0005***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
					[–0.0035]	[–0.0066]	[–0.0032]	[–0.0066]
Linear age					X		X	
Age dummies						X		X
Health quintiles					X	X	X	X
Other Xs							X	X

Note: ***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 9.3B **Effect of percent gain in inclusive OV on retirement by education group**

	Obs.	Mean ret. rate	Mean of % OV	Std. dev. of % OV	Specification (1)	(2)	(3)	(4)
OV: < Upper secondary	2,634,666	0.0709	0.1988	0.2176	–0.0173***	–0.1000***	0.0059***	–0.0828***
					(0.0013)	(0.0016)	(0.0013)	(0.0016)
OV: 2 years upper secondary	3,541,791	0.0519	0.2709	0.2552	–0.0086***	–0.0751***	–0.0063***	–0.0812***
					(0.0007)	(0.0010)	(0.0008)	(0.0010)
OV: 3 years upper secondary	3,104,564	0.0455	0.3693	0.3493	0.0065***	–0.0159***	0.0080***	–0.0153***
					(0.0005)	(0.0006)	(0.0005)	(0.0007)
OV: Post secondary	2,294,036	0.0385	0.4408	0.4414	0.0063***	–0.0062***	0.0060***	–0.0064***
					(0.0003)	(0.0006)	(0.0003)	(0.0005)
Linear age					X		X	
Age dummies						X		X
Health quintiles					X	X	X	X
Other Xs							X	X

Note: ***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

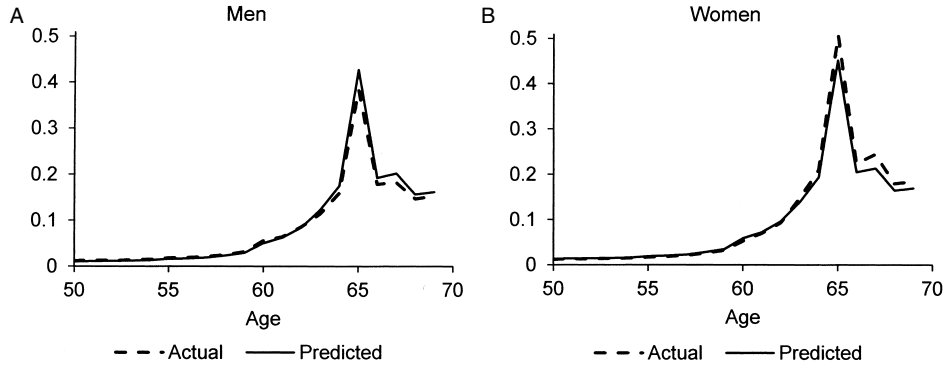

Fig. 9.13 Actual and predicted retirement hazard rates: *A*, men; *B*, women

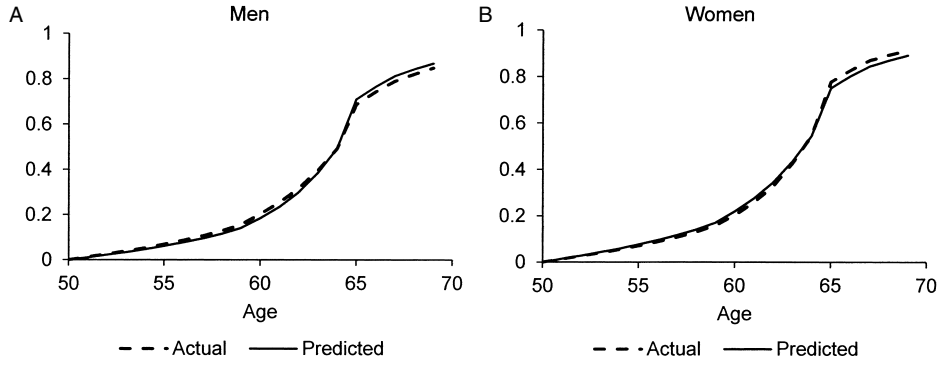

Fig. 9.14 Actual and predicted cumulative retirement hazard rates: *A*, men; *B*, women

clearly if one compares the lowest and the highest education groups. The coefficient estimates for the inclusive option value measure is significantly larger in all specifications for the low-education group.

9.4.2 The Model Fit

To evaluate the model we use the preferred specification, shown in the fourth column in tables 9.1A and B, 9.2A–D, and 9.3A and B. The evaluation of the model fit is of particular importance for the simulation analysis presented in section 9.5. Figure 9.13 shows the results when this model is used to predict the retirement rates by age and compare it with the actual retirement pattern. Panels A and B of figure 9.13 compare the hazard rates by age for males and females, respectively, and figure 9.14, panels A and B show the corresponding results for the cumulative distribution function.

From these figures it can be seen that the model underestimates retirement in relatively early ages and overestimates it in later ages for men. The

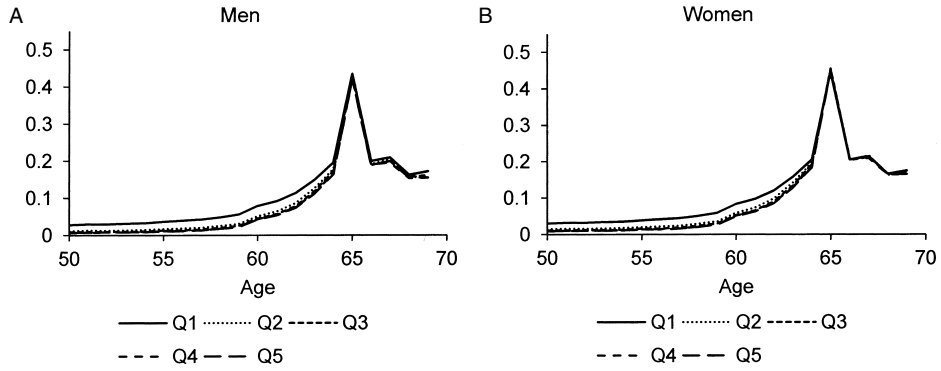

Fig. 9.15 Simulated retirement hazard by health quintile: *A*, men; *B*, women

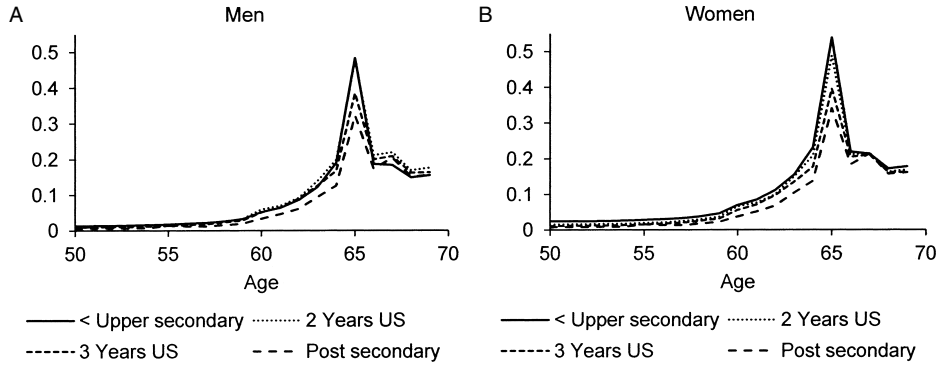

Fig. 9.16 Simulated retirement hazard by education group: *A*, men; *B*, women

opposite is true for women. Overall, however, it is apparent that the model gives a very good prediction of the actual outcome.

9.4.3 Descriptive Key Results in Graphical Form

Figures 9.15 and 9.16 show the results of tables 9.2A–D and 9.3A and B graphically. Panels A and B of figure 9.15 show the predicted retirement hazards by age for the five health quintiles, for males and females, respectively. It can be seen that the largest difference in retirement behavior is between the first quintile, those with worse health status, compared to the other four groups. This is true for both males and females.

Panels A and B of figure 9.16 show the differences in predicted retirement hazards between the four groups with different educational attainments. In general, it can be seen that the differences between groups with different educational attainments are somewhat larger compared to those between the quintile groups with different health status.

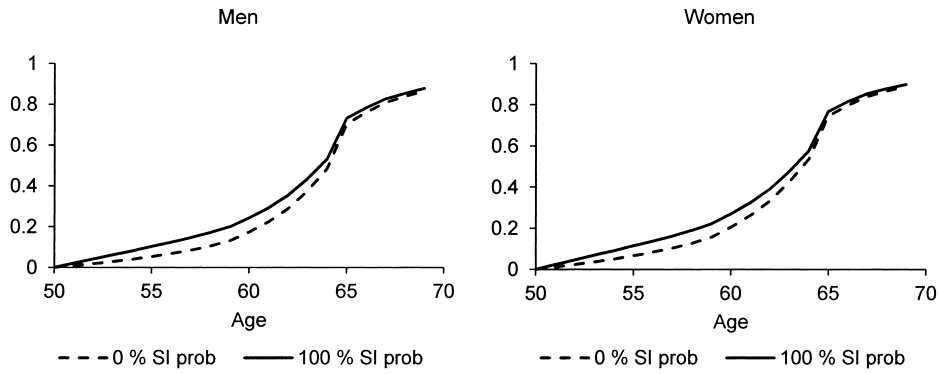

Fig. 9.17 Cumulative retirement hazard from simulations with 0 percent and 100 percent SI probability

9.5 Implications of Changes in DI Eligibility Screening

A key motivation for the study of how economic incentives affect retirement behavior is that it has implications for how screening stringency in the disability insurance program affects labor force participation rates among older workers. If an older worker is denied DI, an alternative is to claim old-age pension, which is a less generous exit path given actuarial reductions for early withdrawal. We use our estimated preferred model (table 9.1A, column [4]) to simulate the difference in retirement behavior in our sample under the hypothetical policy regime that *all* workers were eligible for the DI pathway—regardless of health status—compared to the regime where *no one* was eligible, that is, if only the old-age pension path is available. The driving force behind the observed differences is purely that the insured individuals are affected by economic incentives in their decision on when to leave the labor force.

Figure 9.17 shows the cumulative retirement hazards for these two policy simulations for males and females, respectively. As a summary of the effects of the policy simulations, figure 9.18 shows the expected remaining number years of work between ages fifty and sixty-nine of the two hypothetical policy regimes compared to the actual state. As expected, the cumulative hazard function for the policy regime where all workers are eligible for DI are everywhere above the corresponding regime with no DI. As can be seen in the summary measure in figure 9.18, the simulated difference between the expected lengths of the work life is 0.82 years, or a 5.9 percent prolonging of the work life after age fifty for men, and 0.75 years, or 5.6 percent, for women.

Disability insurance is not a relevant exit path from the labor force for quite a large share of the population. This implies that the simulations shown

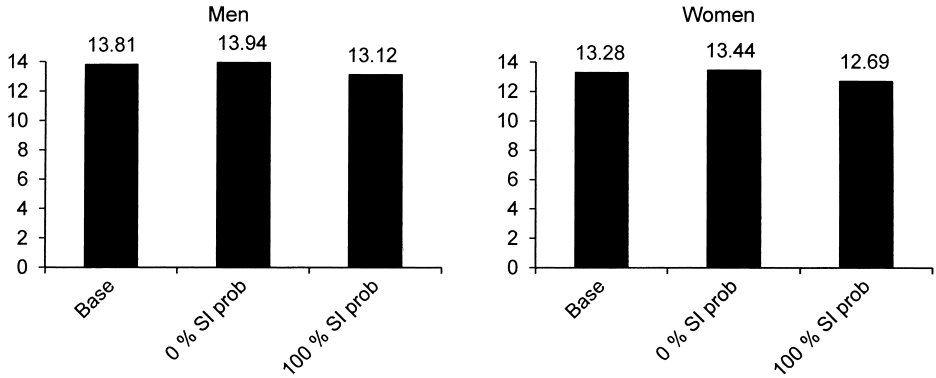

Fig. 9.18 Expected years of work between ages fifty and sixty-nine, base case and various simulations

above overestimate the effect though economic incentives of every relevant policy reform altering the DI screening stringency and should therefore be interpreted as an "upper bound" for possible effects of such reforms. However, the problem is that we do not know the size of the group for which DI is a relevant exit path depending on screening stringency. In addition, the group for whom it is a relevant exit path differs from those for which it is not on several observable as well as unobservable characteristics.

The most restrictive definition of the group for which disability insurance is a relevant exit path is to include only those who we observe use the DI pathway for exit from the labor force. As an alternative simulation strategy, we therefore repeat the simulations reported above on the subsample of individuals that we observe retiring through the disability insurance path separately. The economic incentives for retirement facing these individuals may differ from what we observe in the entire sample. These differences may generate differences in the result of the simulation. However, since we use the same estimated models as in the simulations reported above, possible heterogeneity parameters reflecting sensitivity to economic incentives in retirement behavior between the two samples are not taken into account.

Figure 9.19 shows the cumulative distribution functions for the subsample of DI recipients under different regimes of DI acceptance probabilities. The graphs stop at age sixty-three, that is, at the age when the individuals consider retiring at age sixty-four, which is the oldest age for DI eligibility. In addition to the simulation where we shut down the DI option—that is, zero probability of DI acceptance—and the simulation where everybody is eligible for DI, we also consider the cases where one-third and two-thirds of the group is eligible for DI. As expected, the differences between the simulations with 0 percent probability versus 100 percent probabilities, shown in

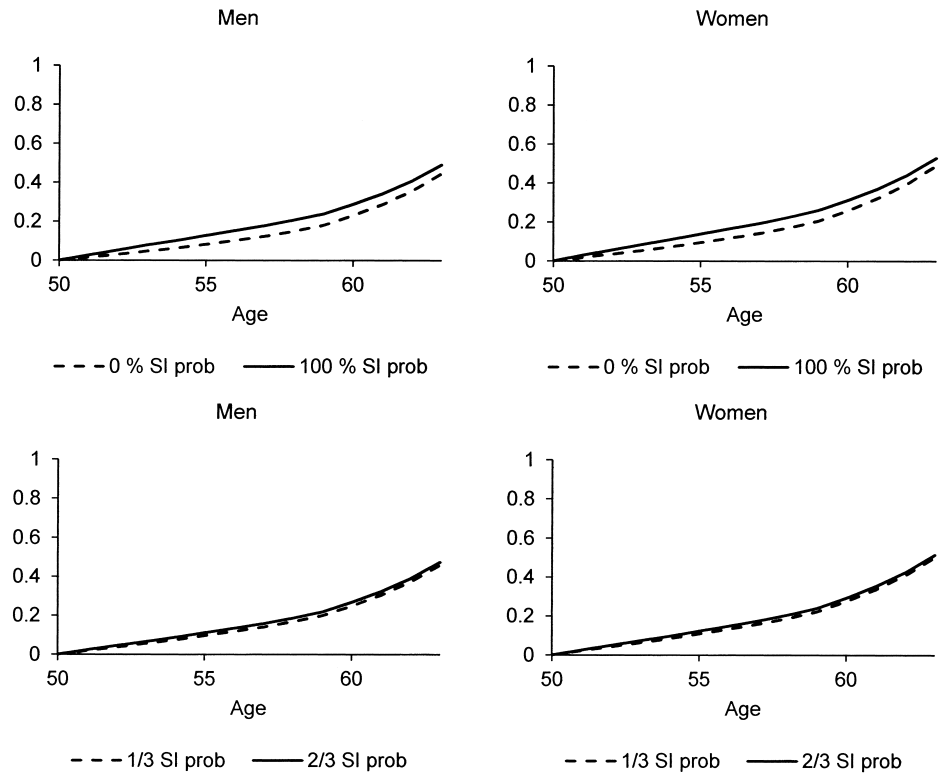

Fig. 9.19 Cumulative hazard functions for different DI probabilities: Males and females, respectively

the two upper panels of figure 9.19, are much larger than the simulation of two-thirds versus one-third DI probabilities, shown in the two lower panels of figure 9.19.

As a summary measure for the simulations, figure 9.20 shows the simulated expected remaining time in the labor force at age fifty under the different policy regimes described above. Comparing the results shown in figure 9.20 with the corresponding ones for the entire sample shown in figure 9.18, it can be seen that the simulated expected duration of the remaining work life is considerably shorter for those retiring through the DI program. This reflects the fact that these individuals on average have an inferior health status and lower educational attainments than the rest of the sample. However, comparing the simulated differences between the policy regimes in figure 9.20 with those in figure 9.18 suggest that the policy response is quite similar in the two samples. This suggests that differences in economic incentives in retiring through the DI path do not drive the observed differences in retirement ages.

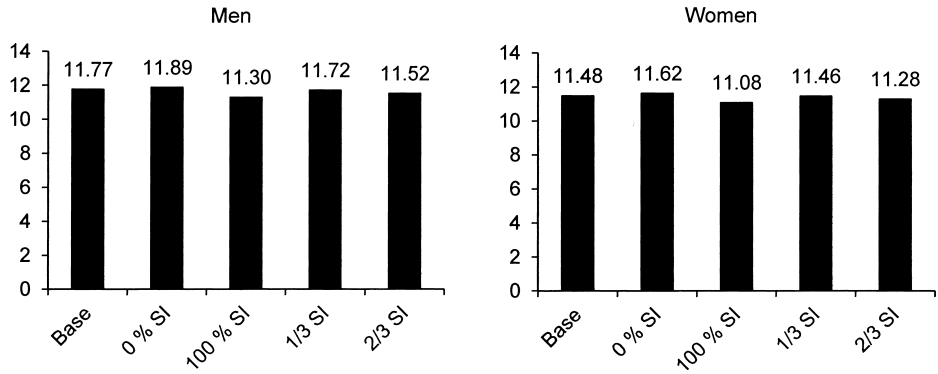

Fig. 9.20 Expected number of years of remaining work life at age fifty under different DI acceptance probabilities

9.6 Conclusions

In this chapter we first estimate an econometric model for the choice between staying in the labor market and leaving it for older workers in Sweden. We consider the economic incentives of two different exit paths from the labor force: the old-age pension path and a composite path consisting of other income security programs, where the DI program is the most important. We then simulate the effect if the probability of being admitted to DI is changed from 0 to 100 percent. The behavioral response to these changes comes through how the individuals in the sample respond to economic incentives in their retirement decision.

We find that the option value of retirement has a statistically significant impact on retirement behavior, that is, economic incentives generated by income taxes and the income security system significantly affects the timing of the exit from the labor market. We also find that there are statistically significant differences between different population groups. The quintile group with the most inferior health status reacts stronger on economic incentives and the strength of the reaction seems to decrease monotonically with health. The difference is even larger between groups with different educational attainments. People with lower education are more sensitive to economic incentives in their retirement behavior.

The simulation exercises, however, show that the effects of economic incentives, through changes in the stringency of DI admittance, overall are quite small. Going from 0 to 100 percent DI admittance probability in the male population would decrease the expected number of years in the labor force at age fifty from 13.93 to 13.17 years.

In Jönsson, Palme, and Svensson (2012), it was shown that changes in the rules for DI eligibility in the long run gave very sizable effects on labor force participation. Also, figure 9.2 in section 9.2.2 of this chapter shows

that employment in the age group sixty to sixty-four increased from around 50 percent in the year 2000 to almost 70 percent in 2012. Our results suggest that such huge changes could not have been driven by economic incentives alone. Other factors such as social norms, credit constraints, and changes in population health may also have been important.

Appendix

Sweden's Occupational Pensions, Income Taxes, and Housing Allowances

Occupational Pensions

The Central Government Sector

The employees in the central government sector included in our sample are covered by two different pension agreements. Those born before 1943 are covered by the PA-91 Act, and the cohorts born from 1943 are covered by the PA-03 Act. The PA-03 replaced PA-91 in 2003. The pension age in both agreements is sixty-five, but pension can be claimed from age sixty under PA-91 and from age sixty-one under PA-03 with an actuarial reduction in benefits. Pension withdrawal can also be delayed with an actuarial increase in benefits.

The PA-91 Act includes a defined benefit pension and a supplementary defined contribution pension. The defined benefit pension in PA-91 is based on the average earnings up to 30 increased price base amounts during the five years preceding retirement. The pension from age sixty-five is 10 percent of the pensionable income below 7.5 increased price base amounts, 65 percent of the pensionable income between 7.5 and 20 increased price base amounts, and 32.5 percent of the pensionable income between 20 and 30 increased price base amounts. For each month of early withdrawal, benefits on the pensionable income below 7.5 increased price base amounts are reduced by 2.6 percent and benefits on the pensionable income between 7.5 and 30 price base amounts are reduced by 0.4 percent. For each month of delayed withdrawal benefits, all levels are increased by 0.4 percent. The pension below age sixty-five is 101 percent of the pensionable income below 1 increased price base amount, 65 percent of the pensionable income between 1 and 20 increased price base amounts, and 32.5 percent of the pensionable income between 20 and 30 increased price base amounts. In addition, benefits below age sixty-five are reduced by 0.4 percent for each month of early withdrawal. Benefits are also reduced proportionally if the number of contribution years from age twenty-eight is less than thirty.

The contributions for the supplementary defined contribution pension in PA-91 amounted to 1.5 percent of the pensionable income from January 1991 to March 1994 and to 1.7 percent from April 1995. Pension rights are collected between ages twenty-eight and sixty-five, and are also accounted for during years with disability benefits and early withdrawal of pension benefits. The defined contribution pension can be withdrawn lifelong or as a temporary pension. Pension rights collected under PA-91 are also accounted for the cohorts born after 1942.

The PA-03 consists of two defined contribution pensions and one defined benefits pension. The first defined contribution pension in PA-03 is the individual pension. The premium amounted to 2.3 percent of annual income during 2003–2007 and 2.5 percent from 2008 for income up to 30 income base amounts. Pension rights are collected between ages twenty-three and sixty-five and are also accounted for during years with disability benefits and early withdrawal of pension benefits. The individual pension can be collected from age sixty-one and is paid out lifelong.

The second defined contribution pension in PA-03 is the supplementary pension. The premium amounted to 1.9 percent of annual income during 2003 and 2.0 percent since 2004 for income up to 30 income base amounts. Pension rights were collected between ages twenty-eight and sixty-five until 2007 and between ages twenty-three and sixty-five since 2008. The supplementary pension is paid out lifelong or as a temporary pension.

The defined benefits pension in PA-03 is based on the pensionable income, calculated as the average income during the five years preceding retirement. In the long run, the defined benefits pension from age sixty-five will only be provided for individuals with income above 7.5 income base amounts and will amount to 60 percent of the pensionable income between 7.5 and 20 income base amounts and 30 percent of the pensionable income between 20 and 30 income base amounts. Cohorts born between 1943 and 1972 are covered by transitional rules, however. For the cohorts born between 1943 and 1958, included in this chapter, pension benefits amount to between 6.3 percent for the youngest cohort to 9.5 percent for the oldest cohort on the income below 7.5 income base amounts, between 62.60 percent for the youngest cohort, 64.85 percent for the oldest cohort on the pensionable income between 7.5 and 20 income base amounts, and between 30.9 percent for the youngest cohort and 32.4 percent for the oldest cohort on the pensionable income between 20 and 30 income base amounts. Benefits are reduced proportionally if the number of contribution years from age twenty-eight is less than thirty.

Individuals on disability benefits are also granted supplementary benefits from the state occupational pension plan from the retirement age up to age sixty-five. The supplementary disability benefits amounted to 21 percent on income up to 7.5 increased price base amounts, 81 percent on income between 7.5 and 20 increased price base amounts, and 40.5 percent

on income between 20 and 30 increased price base amounts between 2001 and 2007. From 2008, the supplementary disability benefits amount to 15 percent on income up to 7.5 increased price base amounts, 75 percent on income between 7.5 and 20 increased price base amounts, and 37.5 percent on income between 20 and 30 increased price base amounts.

White-Collar Workers in the Private Sector

Private sector white-collar workers born before 1979 are covered by the ITP2 occupational pension plan. The scheme consists of a defined benefit pension and a defined contribution pension. The pension age is sixty-five, but pension can be withdrawn early from age fifty-five and delayed until age seventy. For each month of early or delayed withdrawal, benefits are adjusted according to the pension funds actuarially calculated guidelines.

The pensionable income under the defined benefit plan is the annual income up to 30 income base amounts in the year before retirement. The occupational pension is 10 percent of the pensionable income below 7.5 income base amounts, 65 percent of the pensionable income between 7.5 and 20 income base amounts, and 32.5 percent of the pensionable income between 20 and 30 income base amounts. Benefits are reduced proportionally if the number of contribution years from age twenty-eight is less than thirty.

The contributions for the supplementary defined contribution pension in ITP2 amounted to 2 percent of the pensionable income from 1977. Pension rights are collected between ages twenty-eight and sixty-five. If the individual retires before age sixty-five but after age sixty-two, pension rights are accounted for until age sixty-five based on the pensionable income at the time of retirement. The supplementary defined contribution pension is paid out lifelong or as a temporary pension.

Individuals on disability benefits are also granted supplementary benefits from the state occupational pension plan from the retirement age up to age sixty-five. The supplementary disability benefits amount to 15 percent on income up to 7.5 increased price base amounts, 65 percent on income between 7.5 and 20 increased price base amounts, and 32.5 percent on income between 20 and 30 increased price base amounts.

The Municipality Sector

Cohorts in the municipality sector born before 1938 are covered by the PA-KL agreement. The pension points (P) for the defined benefit pension in PA-KL are the average earnings during the best five years of the seven years preceding retirement up to 30 increased price base amounts divided by the increased price base amount. Gross pension points are calculated according to the following formula:

- $0.785*P + 0.1750$ if pension points are between 1 and 2.5 increased price base amounts,

- $0.6*P + 0.6375$ if pension points are between 2.5 and 3.5 increased price base amounts,
- $0.64*P + 0.4975$ if pension points are between 3.5 and 7.5 increased price base amounts,
- $0.65*P + 0.4225$ if pension points are between 7.5 and 20 increased price base amounts, and
- $0.325*P + 6.9225$ if pension points are between 20 and 30 increased price base amounts.

Gross pension points are reduced proportionally if the number of contribution years from age twenty-eight is less than thirty. The supplementary occupational pension from PA-KL is the difference between gross pension points and the pension payments from the public pension system. The pension age is sixty-five, but benefits can be claimed from age sixty with an actuarial reduction. The reduction is 0.3 percent per month if claimed at age sixty-four, 0.304 percent per month if claimed at age sixty-three, 0.339 percent per month if claimed at age sixty-two, 0.379 percent per month if claimed at age sixty-one, and 0.395 percent per month if claimed at age sixty. Benefits are increased by 0.1 percent for each month of delayed withdrawal up to age sixty-seven.

Cohorts in the municipality sector born from 1938 onward were covered by the PFA98 and PFA01 agreements until January 1, 2006. These agreements consist of a defined contribution pension scheme for all workers and a supplementary defined benefit scheme for workers with earnings above 7.5 income base amounts. Under the defined contribution pension scheme, the premium amounts to 4.5 percent of annual earnings up to 7.5 income base amounts and 2.1 percent of annual earnings between 7.5 and 30 income base amounts. Pension rights are collected between ages twenty-eight and sixty-five. Pension could be withdrawn early from age sixty-one and delayed to age sixty-seven.

The supplementary defined benefit scheme in PFA98 and PFA01 was based on the pensionable income, calculated as the average earnings during the best five years of the seven years preceding retirement up to 30 increased price base amounts. The supplementary pension amounts to 62.5 percent on pensionable income between 7.5 and 20 income base amounts and to 31.25 percent on pensionable income between 20 and 30 income base amounts. Benefits can be withdrawn early from age sixty-one and delayed until age sixty-seven, with a reduction in benefits of 0.4 percent per month of early withdrawal and an increase in benefits of 0.4 percent per month of delayed withdrawal. Benefits are reduced proportionally if the number of contribution years from age twenty-eight is less than thirty.

Since January 1, 2006, workers in the municipality sector are covered by the agreement KAP-KL, consisting of a defined contribution pension scheme and a supplementary defined benefits scheme. The premium for the

defined contribution pension is 4 percent of annual earnings up to 30 income base amounts during 2006 and 2007, 4.25 percent during 2008 and 2009, and 4.5 percent from 2010 onward. For workers born between 1938 and 1943, however, the premium is the same as in the PFA agreements described above.

The pensionable income in the supplementary defined benefits scheme in KAP-KL is again calculated as the average earnings during the best five years of the seven years preceding retirement up to 30 increased price base amounts. For cohorts born before 1946, the supplementary pension is the same as under the PFA agreements, amounting to 62.5 percent on earnings between 7.5 and 20 income base amounts and to 31.25 percent on pensionable income between 20 and 30 income base amounts. For successive cohorts, benefits are gradually reduced to a level of 55 percent on earnings between 7.5 and 20 income base amounts and to 27.5 percent for earnings between 20 and 30 income base amounts, for cohorts born in 1967 or later. Benefits can be withdrawn early from age sixty-one and delayed until age sixty-seven, with a reduction in benefits of 0.4 percent per month of early withdrawal and an increase in benefits of 0.4 percent per month of delayed withdrawal. Benefits are reduced proportionally if the number of contribution years from age twenty-eight is less than thirty.

Blue-Collar Workers in the Private Sector

Since 1996, blue-collar workers in the private sector are covered by the SAF-LO agreement, which is a defined contribution scheme. Before then, workers were covered by the STP plan, which is a defined benefits scheme. Cohorts born after 1968 are fully covered by the SAF-LO agreement, whereas cohorts born between 1932 and 1968 are subject to special transitional rules between the two schemes. The premium under the SAF-LO agreement was 2 percent of annual earnings before the year 2000, and is 3.5 percent on annual earnings from 2000 onward. Pension rights are collected between ages twenty-one and sixty-five. Pension can be collected from age fifty-five.

The transitional rules for cohorts born between 1932 and 1968 are somewhat complicated and we have not been able to find any documents explaining these rules. We only had these rules explained to us by an employee at AMF Pension, administering the pension payments. For these cohorts, the pension wealth in 1996 was determined by the defined benefit pension under the STP plan based on the average income from all years from age twenty-eight until 1995. This pension wealth was brought along to the defined contribution STP plan. From 1996, individuals collected new pension points according to the STP rules. Since the transitional rules are rather unclear, we simplify our calculations by assuming that pension rights for the defined contribution plan SAF-LO was collected between ages twenty-one and sixty-five with a premium of 2 percent before the year 2000 and 3.5 percent from the year 2000 onward.

The Income Tax System

Individuals pay income taxes on earnings, public pension, sickness, unemployment, and disability benefits, and occupational pension. This is accounted for in the option value calculations. Individuals pay municipal income tax on the income, net of a basic deduction. If income exceeds a certain break point, individuals also pay a state income tax. In 2007, an earned income tax credit was introduced, which is also accounted for in the calculations.

The basic deduction is based on the total income (I) and is calculated according to the following formula, expressed in price base amounts:

- 0.423 if $I \leq 0.99$,
- $0.423 + (I - 0.99)*0.2$ if $0.99 < I \leq 2.72$,
- 0.77 if $2.72 < I \leq 3.11$,
- $0.77 - (I - 3.11)*0.1$ if $3.11 < I \leq 7.88$, and
- 0.293 if $7.88 < I$.

The municipality income tax varies across municipalities and may change over time. In this chapter, we do not take the municipality of residence into account but apply the average municipality income tax rate in each year for all individuals. The state income tax has two thresholds. Above the first threshold the state income tax is 20 percent, and above the second threshold the state income tax is 25 percent. These brackets have changed over time. Table 9A.1 presents the average municipality income tax and the two thresholds in the state income tax during the period 2001–2008, which is the period under study.

The earned income tax credit applied to earnings, but not to income from public pension or public transfers such as disability benefits. The tax credit was a function of earned income (E), the basic deduction (BD), and the municipality income tax rate (T). Furthermore, there was an age dis-

Table 9A.1 **Average municipality income tax rate and income thresholds for state income tax, 2001–2008**

	Average municipality income tax	Income threshold 20% state income tax	Income threshold 25% state income tax
2001	0.3053	271,500	411,100
2002	0.3052	290,100	430,900
2003	0.3117	301,000	447,200
2004	0.3151	308,800	458,900
2005	0.3160	313,000	465,200
2006	0.3160	317,700	472,300
2007	0.3155	328,600	488,600
2008	0.3144	340,900	507,100

continuity in the tax credit schedule. Individuals who had turned sixty-five at the beginning of the tax year received a substantially larger tax credit, roughly amounting to twice the size of the tax credit for individuals below age sixty-five. The formulas for the earned income tax credit in 2007 and 2008, accounted for in this chapter, are presented below.

For individuals below age sixty-five, the earned income tax credit in 2007, expressed in price base amounts, was:

- $(E - BD)*T$ if $E \leq 0.79$,
- $(0.79 + (E - 0.79)*0.2 - BD)*T$ if $0.79 < E \leq 2.72$, and
- $(1.176 - BD)*T$ if $2.72 < E$.

For individuals below age sixty-five, the earned income tax credit in 2008, expressed in price base amounts, was:

- $(E - BD)*T$ if $E \leq 0.91$,
- $(0.91 + (E - 0.91)*0.2 - BD)*T$ if $0.91 < E \leq 2.72$,
- $(1.272 + (E - 2.72)*0.033 - BD)$*T if $2.72 < E \leq 7$, and
- $(1.413 - BD)*T$ if $7 < E$.

For individuals above age sixty-five, the earned income tax credit in 2007, expressed in price base amounts, was:

- $(E - BD)*T$ if $E \leq 1.59$,
- $(1.59 + (E - 1.59)*0.2 - BD)*T$ if $1.59 < E \leq 2.72$, and
- $(1.816 - BD)*T$ if $2.72 < E$.

For individuals above age sixty-five, the earned income tax credit in 2008, expressed in price base amounts, was:

- $(E - BD)*T$ if $E \leq 1.79$,
- $(1.79 + (E - 1.79)*0.2 - BD)*T$ if $1.79 < E \leq 2.72$,
- $(1.976 + (E - 2.72)*0.033 - BD)*T$ if $2.72 < E \leq 7$, and
- $(2.117 - BD)*T$ if $7 < E$.

Means-Tested Benefits

Housing Supplement

Individuals collecting public pension benefits or disability benefits can be granted a means-tested housing supplement if their income is low. The maximum housing supplement is 93 percent of the housing cost up to SEK 5,000 per month for singles, which is SEK 55,800 per year. For married individuals, the housing supplement is lower. The first step in the calculation of the housing supplement is to determine the individuals so-called "reduction income." It is the sum of public pension benefits, disability benefits and capital income, 80 percent of occupational income, 50 percent of earned

income, and 15 percent of the wealth exceeding SEK 100,000, minus 2.17 price base amounts. The reduction income is based on gross income before tax. The housing supplement is then calculated as the maximum housing supplement minus 62 percent of the reduction income up to SEK 44,500 and 50 percent of the reduction income exceeding SEK 44,500.

Special Housing Supplement and Old-Age Support

Individuals with very low income can also be granted special housing supplement or old-age support. The rules are very similar. The calculation is based on the total net income, including housing supplement. The special housing supplement or old-age support equals 1.3546 price base amounts plus the housing cost of maximum 6,200 SEK per month minus net income.

References

Gruber, Jonathan, and David A. Wise, eds. 2004. *Social Security Programs and Retirement around the World: Micro-Estimation*. Chicago: University of Chicago Press.

Hagen, Johannes. 2013. "A History of the Swedish Pension System." Working Paper no. 2013:7, Uppsala Center for Fiscal Studies, Uppsala University.

Johansson, Per, Lisa Laun, and Tobias Laun. 2014. "Screening Stringency in the Disability Insurance Program." *B.E. Journal of Economic Analysis & Policy* 14 (3): 873–91.

Jönsson, Lisa, Mårten Palme, and Ingemar Svensson. 2012. "Disability Insurance, Population Health and Employment in Sweden." In *Social Security Programs and Retirement around the World: Historical Trends in Mortality and Health, Employment, and Disability Insurance Participation and Reforms*, edited by David A. Wise, 79–126. Chicago: University of Chicago Press.

Karlström, Anders, Mårten Palme, and Ingemar Svensson. 2008. "The Employment Effect of Stricter Rules for Eligibility for DI: Evidence from a Natural Experiment in Sweden." *Journal of Public Economics* 92 (10): 2071–82.

Laun, Tobias, and Johanna Wallenius. Forthcoming. "A Life Cycle Model of Health and Retirement: The Case of Swedish Pension Reform." *Journal of Public Economics*. doi: 10.1016/j.jpubeco.2013.11.002.

Palme, Mårten, and Ingemar Svensson. 1999. "Social Security, Occupational Pensions, and Retirement in Sweden." In *Social Security and Retirement around the World*, edited by Jonathan Gruber and David Wise, 355–402. Chicago: University of Chicago Press.

————. 2004. "Income Security Programs and Retirement in Sweden." In *Social Security Programs and Retirement around the World: Micro-Estimation*, edited by Jonathan Gruber and David Wise, 579–642. Chicago: University of Chicago Press.

Skogman Thoursie, Peter. 1999. "Disability and Work in Sweden." PhD diss., Swedish Institute for Social Research, Stockholm University.

Socialstyrelsen. 2009a. *The Swedish Cause of Death Registry*. Stockholm. http://www.socialstyrelsen.se/register/halsodataregister/cancerregistret/inenglish.

———. 2009b. *The Swedish National Patient Register. Inpatient Diseases in Sweden 1987–2007*. Stockholm. http://www.socialstyrelsen.se/register/halsodataregister/patientregistret/inenglish.

Stock, J. H., and David A. Wise. 1990. "Pensions, the Option Value of Work, and Retirement." *Econometrica* 58 (5): 1151–80.

Wise, David A., ed. 2012. *Social Security Programs and Retirement around the World: Historical Trends in Mortality and Health, Employment, and Disability Insurance Participation and Reforms*. Chicago: University of Chicago Press.