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Health, Disability Insurance, and Retirement in Denmark

Paul Bingley, Nabanita Datta Gupta, Michael Jørgensen, and Peder J. Pedersen

8.1 Introduction

Labor force participation of older persons varies greatly both between countries and within countries over time. Individual health status, labor market conditions, and social security program provisions all play a role in this. Disability insurance (DI) programs are at the interface between social security provisions, labor market conditions, and health and may play an important role for many persons as they move from employment to retirement from the labor market. In principle, it may be the case that changes in DI participation rates reflect changing health and changing labor market conditions. However, trends in DI participation appear to be unrelated to changes in mortality and health. Differences in health between countries would need to be much larger than those revealed in comparable survey data in order to account for differences in DI participation (Milligan and Wise 2012). In many countries, DI effectively provides early retirement benefits before eligibility for other social security programs begin. This begs the main question: Given health status, to what extent are the differences in labor force participation for seniors across countries determined by the provisions of

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DI programs? Answering this question is a challenge because measuring health is notoriously difficult and DI programs interact with social security provisions in different ways across countries.

Social security programs in general have been shown to provide strong incentives for older workers to exit from the labor market at certain ages (Gruber and Wise 2004). In the 2004 volume, incentives were characterized by an option value (OV) model that allows the expected future consequences of current work decisions to be accounted for (Stock and Wise 1990). This was implicitly an inclusive option value, in the sense that different pathways to retirement were included in a single summary measure of expected future consequences. Several countries with extensive DI programs, such as Sweden (Palme and Svensson 2004) and Denmark (Bingley, Datta Gupta, and Pedersen 2004), included a DI retirement pathway probabilistically as part of the inclusive option value. In the current volume, because DI programs are of primary interest, for the sake of greater comparability, DI pathways contribute to inclusive option values in a similar way across all countries.

In order to control for health one needs to follow individuals over time either with repeated survey questions about self-assessed health or administrative data about health care usage. Different countries have different health data sources. Even the European countries participating in SHARE, which follow a survey protocol to maximize comparability across countries might have different modes of response between populations, which makes comparison response-by-response difficult. Most other countries in the volume use self-assessed health from surveys, whereas Sweden and Denmark use administrative records of health care usage for the sake of much greater sample sizes. Each of the studies calculates a single health index on the basis of the first principal component of their own sets of health measures. Most of the analyses are conducted on the basis of quintiles of these indices.

Identification of incentive effects requires variation in pension program provision between individuals, and ideally within individuals over time by way of pension program changes or reform. We choose an observation period 1996–2008. That is from the first year that we can observe health care usage spanning the population based on administrative records, through the announcement of a major pension program reform in 1998, and beyond full enactment of the new law in 2006.

From our descriptive analyses we can see clear gradients in DI participation rates by health quintile and by level of completed schooling. Those in worse health and with less schooling are more likely to receive DI at some point from age fifty. The gradient of DI participation across health quintiles is almost twice as steep as across levels of schooling. We find that pension program incentives in general are important determinants of retirement age. Individuals in poor health are significantly *more* responsive to economic incentives than those in better health, and those with low schooling are significantly *more* responsive to economic incentives than those with long schooling. Hence low schooling and poor health are associated with greater DI participation, and those with low schooling and poor health are also most responsive to economic incentives.

The remainder of the chapter is organized as follows. Section 8.2 shows background trends in labor force and DI participation over time by schooling and health. Section 8.3 presents the empirical approach, describing pathways to retirement, how they are weighted, describing the health index and the option value calculations. Section 8.4 presents results from estimating option value models of retirement controlling for health in various ways. Section 8.5 shows goodness-of-fit measures and conducts counterfactual simulations to illustrate some implications of the results. Section 8.6 summarizes and concludes.

8.2 Background

Previous studies have shown how trends in labor force participation for seniors have only a weak relationship with changes in mortality and other measures of health over time and across countries (Milligan and Wise 2012). Neither did there appear to be any relationship between the development of DI programs and changes in mortality and measures of health. These findings were on the basis of a broad view of disaggregated data covering a dozen countries and spanning several decades. In the current chapter we want to analyze how individual retirement behavior in Denmark is related to DI provisions, when controlling for individual variations in health and other characteristics. As background for this microanalysis, in this section we describe trends over time in DI participation, labor force participation and employment by age, and correlate these with individual characteristics: gender, health status, and educational attainment.

In the population eighteen to sixty-four years old, the share receiving DI has been fairly constant at around 7 percent since 1990 (Organisation for Economic Co-operation and Development [OECD] 2008). This is quite low and stable relative to the situation in neighboring Nordic countries (OECD 2009). However, the relatively low DI participation rate in Denmark needs to be viewed in the context of competing transfer programs. Between 1992 and 1996, an early pension benefit (*overgangsydelse*) was available for the long-term unemployed age fifty to fifty-nine. This program removed many from the labor market who might otherwise have applied for DI. In 1998, an existing wage subsidy program for the disabled was expanded and relaunched (*flexjob*). The disabled with some remaining work capacity were thus encouraged to stay in the labor market rather than exit on DI.

Another relevant aspect in the development of DI in Denmark over recent years is the rather stable overall participation rate, with a growing proportion of new young claimants entering the program with psychiatric diagnoses (OECD 2013). A final aspect of DI in Denmark is that only very few reenter the labor market having once received DI (Høgelund and Holm 2006). This is surprising in light of Jonassen, Larsen, and Høgelund (2009), who find that of those with functional disabilities in 1995, 50 percent had improved functional ability in 2008. This was especially the case for the young and those starting out with a psychiatric functional disability.

Time series of DI participation rates are shown in figure 8.1A for age groups fifty to fifty-four, fifty-five to fifty-nine, and sixty to sixty-four for men, and women are shown in figure 8.1B. Women have higher mean DI participation rates than men, and older groups have higher DI participation rates than younger groups. The youngest group has stable DI participation throughout the period for both genders, at 8 percent for men and 12 percent for women. Disability insurance participation has declined markedly for those age sixty to sixty-four, falling from 21 to 13 percent for men and a dramatic 36 to 17 percent for women. In the post-2008 years, not shown in figures 8.1A and 8.1B, DI shares are stable for the fifty and older group until 2013.

The DI participation rates of figures 8.1A and 8.1B are now set alongside employment rates in figures 8.2A, 8.2B, 8.2C, 8.2D, 8.2E, and 8.2F, which show time series for age groups fifty to fifty-four, fifty-five to fifty-nine, and sixty to sixty-four, separately for men and women. A high degree of symmetry is evident, especially in the older group, whereby falls in DI participation are about two-thirds of the size of employment increases. Indeed, since 1999 employment is more common than DI participation for women age sixty to sixty-four. Overall, the share in retirement in this age group is higher than the share in employment, however, as the share of women in a SS program for early retirement is 40 percent of the age group by the end of the period we analyze.

Associations with health status and schooling levels are shown in the next three figures. Figures 8.3A and 8.3B show DI participation rates for age group fifty-five to sixty-four by schooling for selected years, separately for men and women. There is a clear gradient in schooling in that those with lower education have higher rates of DI participation. Graduating high school approximately halves the DI rate, falling from 24 to 13 percent for men and from 35 to 17 percent for women in 1996. Subsequent educational attainment is associated with an approximately 3 percent reduction in DI rates for those with some college and another 3 percent reduction for graduating college. There is no discernible change in the educational gradient over time.

In the following illustrations and for most of the econometric analysis, health status is characterized by quintiles of a health index. Calculation of the index is described in section 8.3.3. Figure 8.4A shows DI participation rates for age group fifty-five to sixty-four by health quintile for selected years for men, and women are shown in figure 8.4B. There is a clear gradient in health in that those with worse health have higher rates of DI participation.

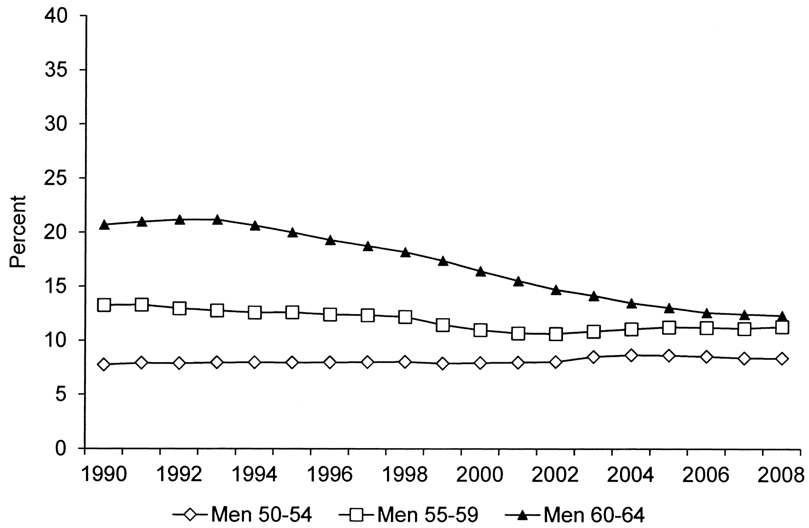

Fig. 8.1A DI participation by age group, men

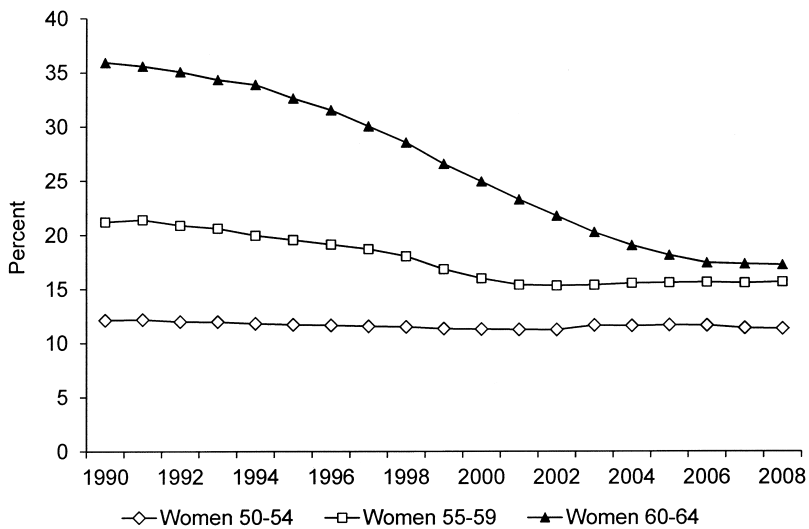

Fig. 8.1B DI participation by age group, women

Our quintile grouping resolves into three different DI rates, the worst quintile followed by quintiles 2 and 3 together with a lower DI rate, followed by better health quintiles with almost no DI recipients. The fall in DI rate from best health quintile to 2 and 3 is more marked than for schooling, falling from 48 to 25 percent for men and from 61 to 37 percent for women in 1996. There is no discernible change in the health gradient over time.

Fig. 8.2A DI and employment for men, age fifty to fifty-four

Fig. 8.2B DI and employment for women, age fifty to fifty-four

Fig. 8.2C DI and employment for men, age fifty-five to fifty-nine

Fig. 8.2D DI and employment for women, age fifty-five to fifty-nine

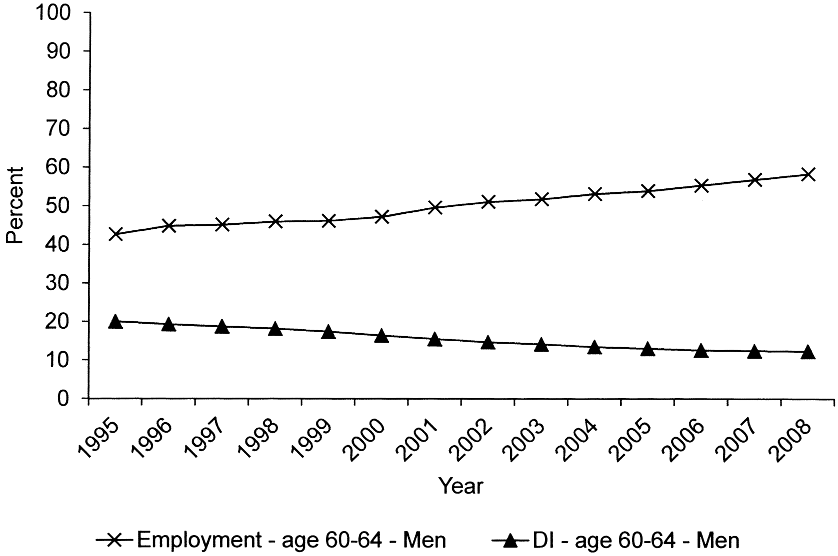

Fig. 8.2E DI and employment for men, age sixty to sixty-four

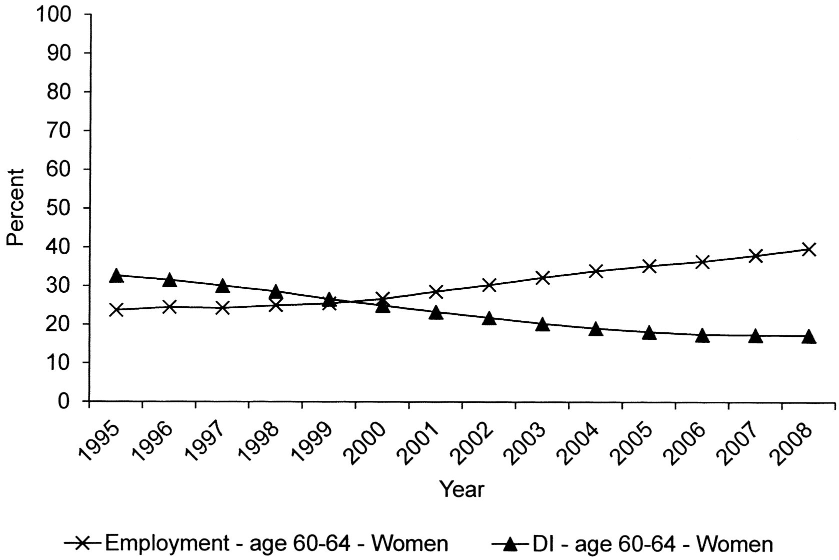

Fig. 8.2F DI and employment for women, age sixty to sixty-four

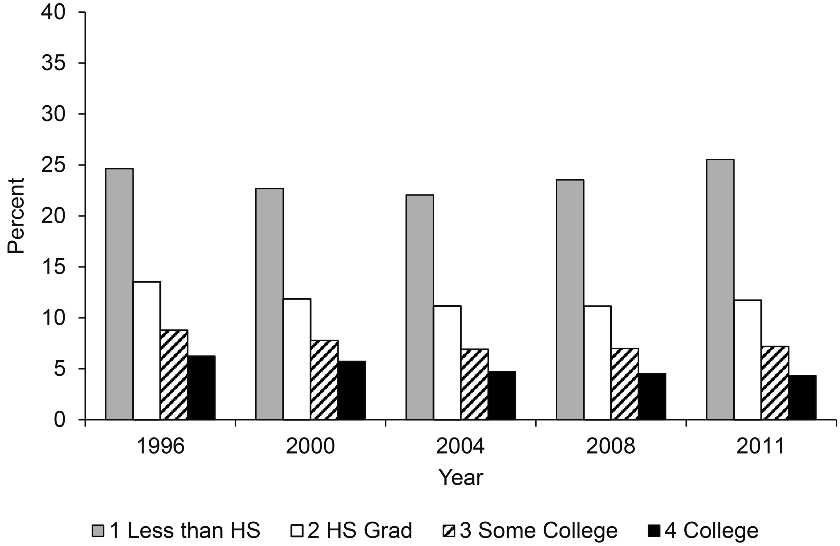

Fig. 8.3A Men age fifty-five to sixty-four who have received DI by education and year

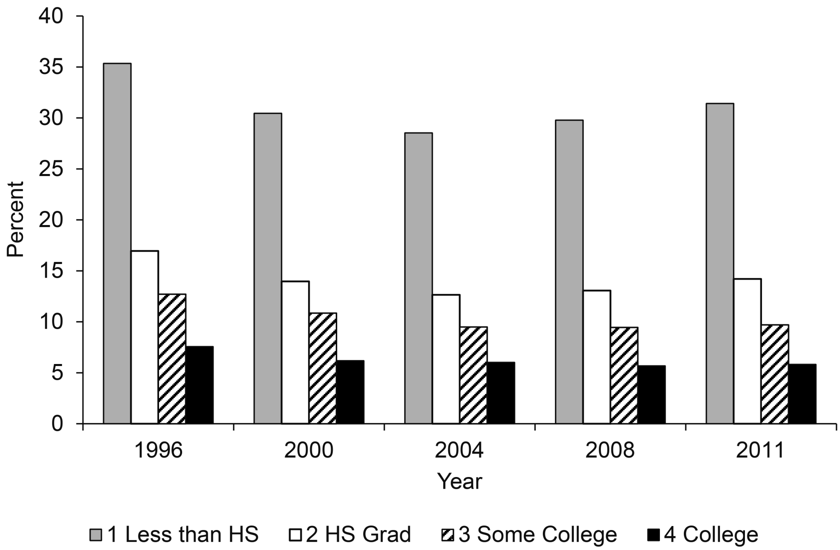

Fig. 8.3B Women age fifty-five to sixty-four who have received DI by education and year

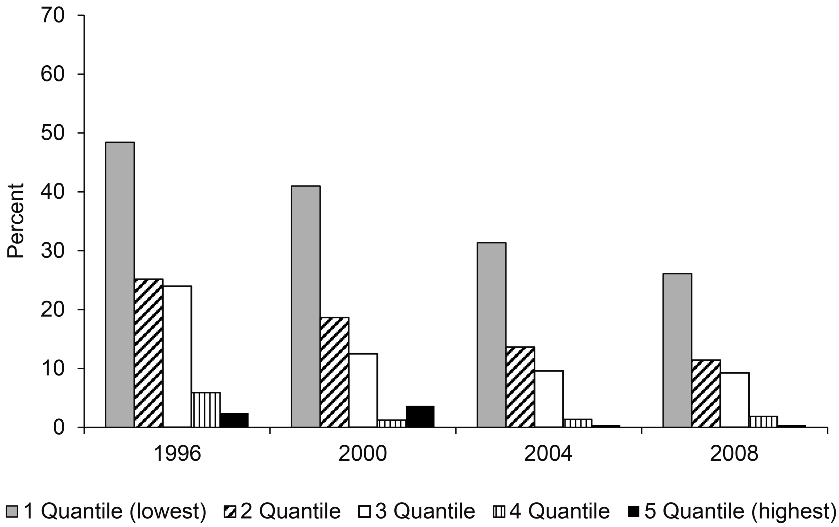

Fig. 8.4A Men age fifty-five to sixty-four who have received DI by health and year

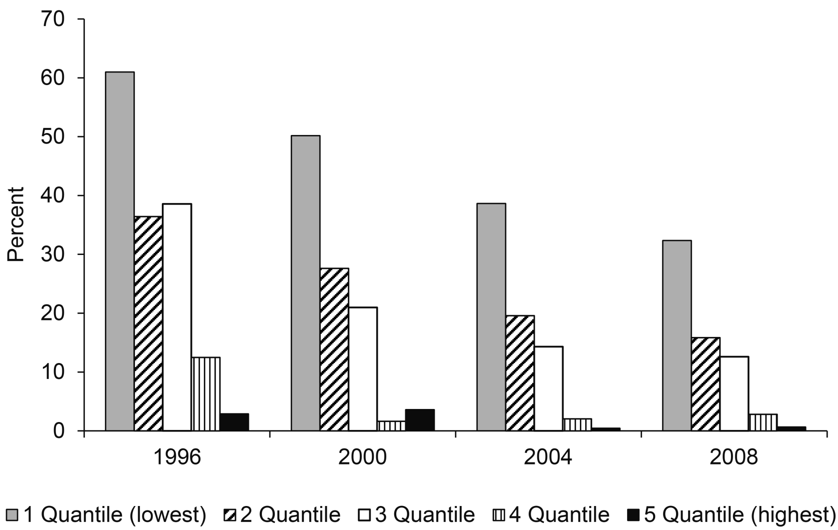

Fig. 8.4B Women age fifty-five to sixty-four who have received DI by health and year

The joint distribution of DI participation rates by schooling and health quintile together is shown in table 8.1 for age group fifty-five to sixty-four (men in the upper pane and women in the lower pane). Subpopulations with worst health and lowest schooling have highest DI participation rates, at 46 percent for men and 55 percent for women. At the opposite corner of the

Table 8.1 **Percent DI receipt age fifty-five to sixty-four by heath quintile and education**

	health quintile					
	1 (low)	2	3	4	5	All
Men						
1 Less than HS	45.58	25.63	22.84	4.03	2.14	20.63
2 HS grad	30.16	12.97	9.25	1.81	0.94	10.70
3 Some college	22.75	8.56	6.08	1.81	1.10	7.01
4 College	17.22	6.98	4.11	1.23	0.73	4.71
All	34.11	16.06	12.72	2.41	1.30	12.83
Women						
1 Less than HS	55.11	35.59	33.46	7.32	2.50	28.91
2 HS grad	32.92	15.63	11.96	2.44	0.86	12.66
3 Some college	25.78	11.43	8.30	1.83	0.69	9.51
4 College	16.98	7.28	5.05	1.33	0.49	5.66
All	42.12	23.55	20.72	4.25	1.48	19.02

table, men and women in the best health and with a college degree both have a DI rate of less than 1 percent. Within each health quintile there is still a marked schooling gradient in DI participation rates. Similarly, within each educational level there is still a marked health gradient. Health is the most important marginal distribution, with 17 percent of men and women receiving DI of those in worst health with a college degree, whereas only 2 percent of men and women in best health and less than high school participate in DI.

Information from table 8.1 is further split by selected years in figure 8.5A, which presents DI participation rates for the age group fifty-five to sixty-four jointly by schooling and health for men, and women are shown in figure 8.5B. The joint gradient in DI participation rates by health and schooling is maintained proportionally throughout, with worst health and lowest schooling men and women in 1996 at 57 percent, falling to 37 percent by 2008. The fall of one-third for this group over twelve years is similar in magnitude to the DI participation rate difference for those in worse health between some high school and some college.

In the final two sets of background figures, employment rates are associated with schooling and health. Figure 8.6A shows employment rates for age group sixty to sixty-four by schooling over time for men, and women are shown in figure 8.6B. Men have higher employment rates than women. Indeed, men with some college have similar employment rates to women with a college degree, and men with a high school degree have similar employment rates to women with some college. There are similar upward trends in employment rates for the three education groups without a college degree. In 2008, for example, the range of mean employment rates across levels of schooling is narrower for men, ranging from 48 to 80 percent, than for women, ranging from 26 to 70 percent.

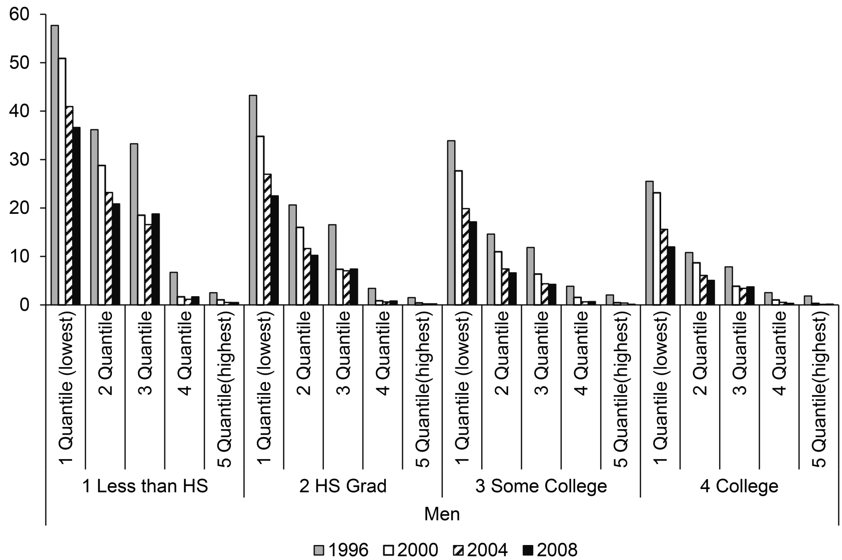

Fig. 8.5A DI recipients by education and health quintile, age fifty-five to sixty-four (men)

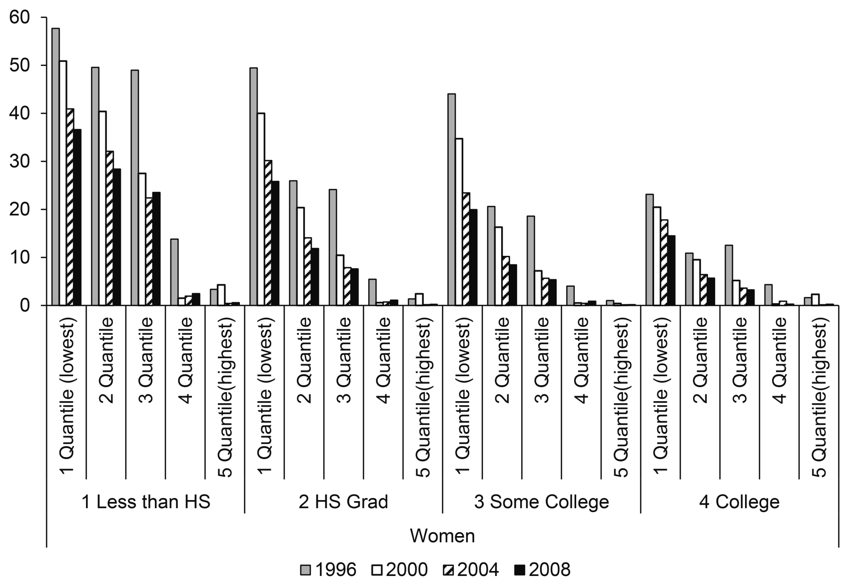

Fig. 8.5B DI recipients by education and health quintile, age fifty-five to sixty-four (women)

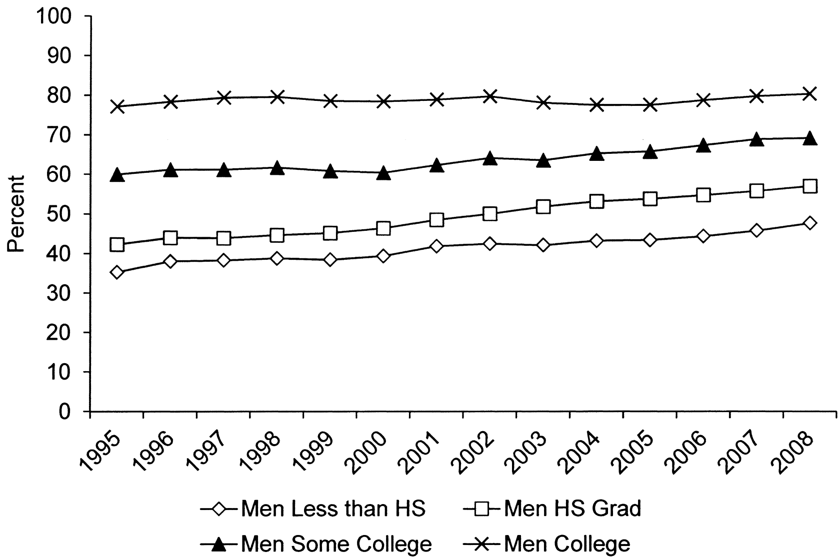

Fig. 8.6A Employment by education, age sixty to sixty-four (men)

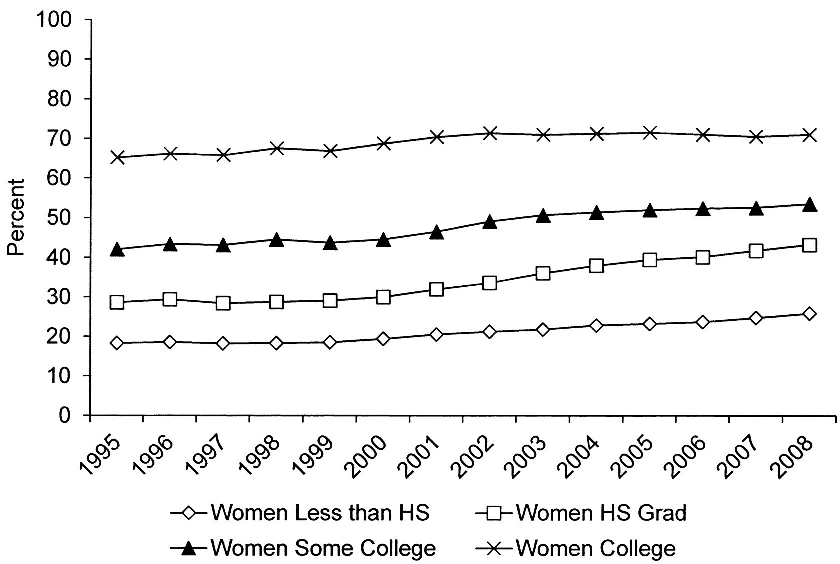

Fig. 8.6B Employment by education, age sixty to sixty-four (women)

Figure 8.7A shows employment rates for age group sixty to sixty-four by health quintile over time for men, and women are shown in figure 8.7B. There is a clear health gradient in employment rates, with those in worst health having lowest employment rates, and those in the best two health quintiles having highest employment rates. Employment rates across all health quin-

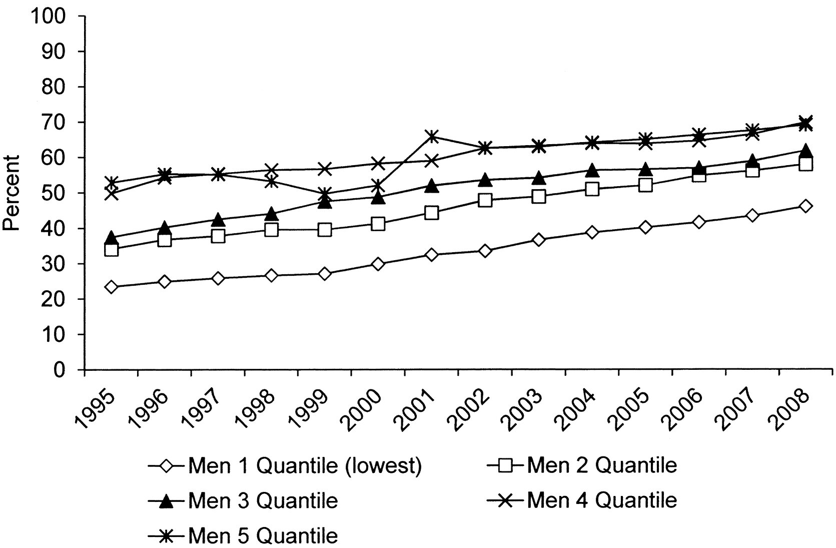

Fig. 8.7A Employment by health quintile, age sixty to sixty-four (men)

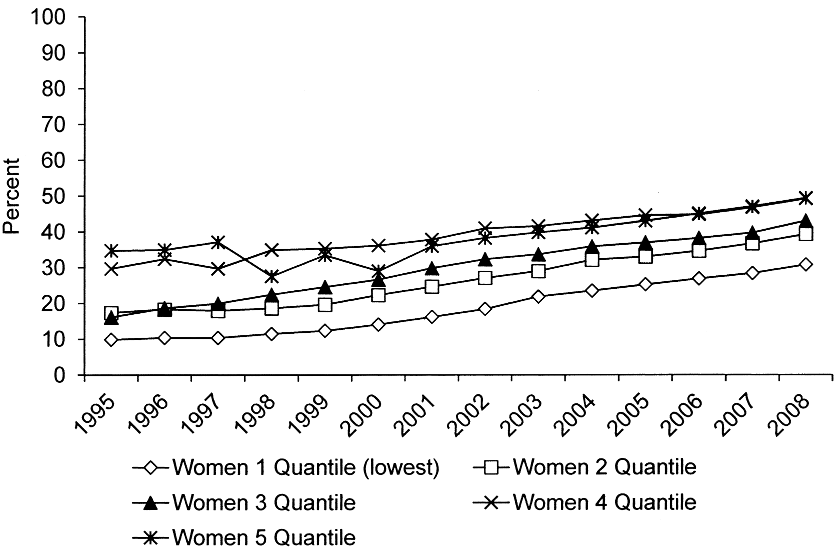

Fig. 8.7B Employment by health quintile, age sixty to sixty-four (women)

tiles for men and women increase uniformly over the sample period. The increase in employment rates from 1995 to 2008 by about 20 percent points is similar to the difference in moving from the two worst health quintiles to the second best.

In summary, our years of observation (1995–2008) covers a period of falling DI participation, increasing labor force participation, and increasing employment for seniors, especially those age sixty to sixty-four. There are steep gradients in health, with those in worse health more likely to participate in DI and less likely to be in employment. There are similar and almost as steep gradients across the schooling distribution, with those without a high school diploma more likely to participate in DI and less likely to be in employment.

8.3 Empirical Approach

Our goal is to estimate the relationship between DI provisions and retirement age, given health status. In order to do this we need to consider all transfer programs relevant for the transition from work to retirement for seniors. These different pathways to retirement need to be combined in a weighted average measure that summarizes their relative potential importance. An inclusive option value framework will be introduced to characterize incentives implicit in the programs to retire at different ages. Finally, we need to condition on health in a way that is comparable across data sets and countries. The following four subsections present these elements of our empirical approach.

8.3.1 Pathways to Retirement

There are three main pension programs supporting income in retirement that are relevant for our analysis. First is a disability insurance program (*førtidspension*, hereafter DI) available for those age eighteen to sixty-six and later eighteen to sixty-four who have permanent social and/or health impairments that reduce work capacity. Second is a contribution-based but largely tax financed postemployment wage program (*efterløn*, hereafter SS), which is essentially unemployment insurance benefit without a job search requirement available for ages sixty to sixty-six and after 2006 from sixty to sixty-four. Third is old-age pension (*folkepension*, hereafter OAP), which is a demogrant available from age sixty-seven and after 2006 from age sixty-five, based on years of residence. Our period of analysis (1995–2008) is chosen to span reforms in DI stringency and SS/OAP incentives in order to provide variation by which to identify the effects of program provisions on the retirement age for older workers.

The SS program was introduced in 1979 for ages sixty to sixty-six and existed largely unchanged until reforms in 1992 and 1999. The 1992 rules are relevant for the first part of our sample period. Eligibility from 1992 to 1995 required membership of an unemployment insurance fund for at least twenty of the last twenty-five years. An individual was allowed to work for a maximum of 200 hours. If the 200 hours was exceeded, it resulted in a permanent disqualification from the program. The political motivation for the 200 hours restriction was the idea that youth unemployment would be reduced by cutting the labor supply. This, however, turned out not to be the case as shown in Bingley, Datta Gupta, and Pedersen (2010). For individuals claiming SS at ages sixty to sixty-two, the benefits for the first two years were at the level of unemployment insurance and reduced to 80 percent for the last four years. Delaying SS until age sixty-three or older gave benefits at 100 percent of the maximum unemployment insurance benefit level until age sixty-six. This policy obviously incentivized retiring at age sixty-three rather than at younger or older ages. In 1995 unemployment insurance fund membership history requirements were increased to twenty-five out of the previous thirty years. Until 1999, only payouts from life annuities in occupational pensions were means tested.

An SS reform was announced in March 1999 and enacted in July 1999. Means testing of payouts or returns from all contributory pensions—whether they were actually paid out or not—was introduced for those claiming SS at ages sixty and sixty-one. Those eligible for SS and not retiring now accumulate a quarterly USD 2,200 bonus beginning at age sixty-two. This reform shifted the retirement age incentive spike from age sixty-three down to age sixty-two. The previous limitation of working at most 200 hours per year was removed and replaced by a high effective marginal tax rate. The UI fund membership history requirements were further increased to thirty out of the last thirty-five years. Contributions were unbundled from UI and became separately elective.

An important element of the 1999 reform was the reduction in OAP age from sixty-seven to sixty-five. Those age sixty and older at enactment (born before July 1939) were unaffected and could first claim OAP at age sixty-seven, whereas those born later could claim OAP from age sixty-five. The change in OAP age was implemented from July 2004 through June 2006 and the maximum age for claiming SS benefits changed accordingly. This policy change was obviously running against the trend of pension reforms typically increasing the age of eligibility. The interpretation is fiscal considerations, in that the great majority of the sixty-five- and sixty-six-year-olds were in the DI or the SS program with benefits significantly higher than in OAP.

The DI program has existed in essentially the same institutional form in the period 1984–2002, but with some stringency tightening in the 1990s. It was available to those with permanent social or physical work impairments depending on three levels of severity/generosity. During this period, benefit levels were closely linked to the overall level of wages, but several stringency measures were introduced at different times. Three stringency reforms can be distinguished. First, during 1995–2002 a series of selective municipal award audits were undertaken, whereby each year two out of Denmark's fifteen counties were chosen and a random sample of new benefit awards was drawn for reassessment of eligibility. Second, in 1997 central government refunds to municipalities were reduced for expenditure on DI to individuals age sixty and older, bringing refunds into line with those for younger age groups. Third, in 1998 municipalities were required to first consider whether other locally administered programs, such as work rehabilitation or a program with disability wage subsidies, might be relevant before processing an application for DI.

In 2003, the government simplified DI for new awards by reducing the number of levels from three to one, but also introduced an array of condition- and needs-specific financial additions. These additions make net changes to incentives due to the reform difficult to characterize for systematic analysis.

Other relevant related programs for those in short-term poor health, with short-term or permanent work impairments but some remaining work capacity, are sickness benefits (*sygedagpenge*), rehabilitation benefits (*revalidering*), and disability wage subsidies (*fleksjobs*), respectively. We do not consider these programs as pensions financing retirement because they involve some degree of attachment to the labor market. Nevertheless, they are worth mentioning because of their relevance at the interface between health, work, and retirement. Work sickness absence benefits and rehabilitation are awarded temporarily. Disability wage subsidies are a payment at the level of the minimum wage for permanently reduced work capacity. Individuals in this program are classified as employed, or unemployed and seeking work, and therefore not retired for modeling purposes.

8.3.2 Calculating the Probabilities of Different Pathways

An option value incentive measure needs to combine provisions across different potential pathways to retirement. In order to integrate DI we need to impute to each person a probability that DI is a realistic option. These probabilities can then be used as weights to combine pathways into a single inclusive option value measure. We use a stock measure of calculating DI probabilities from the proportion participating in DI by different cells combining individual characteristics. Cells are calculated for those age fifty-five to sixty-four by level of schooling, gender, and year. Selected years of these DI weights are presented in figures 8.3A (men) and 8.3B (women).

8.3.3 Health Index and Health Quintiles

A continuous health index needs to be created and divided into quintiles so as to be comparable with other countries. Poterba, Venti, and Wise (2011) propose such an index be calculated from the first principal component of twenty-seven health indicators from the Health and Retirement Study (HRS). In the Danish administrative registers, we use the first principal component from hospital discharge records and prescription medicine purchases. The principal components analysis is conducted on the population age fifty to eighty during the years 1994–2007.

From hospital records we consider all encounters, for both day patients and overnight stays. Each encounter has a primary diagnosis code (ICD-10) and duration. We aggregate diagnoses to the three-digit level, giving 160 distinct diagnoses after twelve diagnoses with fewer than 100 cases are dropped. Durations of hospital stays are summed over a two-year period within each diagnosis for each person. In other words, hospitalization is characterized for each person as length of hospital stay over the previous two years with each of 160 primary diagnoses.

From prescription medicine records we consider all purchases from high street pharmacies. Each purchase has a drug code (ATC-5) and dosage. We aggregate drug codes to the three-digit level, giving 170 distinct drug types after eight drug types with fewer than 100 persons purchasing are dropped. Dosages are normalized according to World Health Organization (WHO)-defined daily dosages and summed over a two-year period within each drug type for each person. In other words, drug consumption is characterized for each person as number of standard daily doses over the previous two years for each of 170 drug types.

Principal components are calculated over hospitalizations and prescriptions together in two-year periods. For example, when modeling retirement behavior in 1996, principal components would be calculated for 1994–1995; for behavior in 1997, principal components would be based on 1995–1996, and so forth. The first principal component forms our health index. Figure 8.8A shows mean centile of the health index over age by gender, and schooling level is shown in figure 8.8B. By convention, a higher centile is taken to indicate better health. Men have a higher mean health centile than women. Note that it is conventional to observe that men have better self-reported health, less health care usage, but higher mortality than women of a similar age. Health declines with age and the gender health gap narrows from 5 centiles at age fifty to 1 centile at age seventy. The gender health gap at age sixty corresponds to the mean health decline over four to five years. According to our health index, based on health care usage, a woman age sixty is as healthy as a man age sixty-four. This is in spite of her having higher expected longevity. Figure 8.8B shows a health centile gradient in schooling with those with lowest schooling having worst health. The schooling health gradient narrows from 10 centiles at age fifty to 6 centiles by age seventy, however the 3 health centile difference of moving from high school graduation to some college persists.

8.3.4 Option Value Calculation

The goal of our analysis is to estimate the relationship between pension program provisions and age of retirement. Incentives implicit in pension program provisions can be characterized by the potential gain from postponing retirement until future ages. In order to do this we follow the option value approach of Stock and Wise (1990) and extend this to explicitly allow for different potential pathways to retirement in the form of an inclusive option value measure.

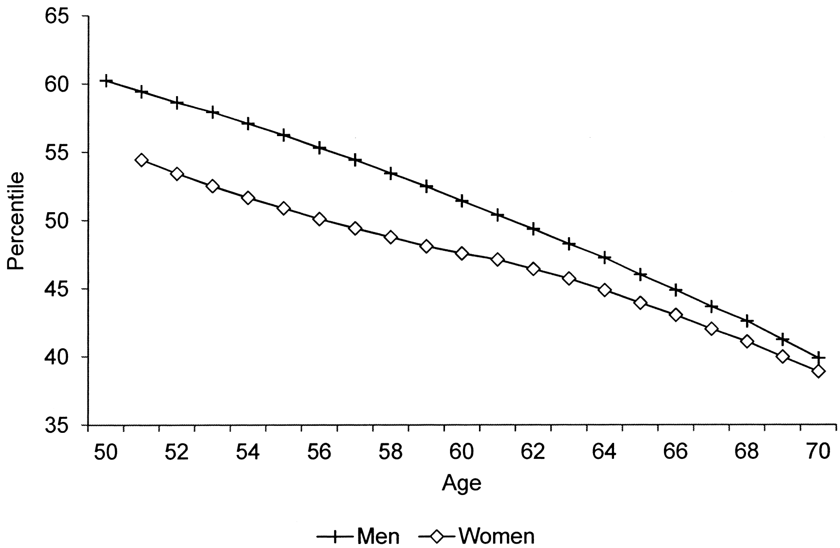

Fig. 8.8A Health index mean by gender

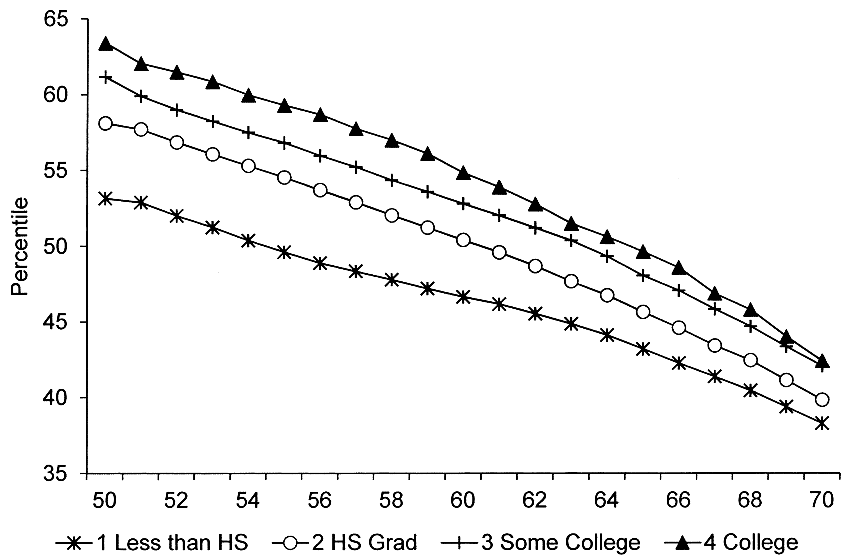

Fig. 8.8B Health index mean by education

From the vantage point of each age a while in work, there are several possible pathways ($pa = 1, \ldots, PA$) to retirement, each with an associated utility stream V dependent upon age of retirement time r. A pathway constitutes a number of years of continued work, denoted in the first summation of equation (1), followed by the number of years receiving pension benefits specific to that pathway until death at age A, denoted by the second summation of equation (1). Expected utility at each future age s from the vantage point of each age E_a is weighted by the probability of survival to that age $p_{s|a}$ and discounted β^{s-t} back to the present. While working, wage income $\omega(s)$ is received at each age, while retired benefit income $B_{rk}(s)$ is received at each age dependent upon pathway and age of retirement. The utility function includes a parameter for leisure κ, which scales retirement benefits relative to earnings. Both incomes in work and retirement are raised to the power γ representing risk aversion:

$$(1) \qquad E_a\ \{V_{ka}(r)\} = \sum_{s=a}^{r-1} p_{s|a}\beta^{s-a}(\omega(s))^{\gamma} + \sum_{s=r}^{A} p_{s|a}\beta^{s-a}(\kappa B_{rk}(s))^{\gamma}.$$

For each retirement pathway pa, the future age of retirement at which the expected discounted utility stream is maximized is denoted r^*. The comparison is between expected utility streams associated with all retirement ages until maximum age of retirement R. The option value of staying in work at the present age a compared to following eventual retirement pathway pa is defined as the difference between the maximum of expected utilities from future retirement ages along that pathway compared to retiring now:

$$(2) \qquad \mathrm{OV}_{ka} \equiv \max_{a<r^*\leq R}[E_a\{V_{ka}(r^*)\}] - E_a\{V_{ka}(a)\}.$$

Having defined the OV of staying in work from the vantage point of each age a for each retirement pathway pa, it remains to weight each pathway with the probability P_k so that it represents a set of relevant alternatives for each individual. An inclusive OV measure combines routes weighted by the probabilities that they are relevant as follows:

$$(3) \qquad \mathrm{OV}_a = \sum_{k=1}^{K} P_k \mathrm{OV}_{ka}.$$

This inclusive option value measure makes explicit the extension to the Stock and Wise (1990) option value approach that allows us to incorporate several different routes to retirement. This can be cast in a regression framework further allowing for differences in health status. Consider retirement status R for person i of age a in health quantile j. This is assumed to be a function θ_j of exogenous individual characteristics X_{ia} and a function δ_j of inclusive option value OV_{ia}; H_j is a measure of health and ε_{iaj} is an error term:

$$(4) \qquad R_{iaj} = \sum_{j=1}^{J}[\theta_j X_{ia} + \delta_j \mathrm{OV}_{ia} H_j] + \varepsilon_{iaj}.$$

Equation (4) is estimated as a probit model for year-to-year retirement. Retirement behavior is characterized as an optimal stopping problem in that an individual remains out of the labor force once retired. Benefit collection and retirement are assumed to be synonymous. Pathways from the labor force to OAP could be direct or via DI, SS, or a private pension drawdown.

Individuals are selected at ages fifty-seven to sixty-six and must be working in the first year of observation. We assume a maximum age of retirement R at sixty-seven and force those who are still working at age sixty-six to retire at sixty-seven on OAP. We use population life tables for survival probability s from age a published in 2009 by age and gender for ages fifty-eight to ninety-nine and impose zero survival probability at age 100. After retirement, an individual leaves the data set. Exits from the data set due to death, migration, or change of marital status are treated as missing at random. Observations for individuals who leave the data set are used in estimation until the year before the exit and the last observation is classified as working. Potential earnings profiles are assumed to be flat from age fifty-seven, with 1 percent real growth. Option value calculations assume knowledge of the pension and tax system as in place at the vantage point of observation. Individuals form expectations on the basis of that system and any future changes that had already been announced at that time. For the sake of comparison with other countries, preference parameters are fixed at the levels found in US data as discount rate $\beta = 0.97$, utility of leisure $\kappa = 1.5$, and risk aversion $\gamma = 0.95$.

It is informative to present examples of these option values in order to fix ideas. Figure 8.9A shows mean option value for the 1941 cohort by age for each retirement path as well as for inclusive option value combining all pathways for men, and women are shown in figure 8.9B. Option value falls with age. The fall is from a higher base for men compared to women, but the proportional fall over age is similar. The DI option value declines smoothly, whereas SS option value slows its decline just for age sixty-one and resumes a decline thereafter more slowly. This reflects an absence of age-related conditions for DI, but a postreform penalty for SS at age sixty-one due to means testing of private pension wealth, followed by bonus payments for delaying SS retirement for each quarter beyond age sixty-two. The ranking between OV profiles differs between women and men. For women the DI OV is lower than SS, while the opposite is found for men. The 1941 cohort of men typically have higher occupational pension wealth than women. As a consequence, benefits from SS are means tested to a higher degree for men than for women. Women, however, have a higher prospective rate of compensation from SS than men due to lower wages on average in a setting where benefits do not depend on preentry wages.

8.4 Results

In this section we present estimates of the models constructed in the previous section. Option value is the main explanatory variable of interest, and it is informative to first see how this evolves over age alongside retirement age to understand how it is driving the retirement decision modeling. Figure 8.10A shows the percent of men or women having reached maximum

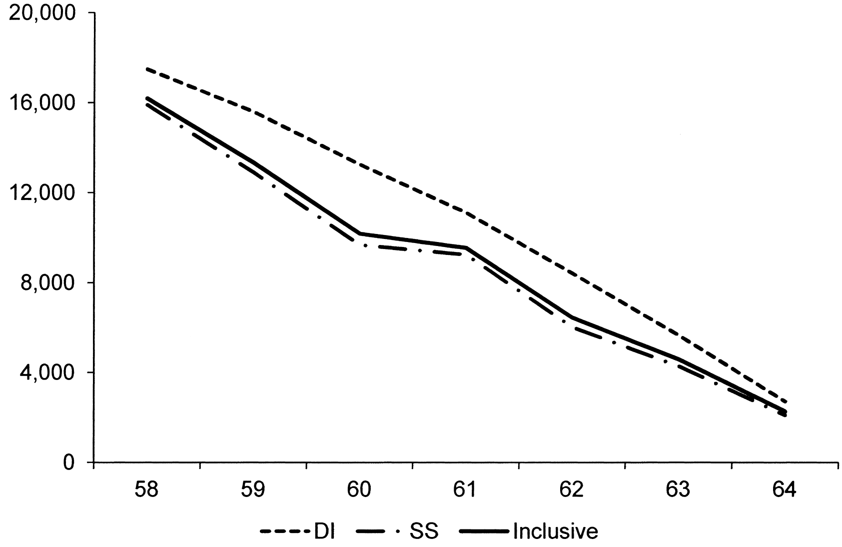

Fig. 8.9A Mean OV by age for 1941 cohort (men)

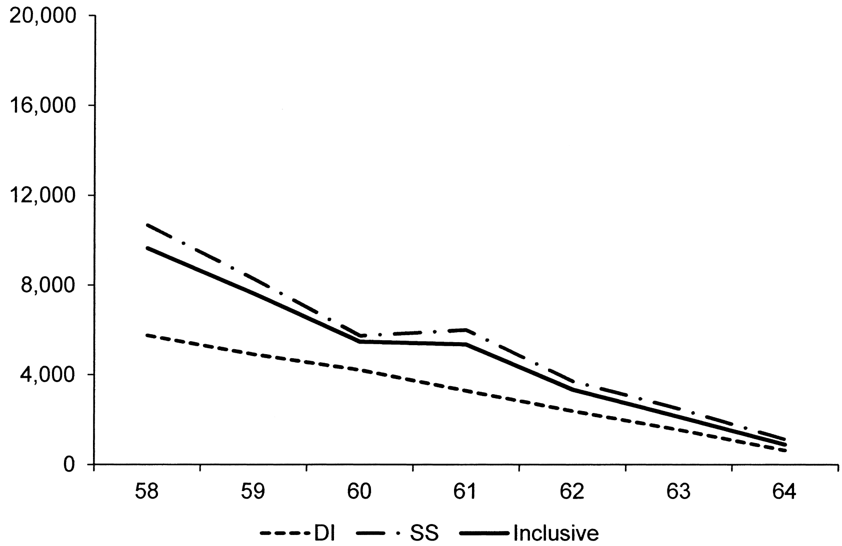

Fig. 8.9B Mean OV by age for 1941 cohort (women)

utility, or minimum option value, by age for the prereform 1938 cohort, and the postreform 1941 cohort is shown in figure 8.10B. Also shown is the percent retired by age for men and women. The percent having reached minimum option value is higher for men than women and rises faster over age for women. The pattern is similar pre- and postreform, but with a bigger share reaching minimum option value by each age prereform.

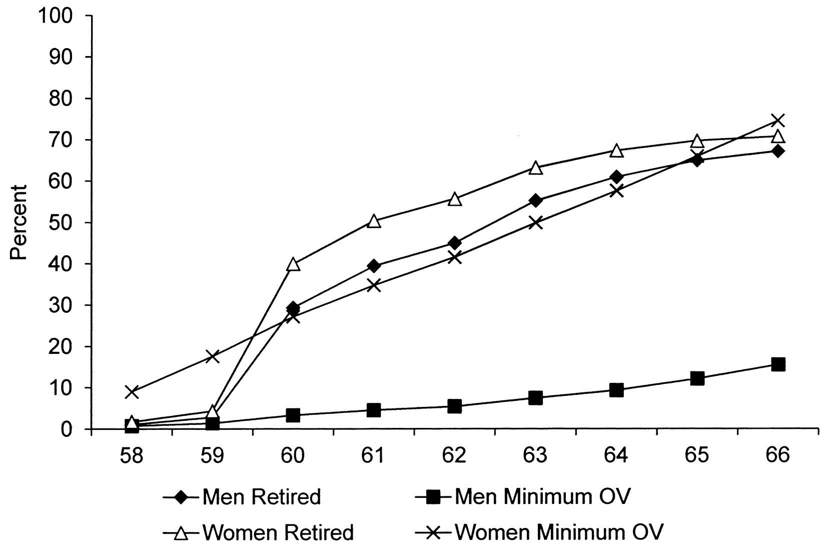

Fig. 8.10A Percent having reached minimum OV and retired by age (1938 cohort)

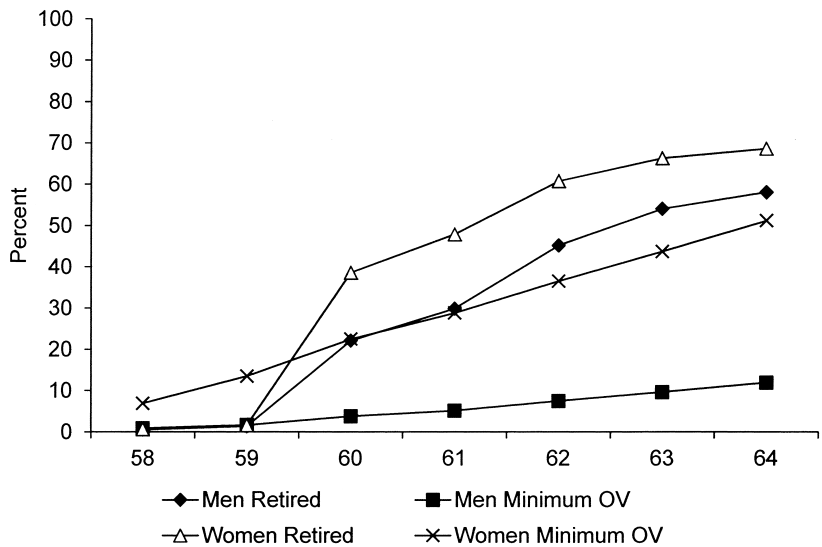

Fig. 8.10B Percent having reached minimum OV and retired by age (1941 cohort)

The remainder of the section presents estimates of option value coefficients and controls for different specifications and samples. Table 8.2A shows estimates from retirement probit regressions with option value as the key explanatory variable and health measures as controls. Each column is for a separate regression to check sensitivity of results to the inclusion of linear age versus age dummies, inclusion of additional covariates, and to different

Table 8.2A Effect of inclusive OV on retirement

	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OV_inclusive	–0.0907***	–0.0591***	–0.0775***	–0.0433***	–0.0903***	–0.0589***	–0.0773***	–0.0434***
	(0.0006)	(0.0005)	(0.0007)	(0.0005)	(0.0006)	(0.0005)	(0.0007)	(0.0005)
Health quint 2	–0.0033***	–0.0190***	–0.0007	–0.0162***				
(second lowest)	(0.0008)	(0.0006)	(0.0008)	(0.0006)				
Health quint 3	–0.0101***	–0.0256***	–0.0089***	–0.0249***				
	(0.0008)	(0.0006)	(0.0008)	(0.0006)				
Health quint 4	–0.0098***	–0.0228***	–0.0116***	–0.0250***				
	(0.0008)	(0.0007)	(0.0008)	(0.0007)				
Health quint 5	–0.0020*	–0.0150***	–0.0047***	–0.0180***				
(highest)	(0.0008)	(0.0007)	(0.0008)	(0.0007)				
Health index					–0.0060***	–0.0063***	–0.0061***	–0.0064***
					(0.0005)	(0.0005)	(0.0005)	(0.0005)
Age	X		X		X		X	
Age dummies		X		X		X		X
Female			0.0016*	0.0051***			–0.0001	0.0024***
			(0.0006)	(0.0005)			(0.0006)	(0.0005)
Married			–0.0198***	–0.0184***			–0.0198***	–0.0188***
			(0.0010)	(0.0008)			(0.0010)	(0.0008)

Spouse retired			0.0542***	0.0428***			0.0543***	0.0432***
			(0.0006)	(0.0005)			(0.0006)	(0.0005)
Total assets			–0.0000***	–0.0000***			–0.0000***	–0.0000***
			(0.0000)	(0.0000)			(0.0000)	(0.0000)
Occup. dummies			X	X			X	X
Educ: <High school			–0.0024***	–0.0045***			–0.0025***	–0.0046***
			(0.0006)	(0.0005)			(0.0006)	(0.0005)
Educ: High school			–0.0194***	–0.0154***			–0.0195***	–0.0156***
			(0.0008)	(0.0006)			(0.0008)	(0.0006)
Educ: Some college			–0.0509***	–0.0362***			–0.0510***	–0.0367***
			(0.0011)	(0.0008)			(0.0011)	(0.0008)
No. of observations	1,296,332	1,296,332	1,296,332	1,296,332	1,296,332	1,296,332	1,296,332	1,296,332
Pseudo R^2	0.081	0.207	0.103	0.229	0.081	0.205	0.103	0.228
Mean ret. rate	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120
Mean of OV	9,898	9,898	9,898	9,898	9,898	9,898	9,898	9,898
Std. dev. of OV	10,110	10,110	10,110	10,110	10,110	10,110	10,110	10,110

Note: Coefficients are marginal effects of a 10,000-unit change in OV from probit models. Standard errors are shown in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 8.2B **Effect of percent gain in inclusive OV on retirement**

	Specification			
	(1)	(2)	(3)	(4)
Percent gain in OV	–0.2180***	–0.1236***	–0.1836***	–0.0806***
	(0.0018)	(0.0014)	(0.0020)	(0.0015)
Linear age	X		X	
Age dummies		X		X
Health quintiles	X	X	X	X
Other Xs			X	X
No. of observations	1,368,865	1,368,865	1,296,332	1,296,332
Pseudo R^2	0.071	0.194	0.099	0.223
Mean ret. rate	0.120	0.120	0.120	0.120
Mean of % gain in OV	0.356	0.356	0.356	0.356
Std. dev. of % gain in OV	0.365	0.365	0.365	0.365

Notes: Models are the same as models 1–4 in table 8.2A. Coefficients are marginal effects. Standard errors are shown in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

ways of controlling for health by quintiles in the health index. Option value has a negative and statistically significant effect on retirement. Estimates are similar regardless of how health is controlled for. The OV coefficients are somewhat smaller with inclusion of additional covariates and considerably smaller with age dummies rather than linear age controls. Other covariates are significant with expected signs. Compared to the reference group in worst health, the healthier are less likely to retire. However, among the four healthy quintiles there is no gradient in retirement. There is a clear gradient in schooling, whereby those with more schooling are less likely to retire early.

An alternative parameterization of option values is as percent gain in option value from delaying retirement. Table 8.2B shows estimates from retirement probit regressions with this as the key explanatory variable and health quintiles as controls. These show the effect of the utility gain from waiting to retire until the optimal age, scaled by the utility available by retiring immediately. Coefficients of interest are negative and statistically significant. Robustness across specifications is similar to that from table 8.2A, with somewhat smaller coefficients when including covariates and considerably smaller coefficients when controlling for age with dummies rather than a linear term.

The most flexible specifications run models separately by different cuts of the data. Table 8.3A shows estimates from retirement probit regressions with option value as the key explanatory variable, run separately by health quintile. Each cell of the table corresponds to a separate regression, with

Table 8.3A **Effect of inclusive OV on retirement by health quintile**

	No. of obs.	Mean ret. rate (%)	Mean of OV	Std. dev. of OV	Specification (1)	(2)	(3)	(4)
OV: Lowest quintile (worst health)	273,552	14.363	8,862	9,392	–0.1055***	–0.0798***	–0.0966***	–0.0639***
					(0.0016)	(0.0014)	(0.0018)	(0.0015)
					[0.0566]	[0.0423]	[0.0499]	[0.065]
	R^2				0.045	0.142	0.064	0.161
OV: 2nd quintile	273,876	12.642	10,095	10,556	–0.0857***	–0.0665***	–0.0722***	–0.0490***
					(0.0015)	(0.0012)	(0.0017)	(0.0014)
					[0.053]	[0.0476]	[0.0405]	[0.0285]
	R^2				0.063	0.159	0.087	0.185
OV: 3rd quintile	273,816	10.524	10,738	11,049	–0.0772***	–0.0510***	–0.0594***	–0.0342***
					(0.0011)	(0.0009)	(0.0015)	(0.0011)
					[0.0673]	[0.0501]	[0.0436]	[0.0256]
	R^2				0.104	0.217	0.131	0.246
OV: 4th quintile	273,827	11.073	9,571	9,960	–0.0800***	–0.0428***	–0.0628***	–0.0282***
					(0.0012)	(0.0008)	(0.0015)	(0.0009)
					[0.0629]	[0.0387]	[0.0418]	[0.0186]
	R^2				0.120	0.269	0.144	0.293
OV: Highest quintile (best health)	273,794	11.249	10,217	9,381	–0.0897***	–0.0509***	–0.0765***	–0.0372***
					(0.0011)	(0.0009)	(0.0014)	(0.0010)
					[0.0835]	[0.0487]	[0.065]	[0.0283]
	R^2				0.127	0.266	0.147	0.286
Linear age					X		X	
Age dummies						X		X
Other Xs							X	X

Notes: Models are the same as models 1–4 in table 8.2A, but are estimated separately by health quintile; each coefficient on the table is from a different regression. Coefficients are marginal effects of a 10,000-unit change in OV from probit models. Standard errors are shown in parentheses. The effect of a one standard deviation change in OV is shown in brackets (this is estimated as the effect of increasing inclusive OV from the current value –0.5 std. dev. to the current value +0.5 std. dev.).

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

specifications differing by column and health quintile sample differing by row. Estimates differ across specifications according to a similar pattern seen in tables 8.2A and 8.2B. Those in worst health have the most negative option value coefficients, followed by those in the second worst health quintile, and the remainder in better health quintiles 3–5 have smaller-sized coefficients, but exhibit no obvious pattern between each other. So those in *worse health* are *more responsive* to pension incentives.

Using a more flexible specification than those presented in table 8.2B, table 8.3B shows estimates from retirement probit regressions with percent

Table 8.3B **Effect of percent gain in inclusive OV on retirement by health quintile**

	No. of obs.	Mean ret. rate (%)	Mean of % OV	Std. dev. of % OV	Specification (1)	(2)	(3)	(4)
OV: Lowest quintile (worst health)	273,552	14.363	0.34	0.36	–0.2128***	–0.1310***	–0.1897***	–0.0924***
					(0.0047)	(0.0039)	(0.0053)	(0.0042)
	R^2				0.032	0.127	0.056	0.153
OV: 2nd quintile	273,876	12.642	0.40	0.44	–0.1851***	–0.1295***	–0.1632***	–0.0931***
					(0.0038)	(0.0031)	(0.0042)	(0.0032)
	R^2				0.053	0.146	0.084	0.179
OV: 3rd quintile	273,816	10.524	0.39	0.36	–0.2043***	–0.1235***	–0.1538***	–0.0744***
					(0.0033)	(0.0026)	(0.0037)	(0.0026)
	R^2				0.094	0.204	0.128	0.240
OV: 4th quintile	273,827	11.073	0.30	0.29	–0.2352***	–0.1155***	–0.1839***	–0.0678***
					(0.0031)	(0.0022)	(0.0037)	(0.0024)
	R^2				0.117	0.261	0.145	0.290
OV: Highest quintile (best health)	273,794	11.249	0.31	0.27	–0.2321***	–0.1145***	–0.1930***	–0.0739***
					(0.0036)	(0.0027)	(0.0041)	(0.0029)
	R^2				0.118	0.253	0.144	0.280
Linear age					X		X	
Age dummies						X		X
Other Xs							X	X

Notes: Models are the same as models 1–4 in table 8.2A, but are estimated separately by health quintile; each coefficient on the table is from a different regression. Coefficients are marginal effects. Standard errors are shown in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

gain in option value from delaying retirement as the key explanatory variables, split by health quintiles. Each cell is the coefficient of interest from a separate regression. There is a familiar pattern of sensitivity across specifications, but no systematic differences in coefficients across health quintiles.

Table 8.3C shows estimates from retirement probit regressions with option value interacted with the health index as the key explanatory variables. This is the continuous health index version of table 8.3A, but further imposes that other covariates do not vary according to health, whereas they were allowed to vary in table 8.3A (not presented). Estimates of the interaction of option value with health index are negative, implying individuals in better health are more responsive to incentives. This is the opposite finding from table 8.3A and is likely due to the restriction that other controls are not allowed to also vary by health.

Analogously to splitting the sample by health quintile, the next two tables

Table 8.3C Effect of inclusive OV on retirement with health interaction

	Specification			
	(1)	(2)	(3)	(4)
OV_inclusive	–0.0842***	–0.0492***	–0.0714***	–0.0348***
	(0.0012)	–0.0009	–0.0012	–0.0009
	[0.0643]	[0.0446]	[0.0502]	[0.0263]
Health index	–0.0003***	0.0002***	–0.0003***	–0.0002***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
OV_inclusive*health index	–0.0001***	–0.0001***	–0.0001***	–0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Linear age	X		X	
Age dummies		X		X
Other Xs			X	X
No. of observations	1,296,332	1,296,332	1,296,332	1,296,332
Pseudo R^2	0.081	0.205	0.103	0.228
Mean ret. rate	0.119697	0.119697	0.119697	0.119697
Mean of OV	9,897.63	9,897.63	9,897.63	9,897.63
Std. dev. of OV	10,109.82	10,109.82	10,109.82	10,109.82

Notes: Models are the same as models 5–8 in table 8.2A, with the addition of an OV*health index interaction. Coefficients are marginal effects of a 10,000-unit change in OV from probit models. Standard errors are shown in parentheses. The effect of a one standard deviation change in OV is shown in brackets (this is estimated as the effect of increasing inclusive OV from the current value –0.5 std. dev. to the current value +0.5 std. dev.).

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

split the population by level of educational attainment. Table 8.4A shows estimates from retirement probit regressions with option value as the key explanatory variable, for samples split by schooling. Each cell of the table corresponds to a separate regression, with specifications differing by column and schooling-level sample differing by row. Once again, estimates differ across specifications according to a similar pattern seen in tables 8.2A and 8.2B. There is a clear gradient in coefficients across schooling samples, with those having the least schooling having the most negative option value coefficients, and gradually coefficients become less and less negative for samples with more and more schooling. The OV coefficients for those without a high school degree are about five times as large as OV coefficients for those with a college degree. The biggest difference in coefficients is at the high school graduation margin.

Finally, table 8.4B shows estimates from retirement probit regressions with percent gain in option value from delaying retirement as the key explanatory variables, for different samples split by level of schooling. This shows a similar gradient to that presented in table 8.4A.

Table 8.4A **Effect of inclusive OV on retirement by education group**

	No. of obs.	Mean ret. rate (%)	Mean of OV	Std. dev. of OV	Specification (1)	(2)	(3)	(4)
OV: < High school	428,140	14.2	7,559	7,346	–0.1030***	–0.0659***	–0.1026***	–0.0549***
					(0.0016)	(0.0013)	(0.0021)	(0.0016)
					[0.0605]	[0.0375]	[0.0596]	[0.0266]
	R^2				0.058	0.204	0.078	0.227
OV: High school	580,931	12.4	9,576	8,768	–0.0913***	–0.0548***	–0.0863***	–0.0463***
					(0.0010)	(0.0008)	(0.0012)	(0.0009)
					[0.0683]	[0.0417]	[0.0608]	[0.0304]
	R^2				0.093	0.219	0.107	0.234
OV: Some college	268,381	8.9	11,798	11,554	–0.0614***	–0.0374***	–0.0595***	–0.0328***
					(0.0010)	(0.0007)	(0.0012)	(0.0008)
					[0.0454]	[0.0292]	[0.0452]	[0.024]
	R^2				0.079	0.181	0.097	0.198
OV: College	86,920	4.1	17,979	17,053	–0.0218***	–0.0150***	–0.0191***	–0.0123***
					(0.0006)	(0.0005)	(0.0007)	(0.0005)
					[0.023]	[0.0186]	[0.0186]	[0.0137]
	R^2				0.086	0.142	0.104	0.163
Linear age					X		X	
Age dummies						X		X
Health quintiles					X	X	X	X
Other Xs							X	X

Notes: Models are the same as models 1–4 in table 8.2A, but are estimated separately by education group; each coefficient on the table is from a different regression. Coefficients are marginal effects of a 10,000-unit change in OV from probit models. Standard errors are shown in parentheses. The effect of a one standard deviation change in OV is shown in brackets (this is estimated as the effect of increasing inclusive OV from the current value –0.5 std. dev. to the current value +0.5 std. dev.).

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

8.4.1 Model Fit

Estimates from table 8.2A, specification (4) are based on the full sample with option values, health quintiles, age dummies, and a full set of controls. Figures 8.11A and 8.11B show goodness-of-fit from this model in terms of observed and predicted hazard rates, separately for men and women. Hazard rate spikes at ages sixty and sixty-two are fitted well for both men and women. Estimates from table 8.3A, specification (4) are based on samples split by health quintile with option values, age dummies, and a full set of controls. Predictions by health quintile are presented in figures 8.11C and 8.11D and track the average hazard rate quite closely, with worst health always clearly more likely to retire at all ages and a more modest gradient in predicted retirement hazard across the better health quintiles. Estimates

Table 8.4B **Effect of percent gain in inclusive OV on retirement by education group**

	No. of obs.	Mean ret. rate (%)	Mean of % OV	Std. dev. of % OV	Specification (1)	(2)	(3)	(4)
OV: < High school	428,140	14.21	0.31	0.31	–0.2269***	–0.1229***	–0.2241***	–0.0935***
					(0.0035)	(0.0027)	(0.0044)	(0.0031)
	R^2				0.055	0.199	0.075	0.223
OV: High school	580,931	12.38	0.36	0.34	–0.2182***	–0.1113***	–0.2053***	–0.0861***
					(0.0026)	(0.0020)	(0.0030)	(0.0022)
	R^2				0.088	0.209	0.103	0.228
OV: Some college	268,381	8.94	0.38	0.41	–0.1544***	–0.0844***	–0.1419***	–0.0679***
					(0.0032)	(0.0023)	(0.0036)	(0.0025)
	R^2				0.074	0.173	0.091	0.192
OV: College	86,920	4.10	0.49	0.61	–0.0537***	–0.0322***	–0.0442***	–0.0246***
					(0.0044)	(0.0033)	(0.0045)	(0.0032)
	R^2				0.067	0.121	0.091	0.149
Linear age					X		X	
Age dummies						X		X
Other Xs							X	X

Notes: Models are the same as models 1–4 in table 8.2A, but are estimated separately by education group; each coefficient on the table is from a different regression. Coefficients are marginal effects. Standard errors are shown in parentheses.

***Significant at the 1 percent level

**Significant at the 5 percent level.

*Significant at the 10 percent level.

from table 8.4A, specification (4) are based on samples split by schooling level with option values, age dummies, and a full set of controls. Predictions by schooling are presented in figures 8.11E and 8.11F and track the average hazard rate closely for those with less than some college, but predicted hazards are more damped for those with some college and especially for college graduates.

8.4.2 Implications of the Results

Counterfactual simulations help us understand how the provisions of DI and SS programs differentially affect retirement ages. Figure 8.12A shows survival rates in work by age for simulating that only the DI retirement pathway is available or only the SS retirement pathway is available, and for those only ever receiving DI in figure 8.12B. Survival in work declines faster for simulations based on individuals who have ever received DI. For both the full population and those ever on DI, there is less survival in work simulating only the DI pathway.

A useful summary measure of the retirement consequences of our counterfactual simulations is the number of expected years of work after age fifty-seven. Figure 8.13 shows this together with two additional intermediate

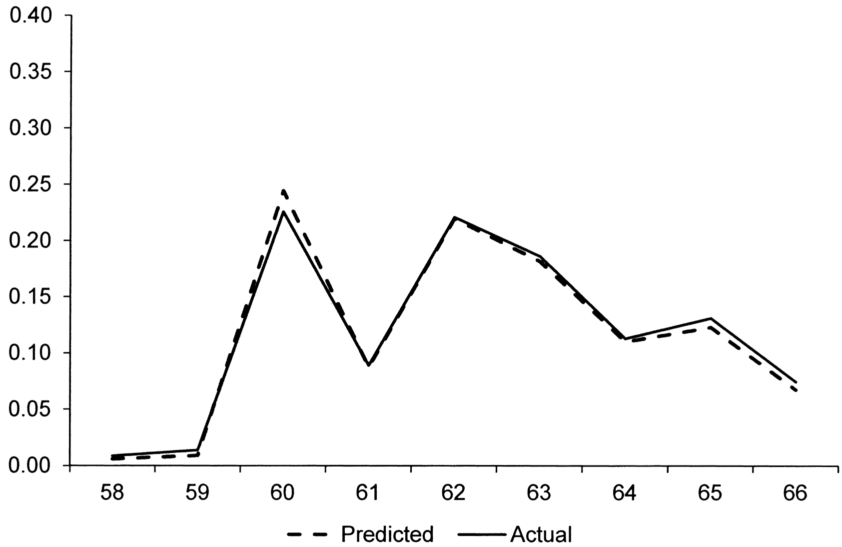

Fig. 8.11A Actual versus predicted retirement age (men)

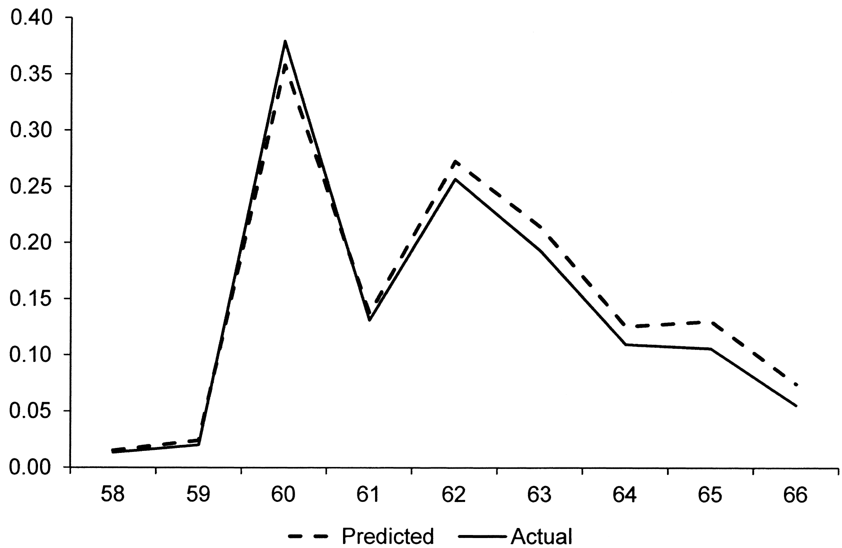

Fig. 8.11B Actual versus predicted retirement age (women)

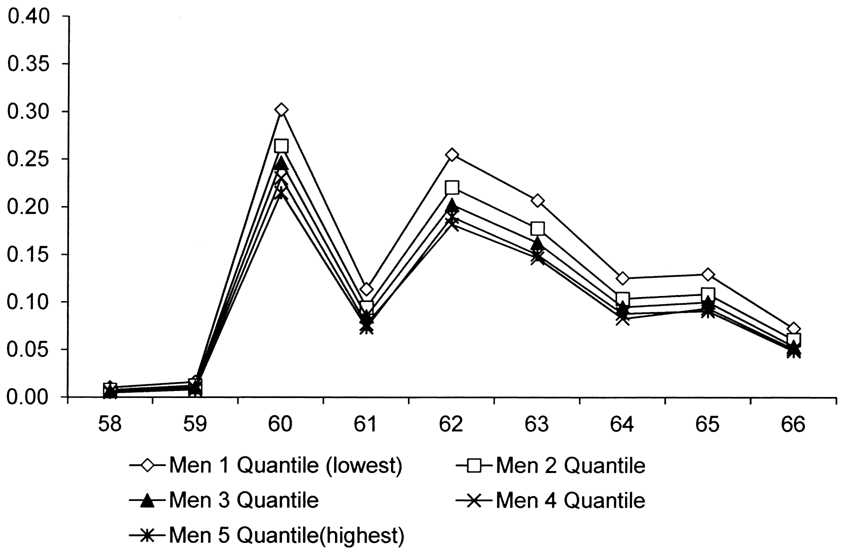

Fig. 8.11C Predicted retirement age by health quintile (men)

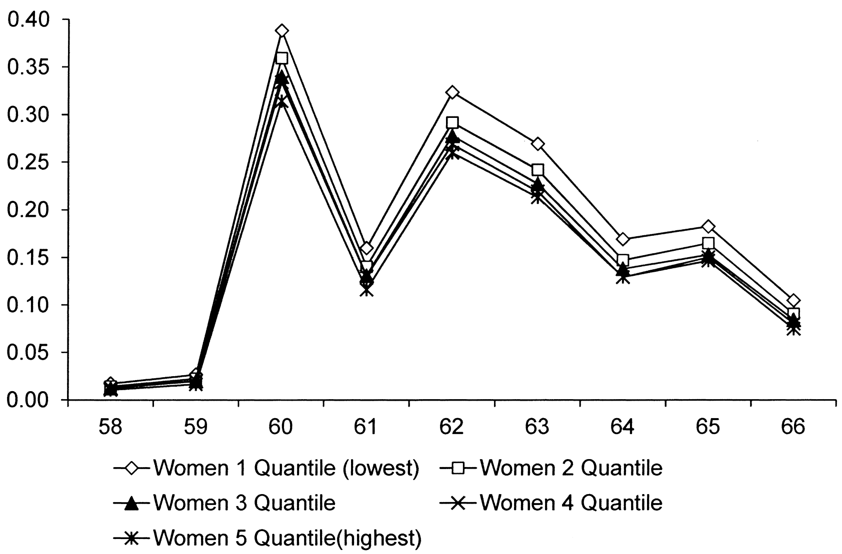

Fig. 8.11D Predicted retirement age by health quintile (women)

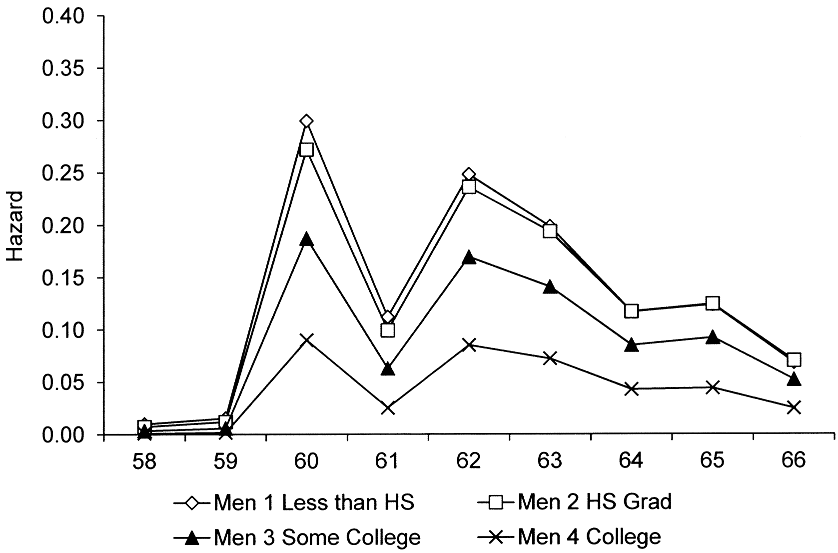

Fig. 8.11E Predicted retirement age by education (men)

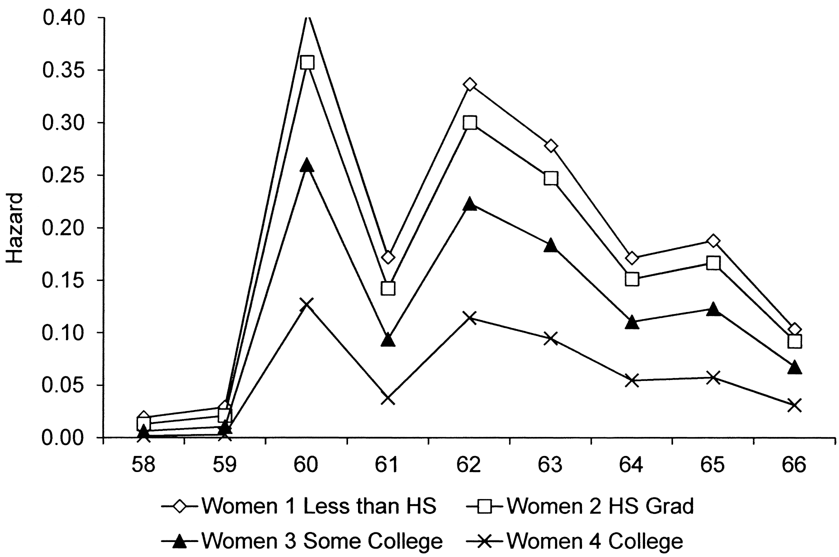

Fig. 8.11F Predicted retirement age by education (women)

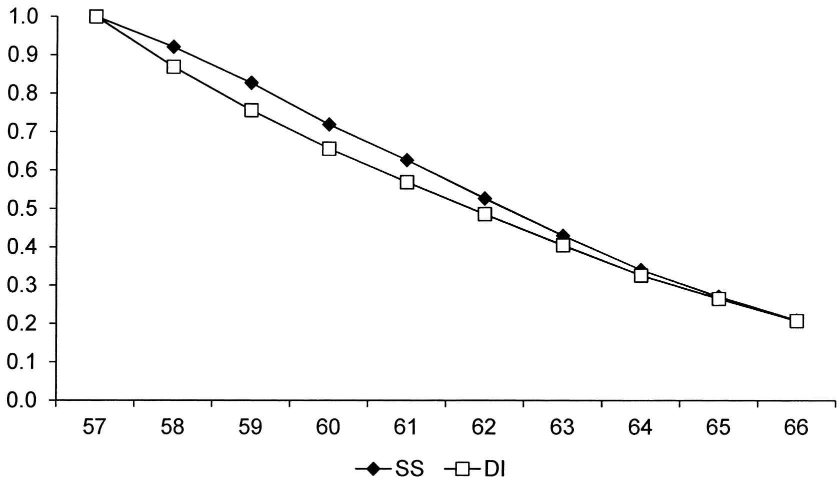

Fig. 8.12A Simulated survival probabilities in work by pathway, for everyone

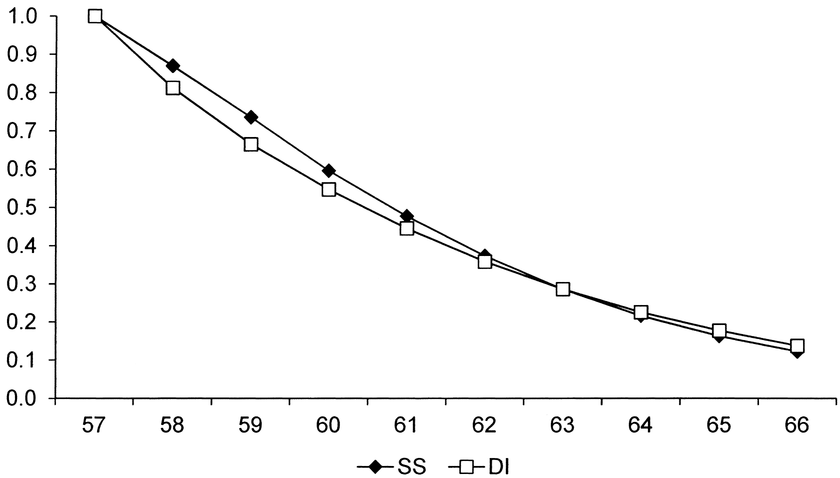

Fig. 8.12B Simulated survival probabilities in work by pathway, for those having received DI

simulations, which are also conducted and presented for those ever receiving DI. The two new simulations involve first a random one-third assignment to the DI pathway and two-thirds assignment to the SS pathway, and second a two-thirds random assignment to the DI pathway and one-third to the SS pathway. For the full population, the SS pathway has 4.8 expected remaining years in work and the DI pathway has 4.5. For the sample of those who have ever received DI, the number of expected work years beyond fifty-seven for the SS pathway is 3.8 compared with 3.6 for the DI pathway.

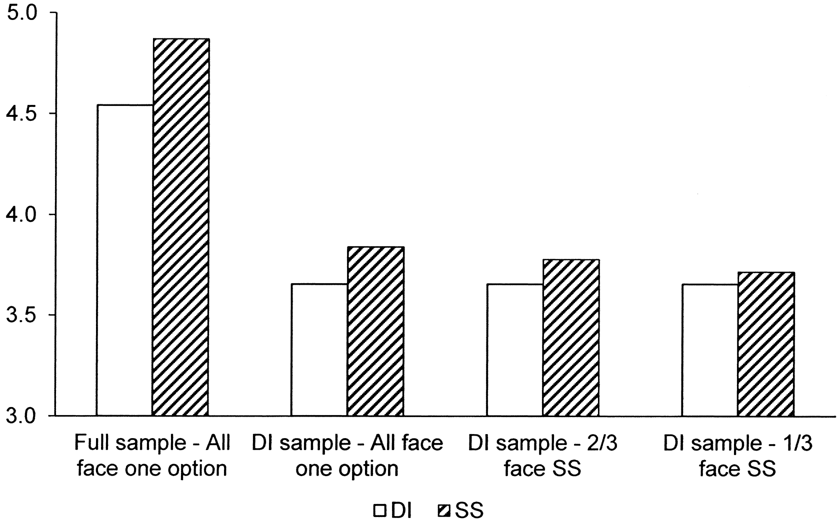

Fig. 8.13 Expected years of work after age fifty-seven on DI versus SS path

Simulated changes in DI stringency are shown in the other two sets of bars in figure 8.13. By randomly assigning first one-third and then two-thirds from the DI pathway to the SS pathway, we tighten access to the DI program and remaining work years increase from 3.60 first to 3.67 and then 3.73. This is a rather modest employment effect from making DI harder to access for a sample who have received DI.

8.5 Conclusion

We have examined the extent to which differences in labor force participation rates by health status are determined by the provisions of disability insurance and other pension programs. Using population-based administrative data for Denmark over the period 1996–2008, we identify incentive effects from a pension reform enacted in 1999–2006 while controlling for health care usage measured by hospitalization and prescription medicine purchase.

Descriptive analyses show that there is a gradient in DI participation rates by health status, with those in worse health being more likely to receive DI. A similar pattern is found for schooling, with those having less schooling being more likely to receive DI. The gradient of DI participation across health quintiles is almost twice as steep as across levels of schooling—when moving from having no high school diploma to graduating college. While the relationship between health status and DI participation is to be expected, the relationship with schooling is less well recognized, though it may largely be due to those who are in better health having more schooling.

In order to capture the incentives implicit in pension program provision, we characterize the potential gains from postponing retirement in an option value model that allows for different pension pathways to retirement. We find that pension program incentives in general are important determinants of retirement age. In order to understand how the provisions of DI and social security programs interact, we simulate increases in DI stringency by randomly allocating one-third, then two-thirds, of DI recipients to a social security pathway. These simulations show only rather modest changes in expected number of remaining work years, largely because of the availability of social security benefits for most people already at age sixty.

In our most flexible specifications, we estimate option value models of retirement age separately by health quintile and educational level in order to measure differential incentive effects. We find that individuals in poor health are significantly more responsive to economic incentives than those in better health. Similarly, those with less schooling are significantly more responsive to economic incentives than those with more schooling. The schooling effect partly reflects that the less educated have worse job prospects and therefore higher replacement rates from pension programs.

Our main finding is the existence of similar gradients in DI participation across health and education, and corresponding gradients in behavior in response to retirement incentives across health and education. Those in worse health and with less schooling participate more in DI and are more responsive to pension incentives. This suggests that reducing pension incentives to retire early will delay retirement most for those currently retiring earliest.

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