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Health Status, Disability Insurance, and Incentives to Exit the Labor Force in Italy
Evidence from SHARE

Agar Brugiavini and Franco Peracchi

10.1 Introduction

Europe has witnessed a variety of policy interventions and reforms aimed at reducing the debt burden and public spending. Old-age spending is most prominent in such a landscape, and Italy has been at the center of the policy debate: on the one hand its debt over gross domestic product (GDP) ratio is one of the highest in Europe, and on the other hand, recent governments have legislated several social security reforms to guarantee sustainability. These reforms have tried to tackle the budgetary effects of the growth in longevity—which in Italy has been quite spectacular in the last decades (see Brugiavini and Peracchi 2012)—by increasing the old-age retirement age, by making early retirement less generous, in terms of both benefits and eligibility requirements, and by linking pension benefits to mortality in a more actuarially fair fashion.

It should be noted that Italy failed to reach the Lisbon target set by the

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This chapter uses data from SHARELIFE release 1, as of November 24, 2010, and SHARE release 2.5.0, as of May 24, 2011. The SHARE data collection has been primarily funded by the European Commission through the 5th framework programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life), through the 6th framework programme (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th framework programme (SHARE-PREP, 211909 and SHARE-LEAP, 227822). Additional funding from the US National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064, IAG BSR06-11, R21 AG025169) as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions). For acknowledgments, sources of research support, and disclosure of the authors' material financial relationships, if any, please see http://www.nber.org/chapters/c13329.

European Union, which required an employment rate for the age group fifty-five to sixty-four of 50 percent in the year 2010. Hence the challenge in Italy has been, for several years, to increase labor supply of workers in the age group fifty to sixty-five both by changing the incentives to retirement and by introducing stringent eligibility conditions. A "season" of pension reforms started in the year 1992 and the last—quite significant—reform took place in 2011.

However, the literature and the policymakers have paid little attention to the potential "substitutability" effects that could take place when the access to an exit route from the labor market, such as early retirement, becomes more limited. Indeed, for some workers in Italy a possible alternative to leave the labor force is to apply for disability benefits. Before 1984, disability benefits were awarded very generously on the basis of very loose health requirements. Eligibility conditions changed dramatically after 1984, in such a way that applicants had to undergo a very stringent medical test in order to qualify. The early retirement option has traditionally been extremely generous in Italy, and firms on the one hand and workers and unions on the other hand took advantage of such lenient rules to cushion negative shocks over the business cycle without having to fire employees or leave the labor force at young ages (Brugiavini and Peracchi 2004). The disability option was clearly less appealing at the time. It is therefore an open question whether a renewed interest by workers for disability pensions could stem from the recent pension reforms and the role played by health limitations in these choices. However, in order to capture the actual behavior of workers it is important, particularly in Italy, to take account of all possible options available in each year and to each individual.

In this chapter, we analyze the retirement behavior of Italian employees by considering distinct pathways to retirement such as old-age, early retirement, and disability insurance. In particular, we focus on the role played by health conditions and socioeconomic factors beyond and above the financial incentives associated to each pathway as measured by the "option value" of working an extra year vis-à-vis leaving the labor force through one of the alternative routes.

These financial incentives are used in a dynamic way, as in Gruber and Wise (2004): at a given age, a full benefit stream is computed for each future age, conditional upon survival and eligibility, and is then updated as extra years of work contributed to the pension calculation. Underlying long-term trends may partly confound the analysis, but we are able to control for cohort effects, which are particularly relevant in the Italian context, especially for women who increased their labor force participation only recently.

We contribute to the current debate on retirement behavior by referring especially to disability insurance (DI) benefits as a potentially utility-maximizing exit route and by analyzing the role played by health and other socioeconomic factors in the decision mechanism. To achieve this goal we combine Italian administrative data from the National Institute for Social Security (INPS) with the information on the subsample of Italian respondents in the Survey of Health, Ageing and Retirement in Europe (SHARE).

The administrative data—available in the form of a long panel—contain information on individuals' working careers and exits from the labor force at different years and ages, but lack information concerning health, education, and household characteristics, which is instead provided in SHARE.

This chapter is structured as follows. Section 10.2 outlines the institutional background of the Italian social security system and provides a first description of the data. Section 10.3 describes the available data in more depth, provides the methodology for constructing the incentive measure, and presents the empirical estimates. Section 10.4 discusses a series of policy reforms (simulations) and outlines their effect in terms of labor market behavior. Section 10.5 concludes.

10.1.1 Institutional Background

The Italian social security system is based on a variety of institutions administering public pension programs for different types of workers (private-sector employees, public-sector employees, self-employed, professional workers).[1] All programs are of the unfunded pay-as-you-go (PAYG) type. Despite a process toward convergence during the last two decades, the rules of the various programs remain somewhat different.

The main risks covered by the system are old age (through old age and early retirement pensions), disability, loss of the spouse or parent (through benefits to survivors), and unemployment. While all workers can access old-age and DI benefits subject to general eligibility conditions, unemployment insurance is not universal but is conditional to specific rules defining periods and types of firms undergoing financial distress.

Old-Age and Early Retirement Pensions

Public old-age and early retirement pensions are by far the largest public spending item of the Italian welfare budget.[2] In this section we briefly review the basic setup of the pension system and its recent reforms, and refer to Brugiavini, Peracchi, and Wise (2003) and to Brugiavini and Peracchi (2004) for further details.

The Italian pension system is characterized by a large first pillar and by almost negligible second and third pillars. Public pensions are organized by type of employment: private-sector employees pay contributions to the National Social Security Institute (INPS). The institute covers about nineteen million workers, twelve million of which are private-sector employees,

1. In this chapter we use the terms social security system and pension system synonymously. In fact, in Italy, social security is the main source of publicly provided income in old age.

2. In 2011, total expenditure on pensions reached 16 percent of GDP, with 11 percent of GDP spent on public old-age pension.

while the others are different types of self-employed workers. Another four million public-sector employees and civil servants pay contributions to a separate fund (INPDAP) now also managed by INPS. Only recently have some private retirement saving accounts been offered to workers, but the impact of the Great Recession has dwarfed the possibilities of growth for these forms of old-age insurance.

The system offers both an old-age pension, which depends on the years of age, and an early retirement (seniority) pension, which also depends on the years of contribution. Originally, seniority pensions were granted irrespective of age to retirees with at least thirty-five years of contribution, or even less for particular categories of workers (for example, female public-sector employees). The idea was to provide income to individuals who had started their working life early on, and also to women who had carried out both market and nonmarket activities during their lifetimes.

Until the 1980s, the statutory retirement age for old-age pensions was sixty for men and fifty-five for women, but a generous early retirement option was also available. The calculation of benefits changed over time, but was essentially of the "final salary" type, for both old-age and early retirement pensions, as averages of the earnings over the last years of work (pensionable earnings) formed the basis for the level of benefits. The initial pension was obtained multiplying pensionable earnings by a "rate of return" (accrual factor) approximately equal to 2 percent for each year of contribution (up to a maximum of 80 percent).

Starting in the early 1990s, the Italian pension system was modified through a long reform process. The most recent is the Fornero reform, legislated in 2011 and named after the labor minister in charge at the time. All these reforms aimed at increasing the retirement age and curtailing benefits, for example, by applying an actuarially fair basis for calculation. In this work, we focus on two major reforms, enacted in 1992 and 1995 and known, respectively, as Amato and Dini reforms from the names of the prime ministers of the time. The 1995 reform is particularly important because it completely redesigned the system by modifying the eligibility rules and by changing the calculation of old-age benefits from a defined-benefit (DB) basis to a notional defined-contribution (NDC) basis. However, because these changes were introduced gradually through a very long transitional period, the immediate effects of this reform were not as marked as those implied by the 1992 reform.

A common aspect of the reforms of the 1990s is the grandfathering approach, that is, the differential treatment of different cohorts of workers. For example, the 1992 reform explicitly distinguished between workers with at least fifteen years of contributions at the end of 1992 and workers with less than fifteen years of contributions; while the former group was kept under the status quo rules as far as benefits calculation and eligibility rules were concerned, for the latter group a new and much less favorable system was introduced. In particular, under the new system, the eligibility age for an old-age pension was increased gradually by one year of age every two years starting in 1994 until reaching age sixty-five for men and age sixty for women in the year 2000. The numbers of years of contribution required for an old-age pension was also increased gradually by one every two years starting in 1993 until reaching twenty years of contributions in 2001. One important change brought about by the 1992 reform, with relevant budgetary implications, was the indexation of pension benefits to price inflation only, rather than to nominal wage growth.

The grandfathering rule was maintained in the 1995 reform. In particular, the 1995 reform distinguished between three categories of workers depending on their number of years of contribution at the end of 1995: those with at least eighteen years of contribution, those with less than eighteen years, and new entrants into the labor force. Except for the changes to the eligibility rules introduced by the 1992 reform, very few changes applied to workers with at least eighteen years of contributions. On the other hand, for new entrants, the benefit computation method changed dramatically from DB to NDC.

Along the transitional phase, due to end in 2032 when all workers are expected to retire under the new (1995) regime, benefits are computed on a pro rata basis according to the number of years of contributions under the two regimes (contributions paid after 1993 count under the new regime). Furthermore, during the transitional phase, eligibility for a seniority pension depends on both years of age and years of contribution. For example, in 1996 a worker could take early retirement at age fifty-two if the worker had accumulated thirty-five years of contribution. These limits were gradually raised in such a way that, in 2002, eligibility required fifty-seven years of age and thirty-five years of contribution for both men and women. The minimum age for seniority pensions was legislated to increase until reaching age forty in 2008 (table 10.1).

The Fornero reform, introduced in 2011, touches three major points. First, concerning the calculation of the initial benefits, it stipulates the immediate transition (starting January 2012) to the contributive system pro rata. Second, the law still allows for two possible exit routes, the old-age pension and the early retirement pension, but the eligibility requirements become more stringent for both. On the one hand, for the old-age pension there will be a gradual increase in the legal age requirement in such a way that by 2018 there will be no difference between men and women, and by 2050 the age requirement will become sixty-nine years and nine months for all types of workers. On the other hand, for the early retirement option, the reform stipulates a gradual increase in the number of years of contributions needed to access this pathway (forty-six years for men and forty-five for women in 2050).

Table 10.1 **Rules for early retirement in the transitional phase for private sector employees**

Year	Age and years of contribution	Only years of contribution
1998	54 and 35	36
1999	55 and 35	37
2000	55 and 35	37
2001	56 and 35	37
2002	57 and 35	37
2003	57 and 35	37
2004	57 and 35	38
2005	57 and 35	38
2006	57 and 35	39
2007	57 and 35	39
2008	58 and 35	40
2009	58 and 35	40
2010	59 and 36 or 60 and 35 (quota 95)	40
2011	60 and 36 or 61 and 35 (quota 96)	40

Moreover, for those individuals whose retirement benefits are computed with the defined benefit method, the law sets a penalty if they retire before the age of sixty-two. Last but not least, the Fornero reform links the adjustment of the age requirement for an old-age pension to the increase in life expectancy. Starting in 2019, the adjustment will take place every two years.

Disability Insurance

A public invalidity pension was introduced in Italy in 1919 for individuals who, because of reductions in their working capacity, were unable to earn income below a given level. In particular, the cut-off point was established at one-third of the normal wage for a worker in the same activity in the same area of the country. Hence, DI benefits were granted on the basis of rather loose health eligibility requirements for those workers who qualified because of limited earnings capacity. In 1984, the public invalidity pension was changed through an important reform: workers would qualify only because of a certified mental or physical impairment. Also, a public "inability" pension was introduced for private-sector employees and self-employed workers with a physical or mental disease, certified by a medical test, which is permanent and makes it impossible to carry out any job. In addition, other forms of disability make individuals eligible for pensions on the basis of a medical test, even if the individual did not contribute to social security.

Currently, the Italian social security system currently provides two types of disability benefits:

1. Ordinary (civilian) disability benefits are granted to all citizens under certain health impairments (including deaf or dumb people older than eigh-

teen). In some cases, a monthly attendance benefit is also paid in order for the beneficiary to receive home care. For people older than sixty-five, a noncontributory pension (*pensione sociale*) is paid. Since 1971, an inability pension is also available to individuals age eighteen to sixty-five who cannot carry out any type of work. The handicap should be certified to be 100 percent of the working capacity of the individual.

2. Invalidity benefits are granted to workers registered with the Italian Social Security Institute (INPS) whose working capacity is permanently reduced by at least two-thirds because of physical or mental impairments. We will also include in this category of benefits "inability pensions" though these would—strictly speaking—follow different rules.

It is important to stress that, after the law passed in 1984, the eligibility rules for an invalidity pension became much more binding. First, benefits were subject to a medical test that certified that the claimed physical or mental disease caused at least a two-thirds reduction of the original working capacity. Second, at least five years of social security contributions were necessary, of which at least three in the five years were before applying for benefits. One of the important restrictions introduced by the reform was that the benefit would not be permanent: eligibility conditions had to be assessed every three years and only after three consecutive successful applications would the benefit become permanent. Furthermore, the law allowed to convert DI automatically into an old-age pension at the legal retirement age and could not be paid along with unemployment benefits.

10.1.2 Recent Trends in Program Participation and Benefit Take-Up

The Available Data

In this chapter we make use of two sources of data: a sample of administrative records from the INPS archives and survey data from the Survey of Health, Ageing and Retirement in Europe (SHARE).

The INPS sample is drawn from administrative records provided by the National Institute of Social Security.[3] The sample has four components: (a) information on the private-sector employees (a stock measure) paying social security contributions recorded at the end of each year; (b) information on beneficiaries (a stock measure) by type of benefit, regardless of the type of job previously held and labor market participation (hence including individuals with no labor market experience); (c) information on the flow of new pension and benefit awards at the end of each year; and (d) a panel of earnings histories, which can be linked to the stock information reported in (b). The years that are available to us are from 1985 to 2004. It should be stressed that the information on working histories described in (d) is

3. We are grateful to Fondazione Rodolfo Debenedetti for making available to us the INPS sample.

available only for a subsample of individuals: those who had any previous attachment to the labor force paying contributions to the social security administration and previously working as private-sector employees. Hence, for the stock and flow data we can observe dimensions such as participation to a program (benefit take-up), gender, age, and possibly previous occupation. When we link with earnings histories, we also obtain information on previous earnings and contribution histories, and detailed characteristics of the occupation held (only for private-sector employees).

In constructing our working sample, we selected only benefit recipients who could be linked with their earnings history (thus excluding, for example, widows who had no earnings ever in their lifetime but currently collect survivor benefits, or individuals who receive benefits that are not work related such as income maintenance for the elderly [*pensione sociale*]). Unfortunately, this choice also excludes public-sector employees because for these retirees no detail is available on the characteristics of their former job and their former contributions. There are two main reasons for our sample selection criteria: first, we are interested in the transition from work to other nonemployment states and want to focus on former (or current) workers only, and second, in Italy it is possible for people to work and collect benefits at the same time (for example, disability benefit), or to collect more than one benefit. In the latter cases we need to rely on a complete set of information regarding the worker/retiree in order to allocate individuals to the relevant category. In this sense, the information provided by the stock or even flow data is only partial. Finally, a further reduction of the sample was required as we had to select the population "at risk of retirement" (of age fifty and above) and focus on complete records in terms of relevant characteristics such as age and occupation. While the INPS data initially included 148,000 individuals, after our selection criteria we ended up with a sample of 81,246 individuals (631,844 records).

A large part of our empirical investigation, in particular the econometric study, is based on the Italian data from SHARE. The survey collects data on European citizens age fifty and over (and their spouses of any age). Questions posed to the respondents refer to different dimensions of their lives from economic conditions, labor supply, and retirement decisions to health status. Four waves of data are available at the moment: the baseline sample collected in 2004, the first panel wave of 2006, the SHARELIFE (retrospective, life histories) wave (that is, entirely panel, with no refresher component), and the second panel wave of 2011. The total number of countries involved in the first three waves is thirteen (Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Italy, the Netherlands, Poland, Spain, Sweden, and Switzerland) and they provide a wide variety of institutional, cultural, and economic differences.

In this chapter we use both the panel component of SHARE for Italy (SHARE-IT sample) and the SHARELIFE component consisting of retrospective information. Through SHARELIFE, we can reconstruct sequences of events relevant to an individual, for example, employment spells or transitions into retirement. The initial SHARE-IT sample from the 2004, 2006, and 2011 waves contains 9,125 individuals. This is the sample used for the descriptive analysis of disability rates. However, as it will become clear in the following sections, some selection had to be made based on criteria related to the health information or to the occurrence of a transition, which required pooling all the data including the SHARELIFE component and further reducing the sample size.

Finally, we make use of mortality data for Italy from the Human Mortality Database (HMD). The database is the result of a joint project by the Department of Demography of the University of California at Berkeley and the Max Planck Institute for Demographic Research in Rostock, Germany, and provides data on mortality by gender, age, and birth cohort for a large number of countries.

Take-Up of DI Benefits

In this section we describe changes over time to DI participation in Italy. We do this by using both administrative and survey data. Administrative data help us characterize changes in DI participation by a set of characteristics such as age, gender, and type of occupation. On the other hand, survey data such as SHARE are much richer in terms of socioeconomic and demographic characteristics of the individuals and the households they belong to. This information can be exploited to analyze to what extent changes in DI reflect improvements in health conditions or in educational attainment for the population of interest. For the purpose of this study, the main advantage from using SHARE is the availability of a large set of variables on health conditions (physical and mental health) in connection with other socioeconomic characteristics, including educational attainment.

In order to get a first grasp of the relevance of DI benefits in Italy, we computed disability rates from the INPS sample, that is, the sample of administrative records provided by the National Institute of Social Security.

Figures 10.1A and 10.1B show the evolution of disability rates for men and women in Italy for three age groups, fifty to fifty-four, fifty-five to fifty-nine, and sixty to sixty-four. For each age group, the disability rates are computed by taking the ratio between the number of individuals collecting DI benefits and the number of individuals who are either working or collecting any type of benefits.[4]

Disability rates increase for men between 1993 and 1999 and then peter

4. Since in Italy retirees can receive more than one pension benefit and, under certain conditions, can also work and receive DI benefits at the same time, we had to use a general—though arbitrary—rule to decide if an individual is in disability, is a retiree, or is a worker. In all those cases where the DI benefit is not the only source of income, we regarded as a DI recipient an individual whose share of income from DI is prevalent (more than 65 percent).

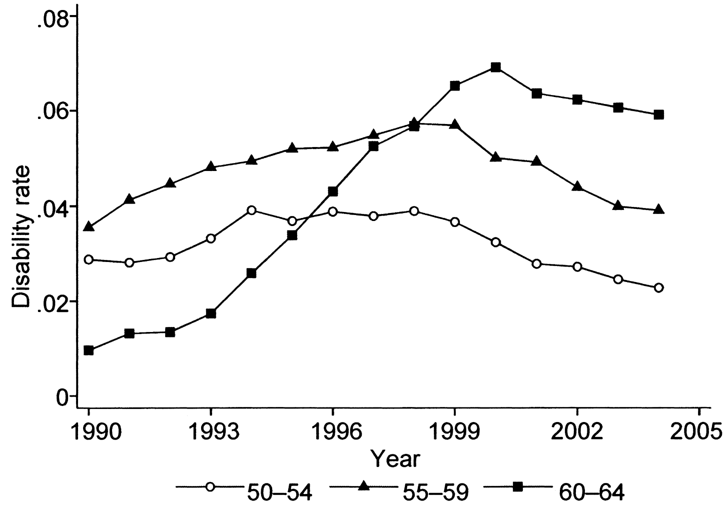

Fig. 10.1A Disability rates by age group, men (INPS data)

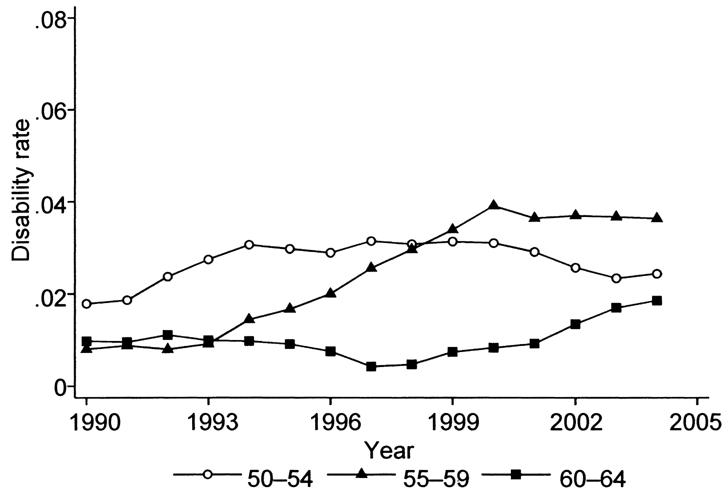

Fig. 10.1B Disability rates by age group, women (INPS data)

out (figure 10.1A). This pattern may be related to the reforms of 1992 and 1995, which gradually increased both the legal retirement age and the contributive requirement. Individuals who qualified for disability benefits (plausibly those in poor health) may have opted for this less restrictive retirement route in order to maximize the probability of receiving the benefit and to minimize the waiting time. In fact, as it is clear from figure 10.1A, disability rates remained rather stable for the age group fifty to fifty-four, which

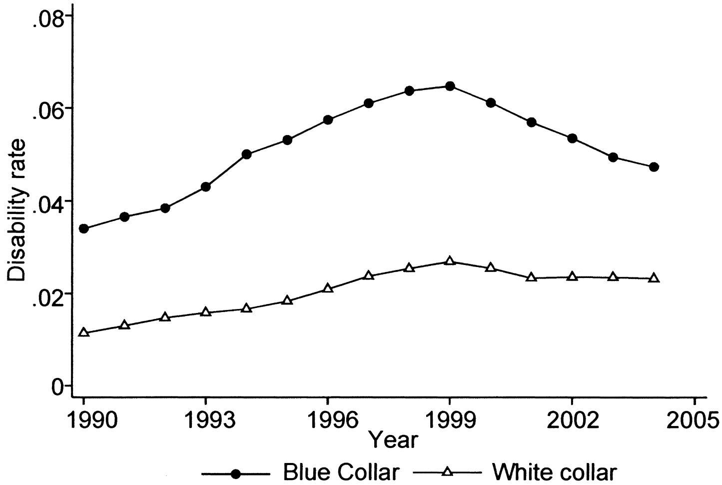

Fig. 10.1C Disability rates by occupational status, men age fifty to sixty-four (INPS data)

was only mildly affected by the changes in eligibility rules for early retirement. Differently, for the age group fifty-five to fifty-nine, we observe a sharp increase in disability rates. An even sharper increase is observed for those in the age group sixty to sixty-four during the period 1993–2000, when the reform gradually changed the normal retirement age from sixty years (in 1993) to sixty-five years (in 2000).

Figure 10.1B shows disability rates for women in each age group. Again, no trend is observed for the age group fifty to fifty-four, which is unlikely to have been affected by the reform. However, we observe a sharp increase in DI take-up after 1993 for the age group fifty-five to fifty-nine, that is, for female workers who experienced the gradual increase in the eligibility age for an old-age pension from fifty-five years in 1993 to sixty years in 2000.

It would be interesting to explore the dynamics in DI participation by educational level. Unfortunately, the INPS data contain no information on education. To partially overcome this limitation, we use data on the type of occupation distinguishing between white-collar jobs and blue-collar jobs. Results are reported separately by gender.

Figure 10.1C shows disability rates for men age fifty to sixty-four, distinguishing by occupation. The DI participation increases over time for both blue-collar and white-collar workers during the observation period, reaching a maximum in 1999 (6 percent) and decreasing steadily afterward. It is interesting to note a significant difference in DI participation rates between the two occupational categories: the largest difference is observed in 1999 (around 3 percent). As already discussed, the change in the legal retirement age introduced by the 1992 and 1995 reforms is reflected in these trends.

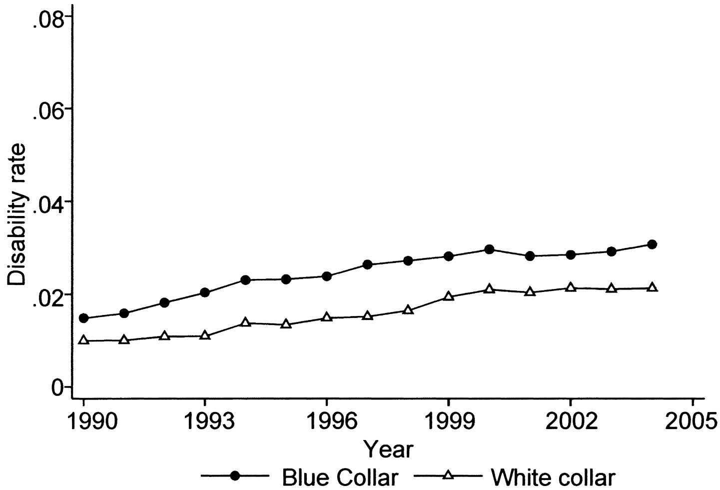

Fig. 10.1D Disability rates by occupational status, women age fifty to sixty-four (INPS data)

Workers who qualified for disability benefits may have preferred to exit the labor force through the easiest route once early retirement became less favorable. The participation in DI for these years is always higher for blue collars (plausibly in worse health) than for white collars: a well-known result as also discussed in Case and Deaton (2005) who show a clear gradient in health status between individuals in low-skill occupations (blue collar) and high-skill occupations (white collar) for the United States.

Disability rates for women age fifty to sixty-four are reported in figure 10.1D, distinguishing by occupational status. Notice that female labor force participation is increasing in Italy for the youngest cohorts, and this trend may dominate the aggregate figures. Overall, a steady growth of the DI rate is observed over time, but the speed of growth is lower than for men. Further, the difference in disability rates between the two educational groups is not as significant as the one observed for men.

Several explanations can be put forward for the low disability rates observed for women. If DI rates reflect the health status of workers, then one possibility is self-selection of women into jobs with lower exposure to occupational risks or that are less physically demanding, leading to a lower demand for DI benefits. Another explanation could simply be that women find it harder to qualify for DI benefits. The fact that no significant difference emerges between white-collar and blue-collar women may again be due to sample composition: when aggregating over the age range from fifty to sixty-four, the trend in disability rates for women age fifty-five to fifty-nine (those mostly affected by the reforms and showing the highest DI take-up rates) may be partially compensated by the trends of the other two age

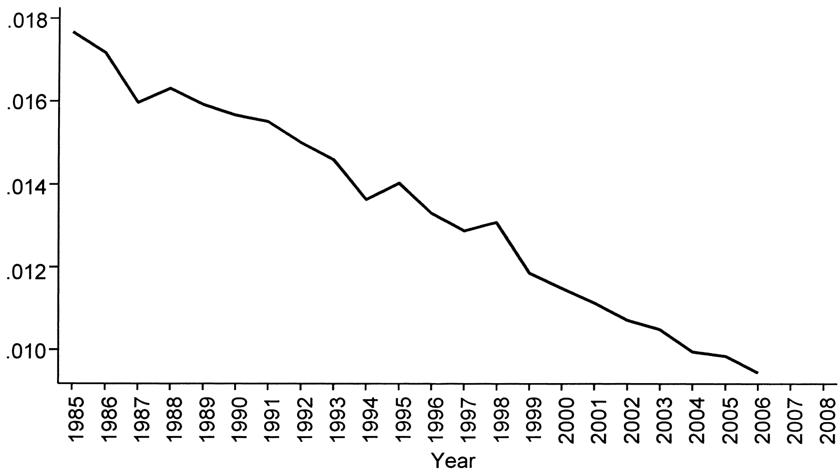

Fig. 10.2 Mortality rates at age sixty-five (Human Mortality Database)

groups. Finally, we cannot rule out that an increasing incidence of health conditions that are more common among women, such as depression, may have caused an increase in DI rates for the most recent years.

Some evidence for these competing explanations may be found in the next section where we look more closely at the relationship of benefits take-up and health conditions.

10.1.3 Disability Rates, Employment Status, and Health

Figure 10.2 shows the decline of mortality rates at age sixty-five between the mid-1980s and the early twenty-first century in Italy. The data are from the HMD. Mortality rates decline sharply over time. Yet, disability rates fluctuate widely over the same period (especially between 1992 and 1997), with a peak in 1999. What is relevant for this chapter is that there is little evidence that changes over time in disability rates could be directly attributed to a trend toward worse health, as crudely measured by mortality.

In order to better understand how reforms affected individuals' decisions, we explore the relationship between the time profile of employment rates and disability rates. As before, we show the two time series separately by gender and age group.

Figure 10.3A shows employment and disability rates for men by age group over the period 1990–2005. Disability rates are generally low (right scale) and show a hump-shaped profile over the period, which is particularly marked for the age group sixty to sixty-four. Employment rates (left scale) are fairly constant for both the age group fifty to fifty-four and the age group sixty to sixty-four. Hence, all the action is taking place in the age group fifty-five to fifty-nine: a negative correlation emerges between employment rates

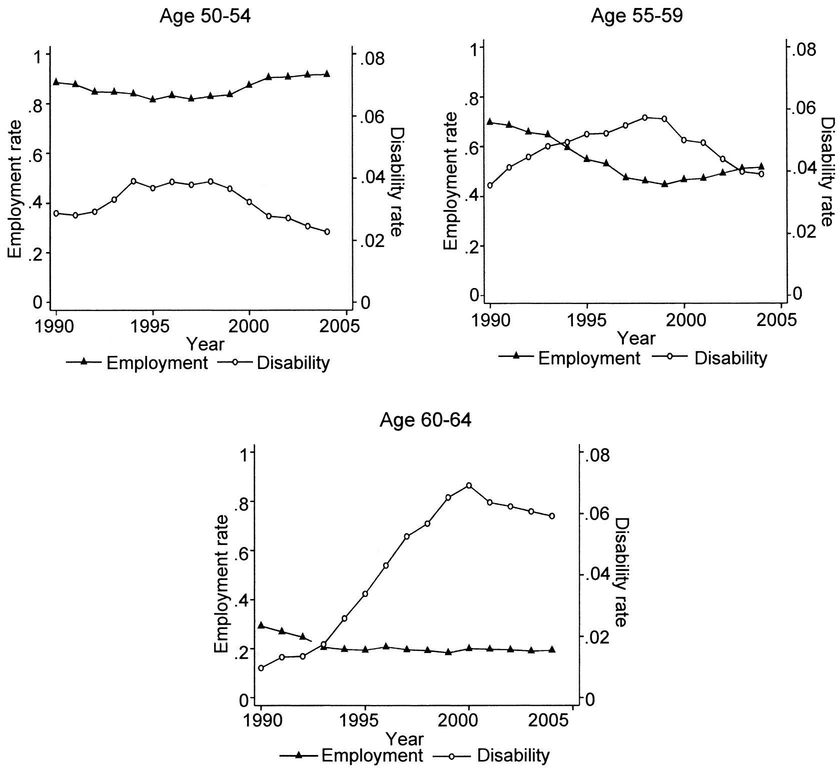

Fig. 10.3A Employment and DI rates by age group, men (INPS data)

and disability rates for individuals that are mostly affected by the reforms of the 1990s.

When plotting the two time series for women (figure 10.3B) we notice a different pattern. Employment and disability rates seem to go in the same direction except for the age group fifty to fifty-five during the years 1990–1995 and 2000–2005. While disability rates seem to increase over time for the age groups fifty to fifty-four and fifty-five to fifty-nine, employment rates remain flat or increase at a low pace. Instead, for the age group sixty to sixty-four, both employment and disability rates tend to decrease.

So far we exploited patterns in DI participation based on the few sociodemographic characteristics that are available in administrative data, namely age, gender, and occupation. Using a richer survey such as SHARE allows us to extend our objectives by looking closely at the relationship between DI and health, as well as between DI and education.

Looking at the role of education, SHARE collects information on educational attainments that can be coded on the basis of standard educational

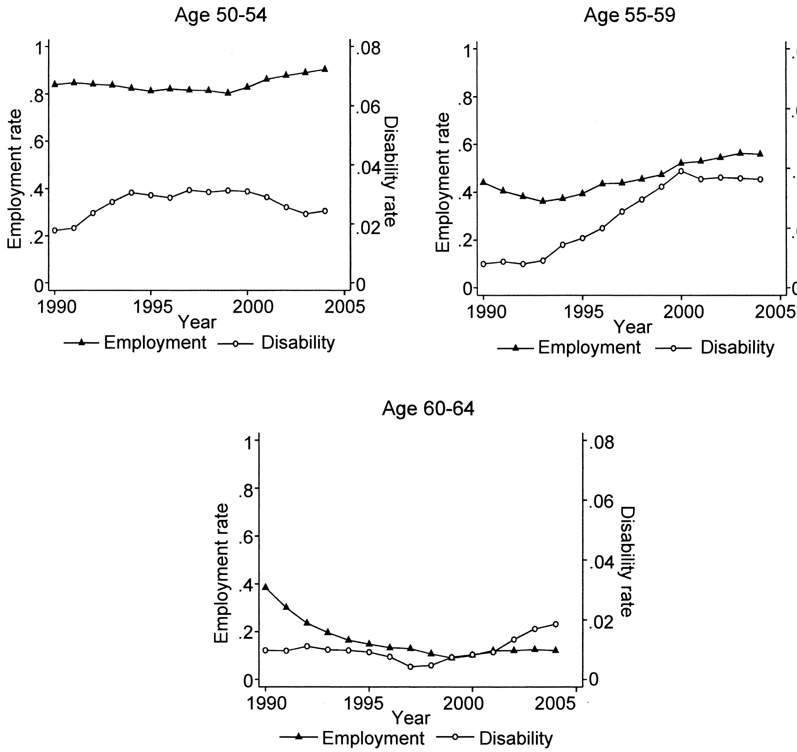

Fig. 10.3B Employment and DI rates by age group, women (INPS data)

scales used in international surveys. In particular, we measure educational levels considering the highest degree obtained by each individual using the International Standard Classification of Education (ISCED) classification. Since the health status is a major focus of this research program, the measurement of health requires particular attention. As detailed in section 10.4 below, we construct an overall index of health via principal component analysis (a procedure first used in Poterba, Venti, and Wise [2011]) by exploiting the wide set of questions on health conditions that are recorded in wave 1, wave 2, and also in wave 4 of SHARE. Unfortunately, we cannot use for this purpose the data from SHARELIFE because it asks very little about current health status. A similar problem emerges for the information on DI participation in SHARELIFE, as the survey questions are not comparable with those in the other three waves of SHARE.

It should also be stressed that, unlike other surveys (e.g., the US Health and Retirement Study), SHARE does not distinguish between "having ever applied for DI" and "having ever received DI," hence no distinction can be

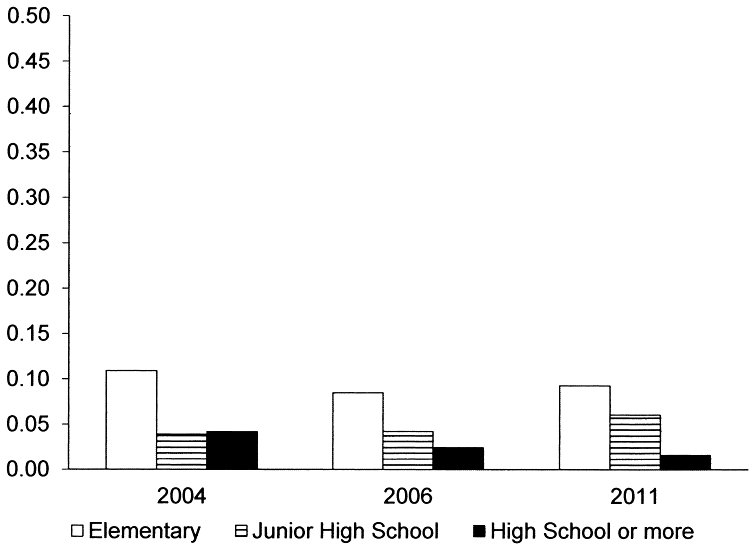

Fig. 10.4A Percentage receiving DI benefits by education and year, men age fifty to sixty-four (SHARE-IT)

made in our data between the two stages of the benefit application process. The only measure available to us from SHARE is based on "having received DI" in a given year.

When analyzing the relation between DI, education, and health using the SHARE data, we condition on gender, age, education, and health quintiles, so we end up with a small sample size for each combination of characteristics. Hence, results should be interpreted with some caution.

Figures 10.4A and 10.4B show that the percentage of individuals receiving DI in Italy is very similar to that for the United States resulting from the HRS data. Across the three waves of SHARE (2004, 2006, 2011), the probability of receiving DI decreases with education (it is higher for those having completed, at most, elementary school and lower for those having a high school degree or more). This is what we expected, as more educated individuals tend to have better jobs on average or jobs in which the probability of suffering a physical limitation is lower.

The SHARE-IT sample allows us to study in more detail the relationship between DI receipt and health. Because many dimensions of health are recorded in SHARE, we would like to have a synthetic measure capturing the key aspects of the health status of an individual and pointing to the potential effects of health limitations. A single measure can be constructed in SHARE by making use of the principal component analysis (PCA): in particular, we focus on twenty-five indicators of health and extract the first component, which explains around 25 percent of the total variation in health. The PCA

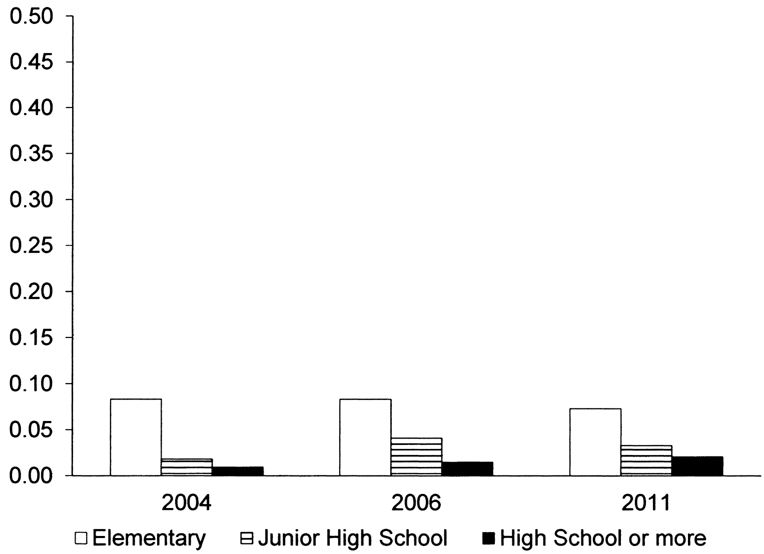

Fig. 10.4B Percentage receiving DI benefits by education and year, women age fifty to sixty-four (SHARE-IT)

allows us to obtain a continuous health index that we use to classify people into health quintiles.

Figures 10.5A and 10.5B show that there is a negative relationship between health conditions and DI rates. The percentage of men age fifty to sixty-four who receive DI is more than 30 percent for those in the first health quintile (worst health) and less than 5 percent for those in the top health quintile (best health). This gradient tends to persist across waves. Women instead show low frequencies of DI for all health quintiles.

Since education and health tend to be positively correlated, it is interesting to look at DI participation conditioning both on health and education. Table 10.2 shows the percentage of respondents who receive DI benefits by health quintile and educational level. For education we consider three levels: elementary school or less (including those with no degree), junior high school, and high school or more. We used this classification since for the cohorts of interest (individuals age fifty and older) the percentage of Italian respondents having a college degree is very low.

We report DI participation separately by gender. The top panel shows the percentage of men receiving DI benefits. Looking at each row we see the percentage of men in DI by educational level over health quintiles. Vice versa, looking at the columns we see the percentage of men with DI for a given health quintile by education. The relationship between DI rates, education, and health is strong. However, we notice two things. First, the percentage of men with DI among the most educated and the healthiest

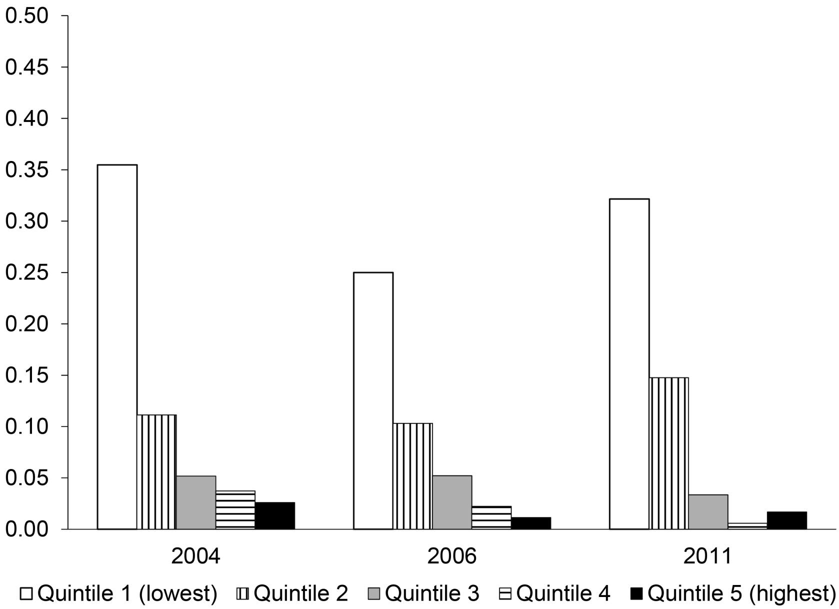

Fig. 10.5A Percentage receiving DI benefits by health quintile and year, men age fifty to sixty-four (SHARE-IT)

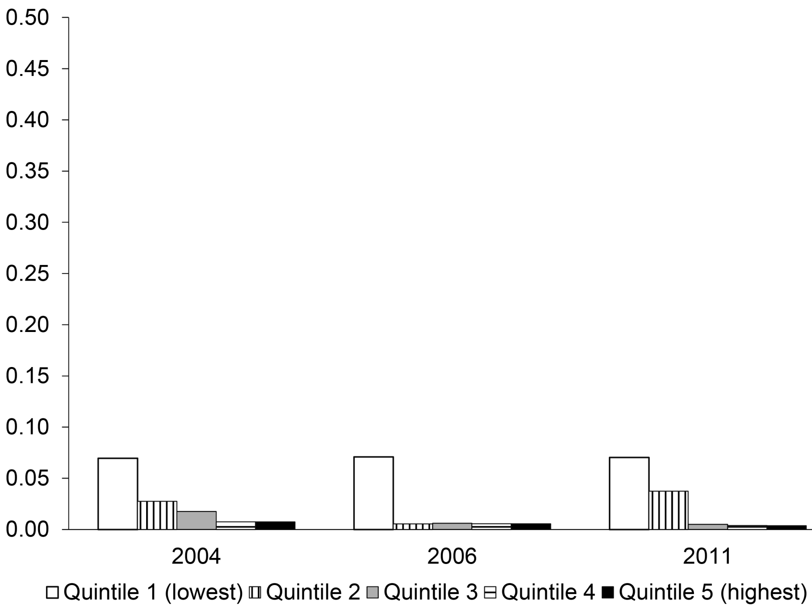

Fig. 10.5B Percentage receiving DI benefits by health quintile and year, women age fifty to sixty-four (SHARE-IT)

Table 10.2 **Percentage of men and women age fifty to sixty-four receiving DI benefits by health quintile and education**

	Percent approved Health quintile					
Education	1	2	3	4	5	All
Men						
Elementary or lower	32.61	15.91	5.26	4.67	4.96	9.80
Junior HS	38.10	7.94	5.05	2.35	1.73	4.84
HS or more	18.75	10.34	3.85	0.85	0.37	2.54
All	31.33	11.90	4.61	2.14	1.76	10.35
Women						
Elementary or lower	23.86	8.70	3.30	1.98	1.78	8.02
Junior HS	11.43	7.09	1.44	0.00	0.00	3.16
HS or more	6.35	4.13	1.71	0.52	0.00	1.58
All	17.48	7.03	2.28	0.94	0.52	5.65

approaches 0. Second, the differences in DI rates by education seem not to be very sharp between those in elementary school and junior high school, even when looking over health quintiles. Thus, having at least a high school degree makes a difference.

A similar pattern is observed for women (bottom panel) in the same age group. In fact, the percentage of well-educated and healthy women receiving DI benefits is equal to 0.

To better highlight the information contained in table 10.2 we also report two figures (figures 10.6A, and 10.6B) showing the differences in DI by education over health quintiles (from the lowest to the top).

Employment Rates by Health and Education

Finally, to better understand the link between employment and DI, we explore the pattern of employment rates by health and education over time for the age group sixty to sixty-four. Because of the limitations of the INPS and SHARE data, we rely on the Italian data from the Labour Force Survey administered by Eurostat. These data allows us to study variation in employment rates by level of education by distinguishing between primary, upper secondary, and tertiary education (see figure 10.7). Unfortunately, the same analysis cannot be carried out for health conditions. We show the variation in the employment rate by educational level focusing on the age group sixty to sixty-four.

Figure 10.7 shows that employment rates are always higher for the more educated workers, but they seem to vary over the cycle in a similar fashion: a decline after the year 1992, a relatively stable pattern until the year 2008 and a slight reversal afterward, with an interesting rise for the highly educated workers after 2011. When more years of data become available we will be

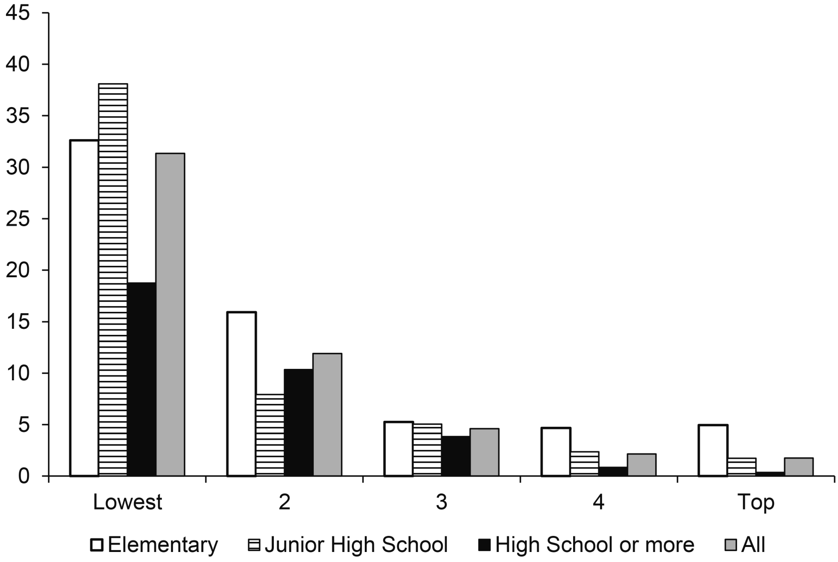

Fig. 10.6A Percentage receiving DI benefits by health quintile and education, men age fifty to sixty-four

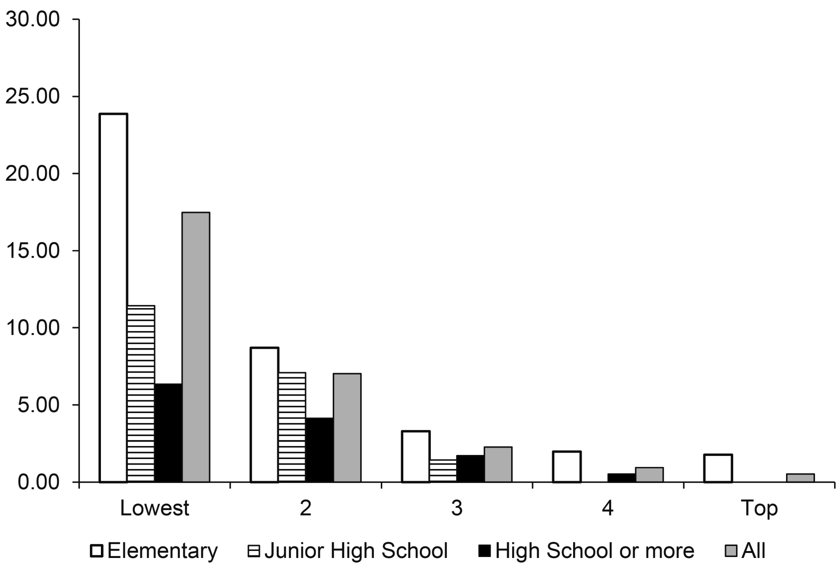

Fig. 10.6B Percentage receiving DI benefits by health quintile and education, women age fifty to sixty-four

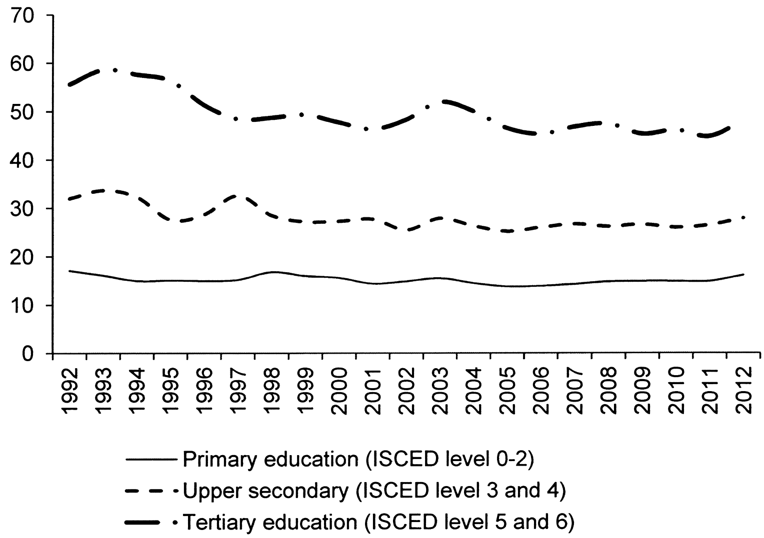

Fig. 10.7 Employment rate for the age group sixty to sixty-four by level of education (ISCED97 classification)

Source: Labour Force Survey (Eurostat).

able to see if the reform of 2011 (which also affected workers of the age group sixty to sixty-four) has had an effect in terms of employment rates.

10.2 Empirical Approach

The goal of this chapter is to investigate to what extent are the differences in employment determined by the provisions of the disability insurance program or other retirement program, for a given health status. Our empirical approach is based on the option value model described in detail in section 10.3: this empirical strategy requires information on the pathways to retirement from work that Italian workers have access to and a measure of health, along with other characteristics of the individual. We present in sequence a description of the relevant pathways to retirement, then the measure of the weights to be used in the option value calculation corresponding to the likelihood that a given pathway is chosen, and finally the measurement of the health of each individual through a specific index.

10.2.1 Pathways to Retirement

As it is clear from our previous descriptive analysis, three pathways to retirement are relevant for Italy: (a) old-age pension, (b) early retirement, and (c) disability pension. The number of exits observed for the first two routes is much higher than the number observed for disability. In order to

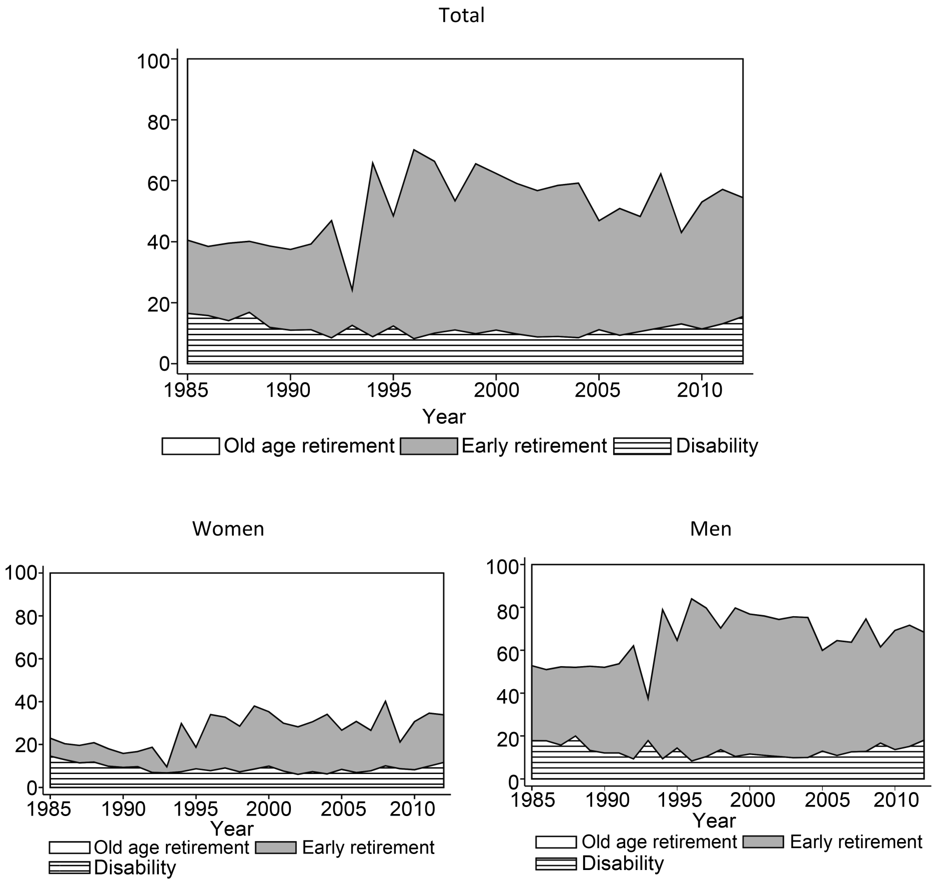

Fig. 10.8 Percentages of new entries in each pathway to retirement

show the relative importance of these three pathways, we consider a sample of individuals receiving a benefit (any of the three types of benefit, excluding other benefits) drawn from the INPS archive and look at the flows, that is, the "new entries" in each pathway.

Figure 10.8 describes a new entry into public pension and disability for individuals above age forty. We observe that there is an important announcement effect of the two main pension reforms of the 1990s. In 1993, the percentage of individuals that took the "old age" retirement route increased significantly for both men and women. Individuals who qualified for this type of pension preferred to immediately exit from the labor force, most likely in the expectation of tighter rules for both the "legal" retirement age and the number of contribution years after 1993. We also observe a slight increase in the number of individuals, especially men, who collect DI benefits. The peak in the old age and the disability exit routes seem to be correlated and appear every two years. This is interesting because, as shown in table 10.1, this is the time interval after which both the retirement age and the contribution years requirements increased by one additional year. In 1996 we observe a sharp increase of the share of the early retirement pathway, especially for men. This is the joint effect of the 1992 and 1995 reforms, as both introduced more stringent rules for the early retirement pathway, particularly in terms of eligibility age. In general, women cannot take advantage of such an exit route because they typically exhibit fewer years of contributions.

10.2.2 Weighting Pathways to Retirement

The trends observed in the pathways to retirement, based on aggregate flows (new entries) into retirement, offer an interesting description of the effects of the pension reforms in Italy. However, flow data provide only one type of representation and a choice has to be made as to how to assign robust weight to each possible pathway. There are three sets of weights which, in principle, could be considered: (a) weights based on "stock probabilities" (i.e., percentages) by year, gender, and age; (b) weights based on aggregate flow probabilities (percentages) by year, gender, and age; and (c) weights based on the estimates of a multinomial logit regression. To ensure comparability with the results for other countries, in this chapter we make use of the first type of estimates, that is, stock probabilities.[5]

Our calculations are based on the administrative data from INPS and our methodology consists in computing the percentage of individuals who enter into retirement separately for each age group and for each pathway. Instead of only considering the broad age range fifty-five to sixty-four, we distinguish between three age groups: fifty to fifty-four, fifty-five to fifty-nine, and sixty to sixty-four. This choice is motivated by the important changes in the Italian eligibility requirements induced by the pension reforms of the period 1992–2010. It is worth recalling that the "legal" retirement age for the old-age pension was revised by the 1992 reform and that the legal retirement age coincides with the time when a DI benefit is automatically converted into an old-age pension. In 1992, the retirement age was fifty-five years for women and sixty for men. Starting with 1994, this requirement increased gradually by one year every two calendar years up to 2000, when it was fixed to sixty years for women and sixty-five for men. Hence, the effect of the 1992 reform becomes clear when looking at the age group sixty to sixty-four for men and fifty-five to fifty-nine for women, as reported in figure 10.9. We observe a

5. We also made use of aggregate flow probabilities (percentages) and probabilities estimated through a multinomial logit, which are individual specific. The results of the econometric estimates are more precise in the latter case (multinomial logit), but are substantially coherent with the econometric results based on stock probabilities.

Fig. 10.9 Pathways to retirement using stock probabilities by gender and age group

dramatic decline in the percentage of fifty-five to fifty-nine-year-old females who use the old-age pathway as an exit route between 1993–2000, falling from approximately 90 percent in 1993 to around 0.03 percent after 2000.

A similar pattern, even if less sharp, is observed for men age sixty to sixty-four. The difference in the trend between men and women is probably due to the fact that women, characterized by more discontinuous careers, used to rely more on the old-age retirement route that had less stringent requirements from a contributive point of view. Differently, men relied more on the early retirement route.

10.2.3 Measurement of Health

We already motivated the use of an index aimed at capturing the overall health status of individuals starting from a large number of health dimensions. We construct our health index via PCA, following the paper by Poterba, Venti, and Wise (2011) and using data from wave 1 (2004), wave 2 (2006), and wave 4 (2011) of SHARE-IT. We employ twenty-four health indicators that provide a large amount of information on health conditions. These include six indicators for physical limitations (e.g., difficulties in walking for 100 meters, getting up from a chair, climbing, stooping, carrying, picking up a coin from a table, etc.), one for self-reported health (SRH) being fair or poor, one for having problems with activities of daily living (ADL), indicators for having experienced chronic diseases or conditions

Table 10.3 Health index: Loadings of first component from PCA

Question	Comp. 1
Difficulty lift/carry	0.2897
Difficulty push/pull	0.2864
Difficulty stoop/kneel	0.2838
Difficulty walking	0.2825
Difficulty climbing stairs	0.2799
Difficulty getting up from chair	0.2699
Difficulty with an ADL	0.2694
Self-reported health (fair or poor)	0.2566
Difficulty reach/extend arms	0.2406
Doctor visit (number)	0.2042
Difficulty sitting two hours	0.2012
Ever experience arthritis	0.1952
Difficulty picking up a dime	0.1871
Back problems	0.1836

(heart problems, high blood pressure, diabetes, stroke, cancer, arthritis, etc.), the body mass index (BMI), which is generated using self-reported data for height and weight, and indicators for having visited in the last twelve months a doctor, a nursing home, or a hospital. Most of these variables are discrete with value equal to 1 if the person is in poor health.

Differently from Poterba, Venti, and Wise (2011), we do not include an indicator for having received home care, as it is not available in the fourth wave of SHARE. Also, we do not pool the observations and compute the index separately by wave. The overall sample from the three waves contains 9,125 observations, whereas the balanced panel contains 3,852 observations. The health index is computed for only 8,859 observations due to the presence of missing values in some indicators. After extracting the first component index, we divide it in percentiles or quintiles according to the analysis at hand.

Table 10.3 shows the loadings for the first component extracted by PCA. We report the most important health conditions that explain most of the variation in the new measure.

Figure 10.10 shows the average health percentile by age and gender. Average health tends to decline with age for both men and women, although men seem to be better off than women at any age.

As an alternative to PCA, we also regressed self-reported health (1 = fair or poor, 0 = excellent, very good, or good) on the remaining twenty-three indicators using a logit specification and saved the fitted values. We then computed the correlation between the fitted values from this regression and the first component of the health. The two measures are highly positively correlated, with a correlation coefficient of 0.94.

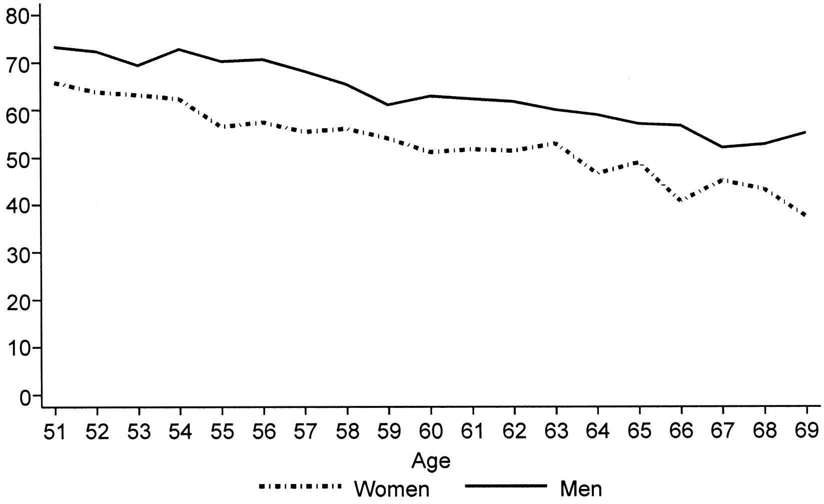

Fig. 10.10 Mean percentiles of the health index by age and gender

10.3 Data Construction and Estimation

The main objective of this chapter is to estimate the relationship between the provisions of retirement programs and retirement incentives. We pay particular attention to the provision of DI programs for which we perform some simulations later on.

We ask how changing the provisions of DI programs (and perhaps other programs) would change retirement decisions. More specifically, conditioning on health status, to what extent are the differences in labor force participation across countries determined by DI programs? The main idea is to analyze the incentives to delay retirement, measured by the potential gain from postponing retirement from today's age until some future age. To this purpose, we first introduce some key concepts from the classical retirement model of Stock and Wise (1990), assuming that there is only one pathway to retirement, and then extend the analysis considering multiple pathways to retirement.

Our analysis relies on SHARE data, and in particular on the SHARELIFE data discussed in the next paragraph. These data cover a wide range of variables useful for our study, such as information on employment pathways during lifetime (from the first job onward), health conditions, and other socioeconomic characteristics. The most important advantage from using SHARE is that it provides important details on individuals' earnings histories (see next section). However, compared with administrative data such as the INPS data, we end up with a smaller sample size, which may lead to loss of precision.

In particular, in our regression analysis, we consider year-to-year transitions into retirement using information from SHARELIFE. Our starting sample consists of about 2,700 observations (unbalanced panel), which falls to about 1,900 observations when we consider a broader set of covariates (e.g., education, health, etc.).

10.3.1 Retirement Incentives and the Option Value

First, we assume that there is a single retirement pathway into retirement. When our representative individual retires, he starts receiving a stream of benefits until death. If an individual retires at age t, the present discounted sum of his stream of benefits, or social security wealth, is denoted by SSW_t. If the person retires one year later, at age $t + 1$, the present discounted sum of his stream of benefits is denoted by SSW_{t+1}. The gain from postponing retirement from one year to the next then is given by $\text{SSW}_{t+1} - \text{SSW}_t$. Notice, however, that there could be larger gains from delaying retirement by two or more years.

Thus, to understand the incentives built into the design of the social security system we must consider all the possible future benefits associated to all possible retirement ages and then evaluate whether it is worth retiring today or continue working until a future date.

The benchmark model used for this evaluation is the option value (OV) model of Stock and Wise (1990). The model is based on a utility maximization approach, where a forward-looking agent decides at each time the retirement option. The expected utility for the worker from retiring at age r is assumed to be of the form

$$V_t(r) = \sum_{s=t}^{r-1} \pi_{s/t} \beta^{s-t} Y_s^{\gamma} + \sum_{s=r}^{S} \beta^{s-t}(kB^{\gamma}(r))^{\gamma},$$

where t is the age (or time) when the worker decides, β is the intertemporal discount factor, and γ is a parameter of risk aversion. The parameter π captures the probability of survival and demographic projections till the time s conditional of being alive at time t. One may think of the parameter k as a leisure parameter because it captures the relative preference of benefits from retirement rather than income from work.

The option value of retiring at a specific age r is just the difference between the maximum utility for the worker from postponing retiring until some future time (r^*) and the utility gained from retiring at age r:

$$\text{OV}_t(r) = V_t(r^*) - V_t(r).$$

As already mentioned, the original model in Stock and Wise (1990) only considers one pathway into retirement. This is clearly not realistic for Italy, as we have three possible pathways: (a) old-age pension, (b) early retirement, and (c) disability insurance. In order to estimate the OV incentive on retirement when multiple programs are present, we use a weighted OV measure. For each pathway, we estimate the probability that a person considers that specific pathway along with the associated OV. Then we compute an "inclusive" OV by taking a weighted average of the OVs for each plan, as follows:

$$\mathrm{OV}_{\mathrm{inc}} = \mathrm{OV}_{\mathrm{DI}} * w_{\mathrm{DI}} + \mathrm{OV}_{\mathrm{Early}} * w_{\mathrm{Early}} + \mathrm{OV}_{\mathrm{Old}} * w_{\mathrm{Old}}.$$

As for the parameters in the expected utility function, we set $\gamma = 0.75$, $k = 1.5$, and the discount rate to 0.03. The weighs for the inclusive OV are generally determined by the relationship between individual attributes and the possibility that a plan was already chosen in the past. In the next two paragraphs, we discuss the way we construct our data set and how we estimate the weights attached to each pathway into retirement.

10.3.2 Data Construction

Instead of pooling data across waves, we perform the analysis considering transitions into retirement from 2004 to 2011 with the help of SHARELIFE data.

The advantage of using year-to-year transitions is that, instead of seeing a worker just once between two waves with a unique OV, we follow him along all the years between two waves seeing him with his actual status in each year (some may work for some years and retire at some point between the two waves, for example, between waves 2 and 4). Since the time interval is long, one record would not be enough to describe the changes that happen along this period and with the OV corresponding to that particular year and status (work or retire). Another advantage is that we increase the number of available observations. Nevertheless, we must highlight the fact that the number of transitions is small due to the short panel length of SHARE.

To construct transitions into retirement we use SHARELIFE, since it allows reconstructing the working life of the respondents up to year 2011 (the year of the last available wave). Unfortunately, in wave 3 (2008) there is no question asking if the individual is retired or not, neither which is the retirement year. We only know if the respondent is still working (variable re_047), and hence we recover this information from wave 2 (variable ep329). In order to create year-to-year transitions into retirement, we make use of the following variables in SHARELIFE: re011_ (start of job spell), re026_ (end of job spell), re031_ (reasons left job), and the answer to the question re035_ (situation in after last job). These questions are asked for all job spells during life. The variable re035_ contains information on the situation after the last job with many alternatives (retired from work, out of the labor force, and so forth), so we are sure to pick up individuals retired after the last job. Considering only transitions means to drop out all records for the years that are subsequent to the transition year into retirement. Because the information on respondents from wave 3 stops in 2008–2009, for those individuals that declare in wave 3 (SHARELIFE) to be still at work we complete their

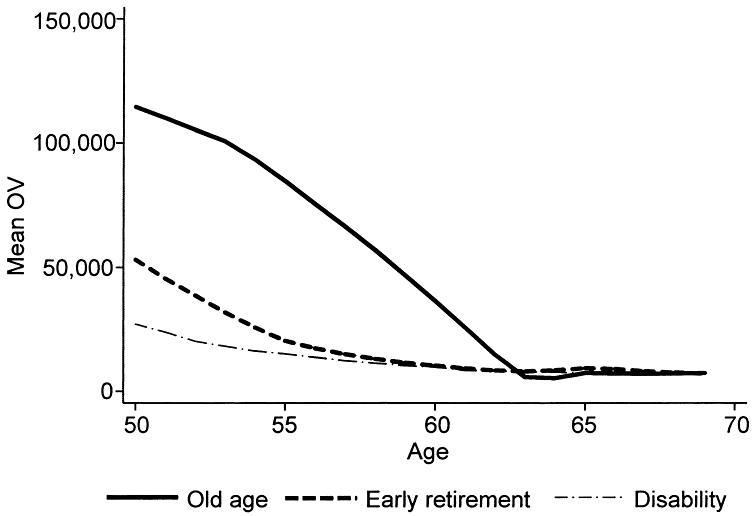

Fig. 10.11 Mean OV for men, cohort 1945–1949

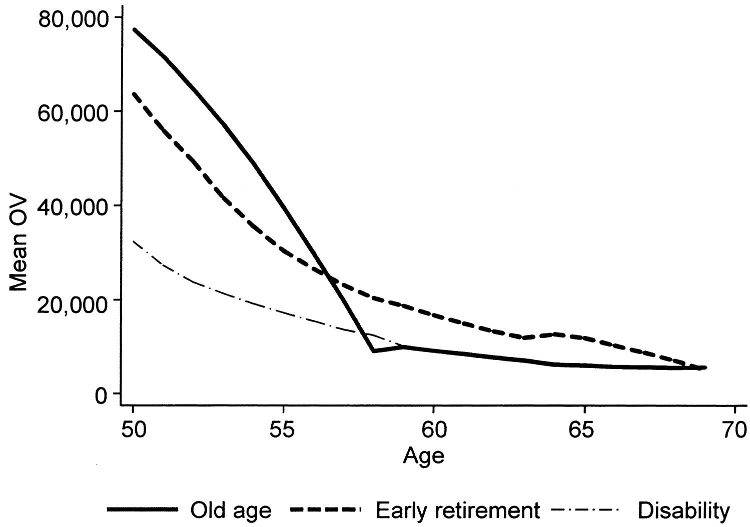

Fig. 10.12 Mean OV for women, cohort 1945–1949

working career with new information on possible retirement from wave 4 (2011) to extend our sample of transitions.

10.3.3 Descriptive Statistics for the Option Values

Figures 10.11 and 10.12 show the mean OVs for each of the pathways to retirement, separately for men and women, for the cohort born in 1945–1949. It is important to stress that the small sample size makes it hard to

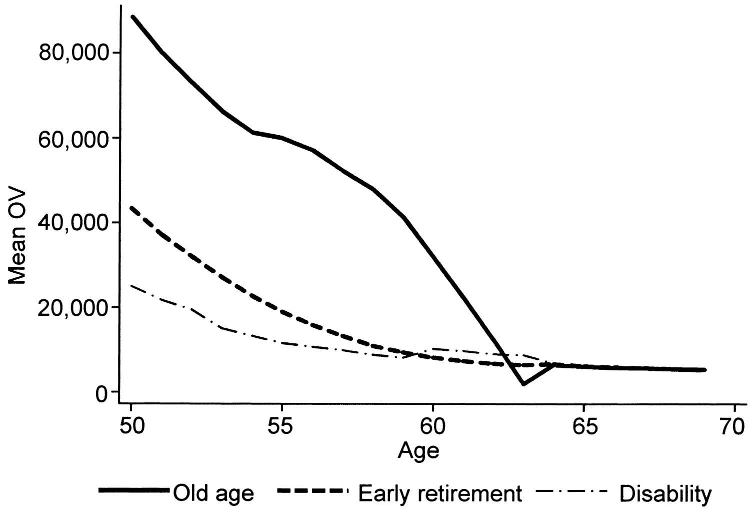

Fig. 10.13 Mean OV for men, cohort 1940–1944

obtain precise estimates of the OV, particularly for DI recipients and for women. Overall, the OV of delaying retirement is larger under the old-age option than under the early retirement or the disability options. This difference holds for both men and women: workers who consider leaving the labor force through DI or early retirement have a much greater incentive to retire at younger ages relative to those considering the old-age pathway. A further point to be noted is that, for men, the OV of the three different pathways tend to converge around age sixty-three, while for women the old-age OV and the disability OV converge much earlier, around age fifty-seven, although the early retirement OV tends to stay separate and is, in fact, higher. This suggests that the group of women who potentially qualify for early retirement is a particular subset of the population of working women as they managed to collect a high number of years of contribution.

We replicate the same figures for an earlier cohort of workers born in the years 1940–1944 (figures 10.13 and 10.14). Interestingly, for men things do not change much, while for women we see that the OV of delaying retirement is much higher under the early retirement pathway compared to the old-age pathway. Although the sample is too small to draw any inference, this result confirms that older women may find it particularly hard to collect an early retirement pension.

10.3.4 Empirical Specification and Results

We estimate a retirement model using probit regressions where the outcome variable is an indicator taking value 1 if the individual has a transition to retirement. Although the inclusive OV is the key predictor in the

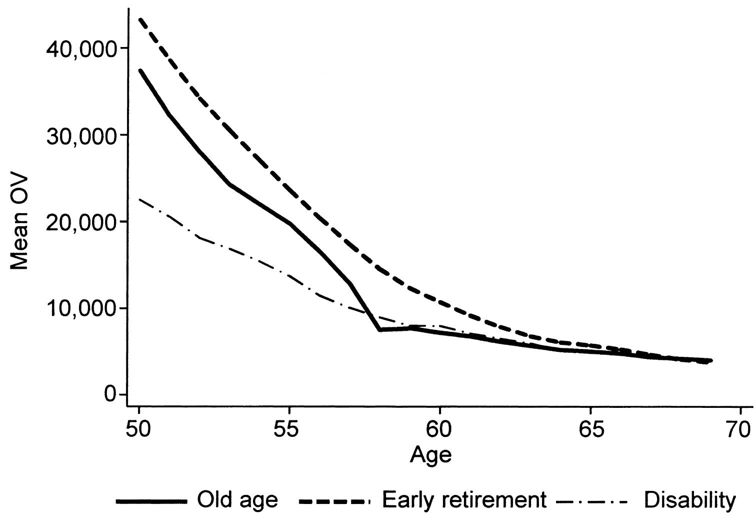

Fig. 10.14 Mean OV for women, cohort 1940–1944

model, we account for other individual characteristics such as educational level (using three categories: less than high school, high school, college or more), health status (using both a continuous index or indicators of health quintiles), gender, whether the person is married, and measures related to economic status such as total assets and occupation indicators (high-skill or low-skill job). We also account for age using two different specifications. The first includes a quadratic polynomial in age while the second includes a full set of age dummies. It is important to stress that the weights used to compute the inclusive OV measure are the weights based on the stock of individuals observed in each pathway for each year (by gender).[6]

In the tables with the estimation results we report marginal effects instead of simple coefficients. The OV coefficient is expressed in units of 10,000 euros. It is important to highlight that since the retirement decision is taken between year t and year $t + 1$, the health variable corresponds to health at time t. The main coefficient to look at is the estimated effect of the inclusive OV. The round brackets report the standard errors, while the square brackets report the effect of a one standard deviation change in OV. The latter are presented in order to cross-compare our results with those from other countries.

Table 10.4 shows the results for the different specifications. In columns (1) to (4) we use indicators for the health quintiles, while in columns (5) to (8) we use the health index as a continuous variable. Further, we control for age

6. We have also performed the same regression analysis by using the OV inclusive based on weights computed through a multinomial logit. The final results are similar and comparable, although the estimates based on the multinomial logit weighting procedure are more robust.

Table 10.4 **Effect of inclusive OV on retirement (estimated probit retirement model—weights based on stocks)**

	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OV/10,000	–0.004*	–0.005*	–0.003	–0.004	–0.004*	–0.006**	–0.003	–0.005
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
	[–0.015]	[–0.017]	[–0.012]	[–0.014]	[–0.016]	[–0.018]	[–0.013]	0.014]
2nd Q	–0.010	–0.011	–0.007	–0.010				
	(0.008)	(0.010)	(0.008)	(0.011)				
3rd Q	–0.003	–0.002	–0.001	0.000				
	(0.008)	(0.011)	(0.009)	(0.013)				
4th Q	0.005	0.006	0.008	0.011				
	(0.009)	(0.012)	(0.010)	(0.014)				
5th Q (best health)	–0.017**	–0.021**	–0.016**	–0.023**				
	(0.007)	(0.009)	(0.007)	(0.010)				
Hindex					–0.003	–0.004	–0.002	–0.003
					(0.002)	(0.003)	(0.002)	(0.003)
Age	0.106***		0.099***		0.106***		0.100***	
	(0.015)		(0.014)		(0.015)		(0.015)	
Age2	–0.001***		–0.001***		–0.001***		–0.001***	
	(0.000)		(0.000)		(0.000)		(0.000)	
Female			0.007	0.013			0.005	0.011
			(0.006)	(0.009)			(0.007)	(0.009)

Married			0.010	0.014			0.010	0.014
			(0.007)	(0.010)			(0.007)	(0.010)
Educ.: <High school			–0.004	–0.002			–0.003	–0.003
			(0.009)	(0.011)			(0.010)	(0.011)
Educ.: High school			–0.003				–0.002	
			(0.008)				(0.009)	
High skill			–0.001	–0.003			–0.001	–0.003
			(0.008)	(0.012)			(0.008)	(0.012)
Low skill			0.001	0.000			0.001	–0.001
			(0.007)	(0.010)			(0.007)	(0.010)
Assets			–0.000	–0.000			–0.000	–0.000
			(0.000)	(0.000)			(0.000)	(0.000)
Educ. >High school				0.004				0.002
				(0.013)				(0.013)
Observations	2,741	2,423	2,234	1,903	2,741	2,423	2,234	1,903
Pseudo R^2	0.115	0.119	0.122	0.121	0.111	0.116	0.115	0.114
Age dummies		X		X		X		X
Mean ret. rate	.0582	.0582	.0582	.0582	.0582	.0582	.0582	.0582
Mean of OV	2.357	2.357	2.357	2.357	2.357	2.357	2.357	2.357
Std. dev. of OV	2.821	2.821	2.821	2.821	2.821	2.821	2.821	2.821

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

through either a quadratic polynomial in age or a set of age dummies. For example, in column (1) we use a quadratic polynomial in age and in column (2) we use age dummies, whereas in columns (3) and (4) we add the other controls. The additional covariates are gradually included to check whether and how results are affected.

The sign and magnitude of the coefficients is in line with our expectations. The main OV coefficient is negative and almost always statistically significant, so that an increase of 10,000 euros in the OV at time t reduces the probability of retiring at time $t + 1$ by about 5 percentage points. Health conditions also appear to influence retirement, especially when we use indicators for health quintiles (excluded category is first quintile, i.e., being in worst health). From columns (1) and (3) we see that those in better health, especially those in the top fifth quintile, are less likely to retire. The sign is also maintained for the other indicators of health quintiles. We get similar results when including a continuous health index. An increase in the health index is associated with a decrease in the probability of retiring next period. The coefficient is not statistically significant, however, which may reflect lower variation in health when using transitions from year to year (we have to approximate health in year 2005 using health reported in year 2004). The other variables, such as education and type of occupation, have the right sign but are not statistically different from 0, while financial assets do not appear to matter for the retirement decision. Our results are robust to different specifications.

We also provide estimates of our retirement model separately for each health quintile (table 10.5). Estimates are presented in each of the five rows, with the columns corresponding to the different specifications. In column (1) we control for a quadratic polynomial in age, in column (2) we control for age dummies, and in columns (3) and (4) we add other covariates.

Similar to table 10.4 we get strongly significant results, especially for individuals in the fourth and fifth quintile. Being in very good health (either in the fourth or in the fifth quintile) lowers the probability of retirement by around 6percent. The estimates are always statistically significant at conventional levels, even when adding more covariates.

The same results hold when we interact the inclusive OV and the health (table 10.6) and when we estimate the effect of inclusive OV on retirement, distinguishing by the level of education (table 10.7). Again we notice a gradient, as individuals who completed a college degree are much less likely to retire compare to those with less than a high school degree.

10.4 Simulations

We perform different simulation exercises. In Gruber and Wise (2004) simulations were used to predict the impact on retirement of an increase in the eligibility age, finding large effects. Since this chapter focuses on DI

Table 10.5 **Effect of inclusive OV on retirement by health quintile (estimated probit retirement model—weights based on stocks)**

	No. of obs.	Mean ret. rate	Mean of OV	Std. dev. of OV	Specification (1)	(2)	(3)	(4)
OV: Lowest quintile (worst health)	476	.076	1.921	3.09	0.0027	0.0072	0.0028	0.0020
					0.0032	0.0098	0.0030	0.0041
					[–0.003]	[–0.005]	[–0.001]	[–0.001]
OV: Second quintile	547	.049	2.380	2.580	–0.0187	–0.0541	–0.0095	–0.0422
					0.0046	0.0130	0.0057	0.0138
					[–0.023]	[–0.044]	[–0.024]	[–0.043]
OV: Third quintile	551	.063	2.688	3.048	–0.0066	–0.0207	–0.0050	–0.0185
					0.0029	0.0072	0.0034	0.0089
					[–0.024]	[–0.028]	[–0.036]	[–0.043]
OV: Fourth quintile	546	.062	2.384	2.663	–0.0079	–0.0123	–0.0073	–0.0121
					0.0031	0.0043	0.0030	0.0045
					[–0.028]	[–0.034]	[–0.032]	[–0.041]
OV: Fifth quintile	547	.032	2.351	2.569	–0.0061	–0.0097	–0.0050	–0.0082
					0.0021	0.0028	0.0022	0.0031
					[–0.018]	[–0.013]	[–0.037]	[–0.037]
Linear age					X		X	
Age dummies						X		X
Other Xs							X	X

Notes: 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.).

provisions, increasing the eligibility age would find obvious obstacles. Thus, here we ask how employment is affected when we change the eligibility stringencies in DI, and when we do it gradually.

This section is organized as follows. First we show the fit of our model, using specification (4) in table 10.4, by plotting actual and predicted retirement rates (hazard) by gender, health quintile, and educational level. Then we carry out some counterfactual analysis by changing the stringency of the criteria for admission into DI, separately for the overall population and the subpopulation of those who have received DI or early retirement benefits.

10.4.1 Model Fit

Our reference model is specification (4) in table 10.4, with the probability of retirement depending on the inclusive OV, dummies for age and controls for education, health quintiles, and so forth.

In figures 10.15 and 10.16 we show the actual and predicted retirement rates by gender. Because of the use of a full set of age dummies, our specification fits the data very well, especially in the case of men. The good fit of the model is also clear when we plot the actual and predicted probabilities

Table 10.6 **Effect of the inclusive OV, of the health index, and their interaction (estimated probit retirement model—weights based on stocks)**

	Specification			
	(1)	(2)	(3)	(4)
OV	–0.00535***	–0.00697***	–0.00477***	–0.00665***
	(0.00137)	(0.00158)	(0.00137)	(0.00174)
	[–0.019]	[–0.022]	[–0.018]	[–0.021]
OV*hindex	–0.00135***	–0.00175***	–0.00124***	–0.00174***
	(0.00039)	(0.00048)	(0.00038)	(0.00049)
Hindex	–0.00021	0.00005	0.00006	0.00039
	(0.00208)	(0.00261)	(0.00208)	(0.00287)
Observations	2.741	2.423	2.234	1.903
Pseudo R^2	0.122	0.128	0.128	0.128
Linear age	X		X	
Age dummies		X		X
Other Xs			X	X
Mean ret. rate	.0569	.0569	.0569	.0569
Mean of OV	2.345	2.345	2.345	2.345
Std. dev. of OV	2.810	2.810	2.810	2.810

Notes: Models are the same as models 5–8 in table 10.1, with the addition of OV*health. 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.). Robust standard errors in parentheses.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 10.7 **Effect of inclusive OV on retirement by education level (estimated probit retirement model—weights based on stocks)**

	No. of obs.	Mean ret. rate	Mean of OV	Std. dev. of OV	Specification (1)	(2)	(3)	(4)
OV: < High school	1,232	.064	1.858	2.734	–0.0024	–0.0025	–0.0013	–0.0014
					0.0036	0.0038	0.0025	0.0028
					[0.000]	[0.000]	[0.000]	[0.000]
OV: High school	1,090	.051	2.543	2.614	–0.0050	–0.0126	–0.0020	–0.0101
					0.0018	0.0032	0.0013	0.0037
					[0.000]	[0.000]	[0.000]	[0.000]
OV: College or more	442	.056	3.289	3.237	–0.0025	–0.0054	–0.0009	–0.0011
					0.0016	0.0023	0.0009	0.0009
					[0.000]	[0.000]	[0.000]	[0.000]
Linear age					X		X	
Age dummies						X		X
Health quintiles					X	X	X	X
Other Xs							X	X

Notes: 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.).

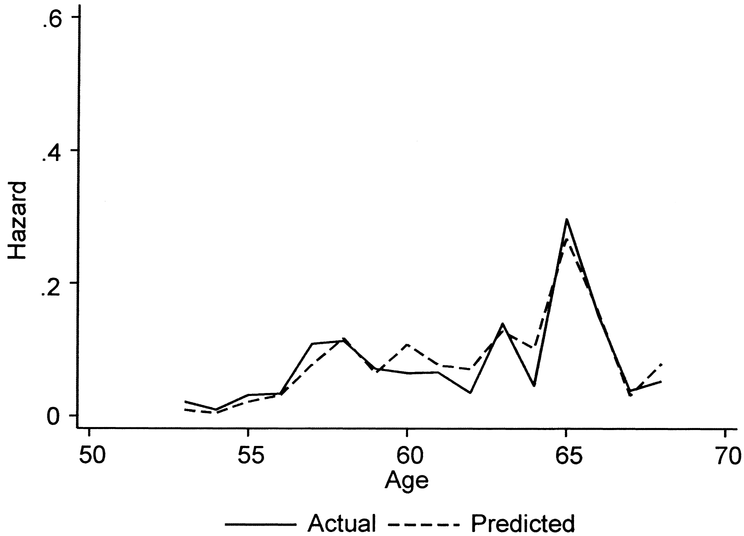

Fig. 10.15 Actual versus predicted retirement rates, men

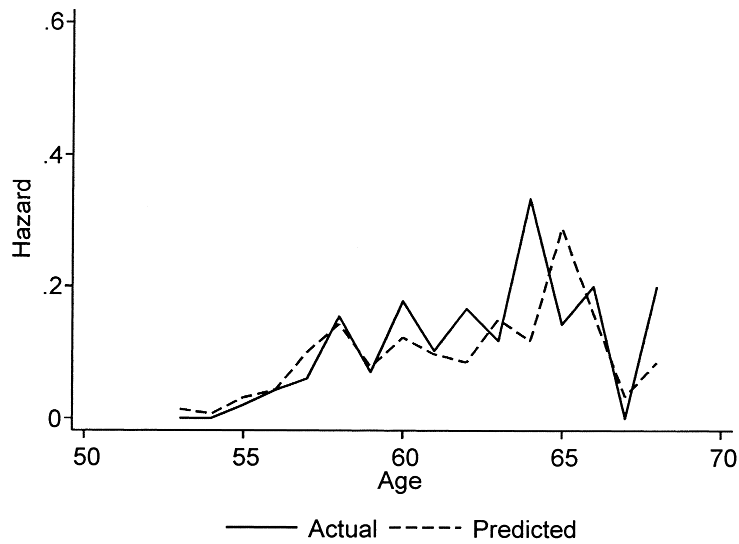

Fig. 10.16 Actual versus predicted retirement rates, women

of remaining employed, or "employment survival rates" (figures 10.17 and 10.18).

In figures 10.19–10.22, we also show the predicted retirement rates by education and health quintiles, separately by gender. It is clear from figures 10.19 and 10.20 that, for each age, the predicted retirement rate is higher for those in worse health (i.e., in the first and second health quintile) and

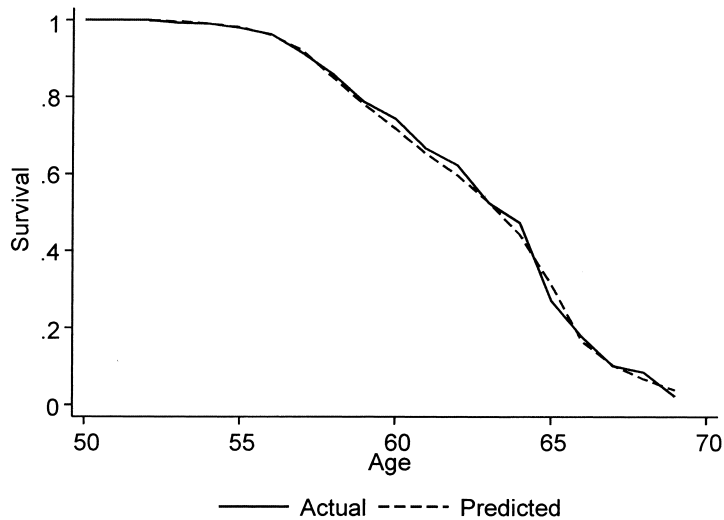

Fig. 10.17 Actual versus predicted employment survival rates, men

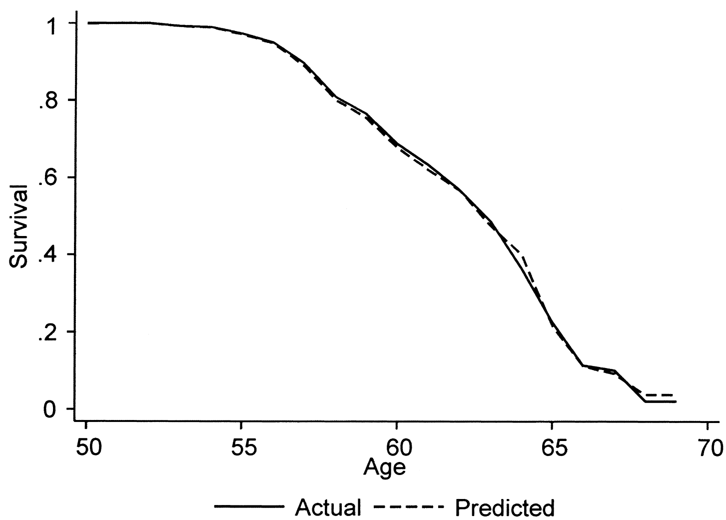

Fig. 10.18 Actual versus predicted employment survival rates, women

lower for those in better health (i.e., in the fourth and fifth quintile). This gradient is common to both men and women, although its age profile is somewhat different by gender.

Finally, figures 10.21 and 10.22 plot the retirement rates by educational level (less than high school, high school, college or more) separately for men and women. Similar to the previous figures, retirement rates tend to be

Fig. 10.19 Predicted retirement rates by health quintile, men

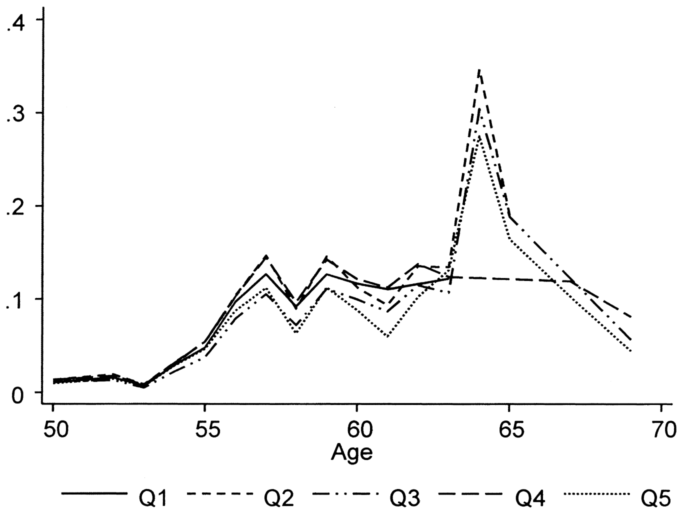

Fig. 10.20 Predicted retirement rates by health quintile, women

higher for those with less than high school and lower for those with college. Differences are more evident in the age range fifty-three to sixty-five, thus before both men and women reach the statutory retirement age. Generally, these figures show that specification (4) in table 10.4 allow the data to fit quite well when using the OV inclusive as the main variable (the weighted average of the OVs by pathway).

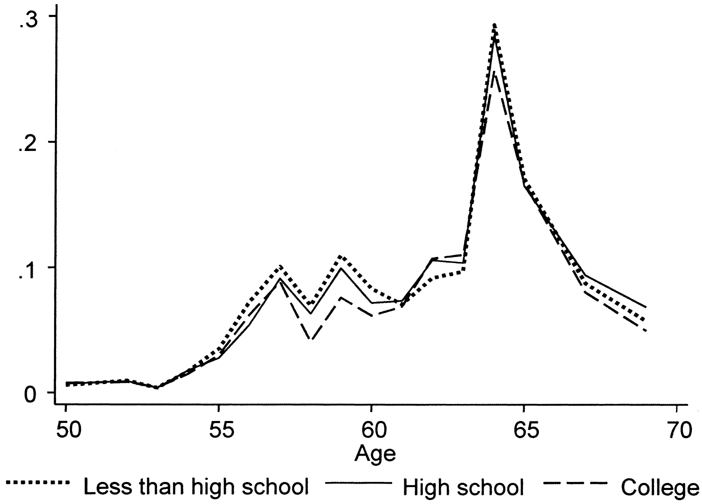

Fig. 10.21 Predicted retirement rates by education level, men

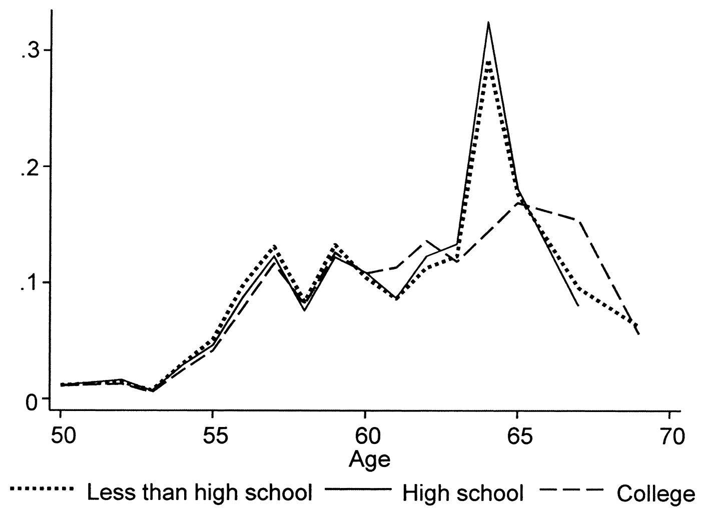

Fig. 10.22 Predicted retirement rates by education level, women

10.4.2 Counterfactual Simulations

We carry out some simulation analysis to evaluate the impact on employment participation of different incentives inherent in each retirement program. Since the focus is on disability, we ask whether employment is affected differentially by the provision of DI, compared to the provision of the old age or early retirement routes. Further, we want to see if this effect varies when we increase the eligibility stringency in DI.

Table 10.8 **Effect of incentive measures on years of work for the age group fifty to sixty-nine, results from three simulations**

Pathway	All face the same pathway	If all DI and early retirement recipients had faced each option	Two-thirds to DI and one-third to old age	One-third to DI and two-thirds to old age
	(1)	(2)	(3)	(4)
DI	12.97	9.33	—	—
Old age	13.38	9.74	9.49	9.56
Early retirement	13.14	9.25	—	—

Three types of simulations are used, depending on the stringency rules that we adopt. They are all based on the estimates obtained in table 10.4, specification (4), which represents our reference model and includes as regressors the inclusive OV and other control variables.

For each simulation, the first step is to calculate the OV separately for each retirement pathway: old age, early retirement, and DI. Then the estimated coefficients from specification (4) in table 10.4 are used to simulate retirement at each age under the different programs (with the inclusive OV associated to each program) for each person in the sample. We now discuss in detail the procedure and the final results.

The first simulation is intended to evaluate the differential effect of changing the stringency for each retirement route—as if all individuals were to face only one retirement pathway with probability 1. Then, for each program, we compute the mean predicted retirement rate by age, the employment survival rate, and calculate the expected years of work between fifty and sixty-nine years of age.

We find that the average expected number of years of work past age fifty is simulated to be 12.97 years if everyone faces the DI option, 13.4 if everyone faces the old-age option, and 13.13 if everyone faces the early retirement option (see table 10.8, column [1]). Thus, individuals need to work more if they all were to face the old-age option compared to the DI option. However, this result should be taken with care for two reasons. First, we have a small sample when using the year-to-year transitions into retirement. Second, we partial-out the age effects by using a set of the age dummies that capture most of the variation in retirement. If we drop age dummies, then we do observe higher differences in the incentives across pathways expressed by expected years of work for the age group fifty to sixty-nine.

Instead of making calculations for all persons in the sample, the second and third simulation would ideally consider only individuals who are DI recipients. Unfortunately, with the data at hand, one cannot perform this type of simulation as the subsample of DI recipients is very small and using the year-to-year transitions to retirement we get an even lower sample. We consider instead the subsample of individuals who are either DI recipients or early retirement recipients and force them to go in old age (we use the question ep071 in SHARE).

We ask how many extra years the individuals in this subgroup would work had they faced the OVs for the old-age pathway. The exercise is similar to that performed in the first simulation. We compute the mean retirement rate if they face the old-age program, the survival function, and calculate the expected years of work between age fifty and sixty-nine (results are shown in column [2]). We find that the expected years of work for this subgroup is 9.33 under the disability route, 9.74 under the old age, and 9.25 under the early retirement. The expected years of work for the disability route and early retirement do not differ much since the simulation is based on the subgroup of recipients of either disability or early retirement benefits.

The third simulation considers again the effect on retirement of greater stringency in DI rules. As in the second simulation, we consider the subgroup of individuals who receive either DI or early retirement benefits. We are aware that performing this simulation on the subgroup containing both DI and early retirement recipients does not allow us to separately identify the effect on labor force participation of a greater stringency in DI rules. However, in the Italian case, the DI and early retirement routes sometimes happen to be substitutes. Thus, we first randomly assign two-thirds of the group to the DI pathway and the other third to the old-age pathway. Then we calculate the mean retirement rate, the employment survival rate, and take the sum of the employment survival for the age interval fifty to sixty-nine. The same process is repeated by randomly assigning one-third of the respondents to the DI pathway and two-thirds to the old-age pathway. The idea of this simulation is to simulate the effect in terms of working years of making DI harder to access for a share of the population (see table 10.8, columns [3] and [4]). From the third and fourth columns we see, in fact, that by closing the DI pathway by one-third (hence by restricting two-thirds to go in DI and one-third in old age), the number of years of work under the old-age pathway reduces from 9.74 to 9.49, so there is an answer to the DI stringency, although we cannot identify the effect on the DI recipients only as explained above. The same occurs when we close the DI pathway by two-thirds; the number of years of work for the old-age pathway reduces from 9.74 to 9.56.

Thus, from these simulations we conclude that individuals respond to the incentives, although not very strongly. For future work, we need to consider a larger sample on which to perform the simulation analysis.

10.5 Conclusions

In this chapter we analyzed the retirement behavior of Italian employees considering distinct pathways to retirement such as old age, early retirement, and disability insurance.

We exploited the determinants of retirement behavior focusing on the role played by health conditions and socioeconomic factors beyond and above the financial incentives associated to each pathway. This was made possible thanks to the availability of SHARE data, which allowed considering a wide set of socioeconomic characteristics compared to administrative. However, we cannot neglect problems related to the small sample size when using SHARE at the level of a single country.

Although our estimated retirement model is standard in the literature, this chapter offers some new developments. First, we construct an overall or "inclusive" option value (OV) measure as the weighted average of the OVs associated to each of the three pathways into retirement using specific weights. Second, following Poterba, Venti, and Wise (2011), we construct an overall index of health via principal component analysis by exploiting the large amount of information on health conditions available in SHARE. Third, we again exploit the possibilities offered by the SHARE data and use year-to-year changes into retirement instead of considering a pooled panel.

Our results are in line with those found in the literature. An increase by 10,000 euros in the OV at time t reduces the probability of retiring at time $t + 1$ by about 5 percent, an effect that is statistically significant at the 5 percent level. Health conditions appear to influence retirement. In particular, being at the top quintile of the distribution of the health index reduces the probability of going into retirement by about 2 percent. Overall, the specification we use seems to fit the data quite well.

In the second part of the analysis, we devote particular attention to the provision of DI programs. In particular, we perform some counterfactual simulations and ask whether employment decisions are differentially affected by the availability of the DI pathway compared to the availability of the old-age or early retirement pathways. Further, we assess the effect of changing the stringency of DI rules.

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