The effect of retirement incentives: micro-evidence for Italy

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Abstract

This chapter discusses the evidence at the individual level of the retirement decision in Italy, also in relation to pension reforms. By exploiting different sets of micro-data, it computes retirement financial incentive measures in the public pension system, based on the real individuals working careers and estimates the impact of these on the decision to retire/continue to work. We model individual behavior and compute predictions to retire by age and year. In addition we perform simulations in order to assess what would have been the probability to retire, have the reforms not been adopted.

1. Introduction and Motivation

The recent demographic trends of fast population ageing have challenged the sustainability of the public pension systems in most industrialized countries (Gruber and Wise, 1998; OECD, 2019). The recent economic literature have studied extensively the determinants of the decision to retire, aiming at identifying the drivers of exits from the labor market and designing effective policies. These studies pointed out that the most important determinants of labour market choices of older individuals are: the health status (Disney, Emmerson, Wakefield, 2006), job satisfaction (Teemu et al, 2012), eligibility requirements, the level of pension benefits and income, dynamic retirement incentives (Gruber and Wise, 2004, Coile and Gruber, 2007).

The aim of this chapter is to explain the retirement behavior of older Italians over the past twenty years in relation to dynamic financial incentives and other potential determinants of labor force participation. For several decades the Italian economy has been characterized by changes in Social Security rules, at the same time improved health conditions and increased longevity have changed the demographic structure of the population, which is characterized by a large share of older individuals, to the extent that demographers refer to an inverted age-pyramid[1]. Other relevant trends have emerged: on the one hand rising female Labor Force Participation, partially mitigating the fall in the number of workers, but, on the other hand, persisting out-flows from the labor market into retirement.

These trends, coupled with the high level of public debt (over 130% of GDP), and low level of GDP growth, prompted important reforms of the Italian social security system. The other drivers of the concerning long- term outlooks, which project high public pension exposure, are: a low fertility rate (around 1.4 children per woman) and a high life expectancy. Important changes were introduced in 1995 which implemented a Notionally Defined Contribution method of benefit calculation, however the public pension system remains basically a PAYG system (see Brugiavini and Peracchi, 2007 and Brugiavini, Pasini and Weber 2019). An important role for the public pension system in Italy could be played by foreign workers, besides the participation of women to the labor force, but the combination of demographic imbalances and economic stagnation raises the issue of extending working lives.

Indeed, the public debate has focused on pension reforms, which increased labor force participation for workers in the age group 50 to 65 mainly by introducing tighter eligibility conditions for pensions. However, a recent inversion in the direction of the reforms has allowed some relatively young workers to exit the labor market through specific provisions: as a result a complex patchwork of rules, which depend on age, seniority and type of occupation have emerged which require a careful analysis of individual cases as we do in this chapter.

[1] Italy has the largest share of individuals aged 65 and over in Europe. Worldwide, it comes second only to Japan (UN, 2019)

This chapter is organized as follows: we first provide a brief background of the Italian pension system and the timing and nature of the reforms in the last 30 years. Section 3 describes the microdata while section 4 analyses the financial incentives to retirement as estimated in the data. Section 5 draws the main conclusions.

2. Social Security Reforms and Pathways to Retirement

In a previous volume we have documented the reform process taking place in Italy and the way it interacted with other macro-economic and demographic trends. In particular, we have shown that there exists a sizeable labor force participation reversal at older ages over the recent decades: we have related the “U-shaped” pattern of labor force participation rates to the pension reforms of the early 1990s (Brugiavini, Pasini, Weber, 2019). We have shown how eligibility to early retirement and old age pension schemes have been restricted over the years, making it progressively more difficult for individuals in their 50s or early 60s to start drawing a pension.

In the present work we focus on the impact of the changes in the incentives to retirement due to pension reforms on the retirement decision of the individuals in Italy.

2.1 The Italian Social Security System and the Reforms

The Italian social security system has been characterized by, essentially, three regimes: a first spell in which a rather generous defined benefit system was in place, a second spell in which a sequence of reforms, starting in the 90’s, took place and a recent period of radical changes, which have then been reversed. Figure 1 provides a synopsis of the main changes over time.

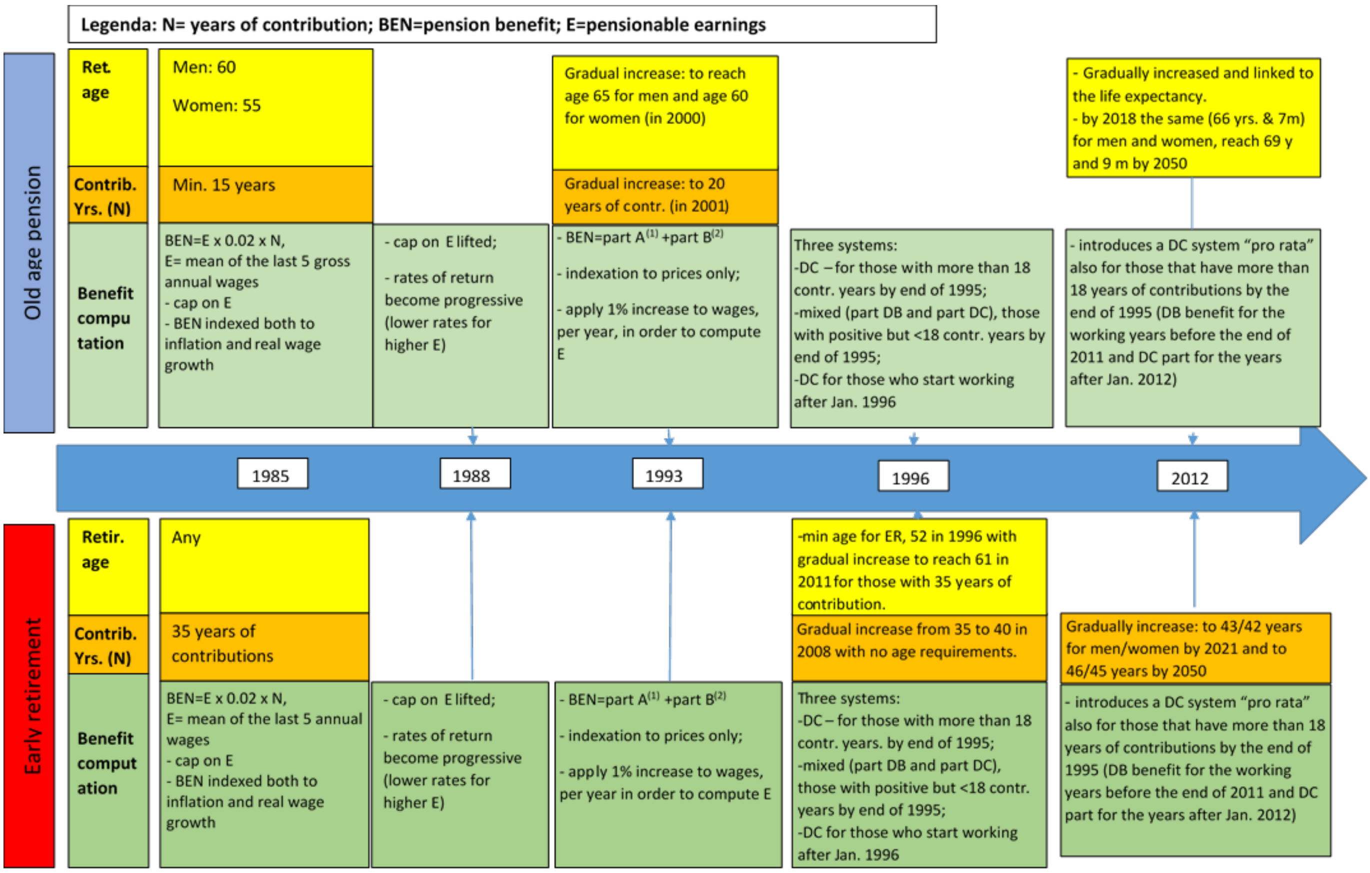
1. Starting in 1969 the social security system offered two retirement paths: an old age pension or an early retirement (seniority) pension, disability benefits or unemployment benefits did not emerge as pathway to retirement[2]. Eligibility criteria for both types of benefits were based on the number of years of contribution and an age requirement. Before 1993 old age benefits could be collected at age 60 for men (55 for women) while early retirement pensions (ER) could be collected, irrespective of age, if at least 35 years of contribution had been paid into the system. Pensions benefits were earnings related, based on average gross earnings over a 5-year window before retirement and an accrual factor of 2% for every year of contribution (up to a maximum of 40 years). Workers who had worked for forty years could collect gross pensions equal to 80% of their last wage. Early Retirement benefits would not

[2] Disability benefits have been of some relevance during the 1970’s, but important changes to the award process took place in 1984, which made disability insurance basically negligible

attract any actuarial penalty: a retiree in her/his 50s would still enjoy a benefit equal to 80% of the last wage. Pension benefits were indexed to nominal wage growth.

2. An important reform was enacted in 1992, which increased the statutory retirement age from 60 to 65 for men and from 55 to 60 for women. It also changed the way benefits were indexed, by price inflation only, and changed the benefit computation introducing a *pro rata* system, i.e. a computation methodology that counted the share of contributions paid under each specific regime. For example, contributions paid by workers over their entire work history would be split in two parts: contributions paid before 1993, (share A) and contributions paid since 1993 (share B). A different legislation would be associated to share A or share B. In particular, share B used a broader base for the weighted average of earnings (over a 10-year window before retirement) and an accrual factor of 2% for every year of contribution after 1992. Past earnings were revalued at a 1% rate per year.

Figure 1. Timeline of pension system reforms in Italy



In 1995 the so called "Dini Reform" legislated a more radical set of rules, based on a notional defined-contribution (NDC) system. However the reform envisaged a long transitional phase and a "grandfathering" approach, protecting the older cohorts of workers, so that the new rules would be fully operational for all workers in the year 2032. In the interim phase benefits are computed as a weighted average of the pension benefit resulting from the old regimes (parts A and B) and the new regime (part C), also on a pro rata basis. Early retirement pension eligibility ages were raised according to a formula that accounted for both age and years of contribution: thus a worker could take early retirement in the year 1996 if aged 52 and had accumulated 35 years of contribution, but would need 40 years of contributions in 2008.

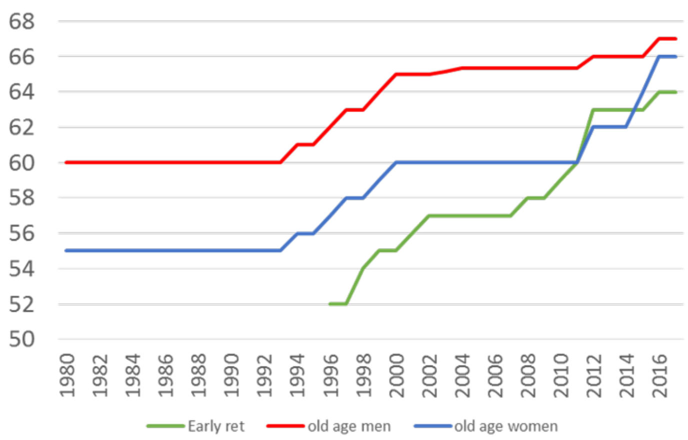
3. In 2011 the Italian Government was under considerable pressure to guarantee sustainability of social security expenditures and changed the calculation of benefits by implementing a rapid convergence to the NDC system (Monti-Fornero reform). Eligibility for old-age pension became much tighter: in the year 2018 there should be no difference between men and women, and by 2050 the age requirement would become 69 years and 9 months for all types of workers. Under the new regime, which is currently in place, retirees can still access the ER option, but a marked increase in the number of years of contributions needed for eligibility occurs: 42/41 years for men/women in 2012 and will increase up to 46 years for men and 45 for women by the year 2050

3. Capturing the dynamics of financial incentives for retirement

Financial incentives have been proved to play a role in the retirement decisions of individuals, however it is a challenging task to capture in one measure (variable) all the features of the pension system and its changes over time and across groups in the population, while controlling for other relevant determinants of retirement. In a recent paper, Brugiavini et al. 2020, show how the variations in the eligibility requirements and benefit computation introduced by the reforms have altered the incentives to retire/work, such as, Social Security Wealth, the index known as Implicit Tax on Work (also used in this chapter) and the Replacement Rate, creating in some cases more variability, in terms of coverage and generosity, than in the previous configuration of the public pension system. The results suggest that for the medium income (medium education) individuals belonging to the generations “at risk” of retirement, the reforms in the ‘90s produced an important reduction of Social Security Wealth, but did not determine a decrease in the replacement rate or in the dynamic incentives to retire. This result is probably due to the fact that older generations experienced an increase in the statutory retirement age and contribution years, while they still enjoyed a generous benefit computation rule based on the defined benefit method. Differently, the Monti-Fornero reform of 2011 determined an important drop in both Social Security Wealth, dynamic incentives and replacement rates, because it entailed for all workers an additional tightening in the retirement eligibility requirements as well as the immediate implementation (pro rata) of the Notional Defined Contribution system. However, while the paper by Brugiavini et al. (2020) provides a novel overview of the impact of the changes taking place in Italy in 2011, it does not fully exploit the dynamic nature of incentives. In the previous ISS volume Brugiavini, Buia, Pasini and Weber (2020) show that dynamic incentives are relevant, but present aggregate results for groups in the population. The present chapter bridges this gap by looking at the dynamic effects of pension reforms at the individual level.

A first step is to recall which variables generate the pattern of financial incentives: a crucial role is played by the statutory retirement ages (and their changes). Figure 2 shows how eligibility ages changes over time distinguishing by gender: this type of variability requires modelling a sufficiently long spell of workers' life.

Figure 2. Evolution of the statutory and early pension eligibility ages in Italy, by gender

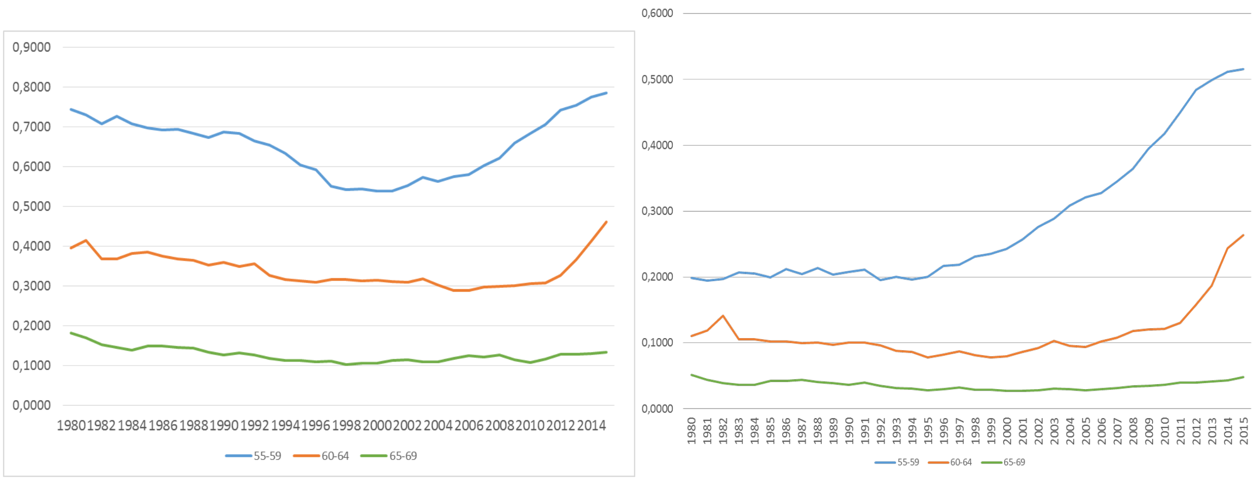


In order to gain prima *facie* evidence on the effects of the changes in pension rules it is useful to present aggregate profiles of the labor force trends prevailing in Italy over a sufficiently long time-span. On the one hand, important changes to the economic, educational and welfare system took place during the 70s and 80s, regarding the educational system and the industrial structure of the country, on the other hand the welfare system lagged somewhat behind in offering coverage and protection to the changing working environment. The only area where the welfare system became more and more generous over the years is in fact pension provisions. Brugiavini, Pasini and Weber (2019) looked at Labor Force Participation and Employment rates drawn from the OECD statistics augmented with information from the MARSS database provided by ISTAT (the Italian National Statistics Office)[3]. Labor force participation (LFP) for older workers (grouped in three distinct age bands: 55-59, 60-64 and 65-69) are documented in Figure 3, left panel for men and right panel for women. There are clear gender and age differences: the pattern of LFP for women

[3] The data sources are described in the Appendix. We look at the years 1980-1983 for the age group 55-59 and the years 1980-1992 for the age group 65-69. As both datasets are based on the Labor Force Survey, we can safely link the two series; a comparison for the overlapping period shows that they are almost identical

is dominated by the experience of younger cohorts, but for both genders we observe a “u-shaped” pattern: while the early years are characterized by a steady decline, especially for the age group 55-59, in recent years we observe a sharp increase in participation.   A simple inference is that these trends can be related to changes in pension rules, but we have argued that variability at the individual level is substantial and group-means could conceal important differential impacts of incentives to retire.

Figure 3. Labor Force Participation by age group – men (left panel) and women (right panel)



3.1 The data and the construction of earnings profiles at the individual level

The analysis of social security wealth and pension reforms requires very detailed datasets, which provide comprehensive information at the individual level on the working life history. In addition, it is important to know a set of socio-economic and household related variables, such as education, marital status, health status, household composition, income or wealth measures. Ideally, one would like to have access to a variety of datasets providing information for workers and retirees in the country: administrative archives have the advantage of supplying accurate data regarding the working careers of individuals, but have the drawback that generally they do not include information about health, social status or the household situation and composition. On the other hand, survey data contain information on the socio-economic condition of the respondents, but do not cover their entire working life. In Italy, we have access to two sources of data: the INPS (Italian National Institute of Social Security) archive, based on administrative data, and a sample drawn from the SHARE survey for the Italian older population (Survey on Health Ageing and Retirement in Europe).

SHARE is a longitudinal, multidisciplinary survey focused on a representative sample of population aged 50 or more. The survey started in 2004 and is run every two years. Until now, data for the first seven waves have been collected and released. SHARE provides information on multiple aspects of the individuals' lives: accommodation, socio-economic status, social network, physical and mental health, health care, cognitive capacities, financial situation etc. There are several advantages in using SHARE data. First, the survey is longitudinal and hence we can follow the individuals from the time they enter the survey until the last interview, observing the changes in household composition, financial situation, health and working status. Second, the third and the seven waves of the survey (SHARELIFE) collected comprehensive retrospective data about the respondents' life histories, since their birth until the interview year, including detailed information on their working careers. In particular, we use information from both regular waves (1-2 and 4-7) and SHARELIFE. Regarding the individuals' working lives, SHARELIFE provides information on all the states with their start and end date: employment spells, unemployment spells, maternity leave, out of the labour force spells, occupation and type of contract (part time or full time). A generated panel, the Job Episodes Panel (Brugiavini et al. 2019) has been constructed based on these spells, which reshapes the data in longitudinal form, such that every respondent enters the dataset with as many registrations as years of life, until the time of the last interview. While the job-episodes panel is very rich in several dimensions, it only provides information on the first wage of every job spell for all respondents, plus the last wage of the main job spell, if the respondent is retired, or the current wage if she/he is still working. We supplement the wage profile with data on current wage drawn from the regular waves, but in many cases we cannot reconstruct the complete earning history, so we need to adopt a general model for the data generating process of wages.

In order to be able to predict (and impute) the employment earnings for every year of the working life we use a large dataset constructed by pooling together the INPS administrative data and the SHARE ones. The INPS dataset provides information for the private sector employees, who pay contributions and are covered by social security. The sample is obtained by selecting all the individuals registered with INPS who were born on the 10-th of March, June, September and December of every year. Our sample contains 2743516 records for the years 1985 to 2004. However, we focus the attention on ages between 55 and 70 in the time-period 2004-2015, that is, we make use of data on the cohorts born between 1930 and 1959. As a result, we retain a dataset of 987216 records, complemented with both observations from the Job Episodes Panel and information on the current wages in SHARE regular waves (6726 records). Table 1 describes the sample composition by cohort of birth and sample.

Table 1. Sample composition

cohort	INPS	SHARE	Total
1930-1934	44086	337	44423
1935-1939	93157	644	93801
1940-1944	131739	928	132667
1945-1949	210944	1362	212306
1950-1954	238352	1568	239920
1955-1959	268938	1887	270825
Total	987216	6726	993942

Equipped with this lifetime information we estimate earnings profiles as specified in equation (1), separately for men and women. The dependant variable is the logarithm of the gross annual wage.

$$\text{(1)} \qquad \ln(y) = \alpha + \beta A + \gamma A^2 + \delta A^3 + \varepsilon Cohort_D + X'\underline{\theta} + \vartheta PT + \mu North + \pi South + \nu White + \lambda SHARE\_D + \varphi SHARELIFE\_D + u$$

where:

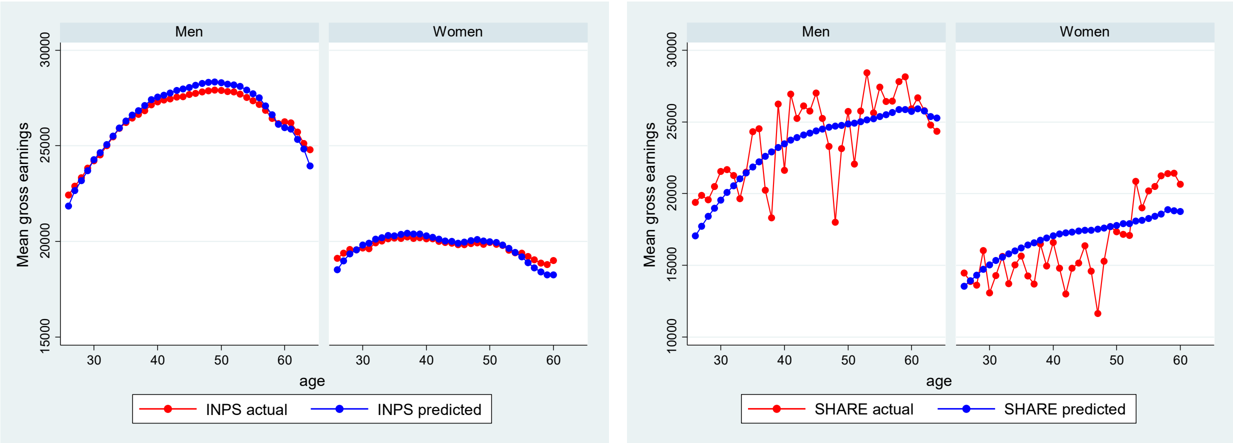
A=(Age-40)

X= interaction of age and cohort dummies

The explanatory variables are: a cubic polynomial in age, the type of occupation (white-collar/blue collar), the type of contract (part-time or full-time), the macro-region where the individual works and dummy variables for the data source (SHARE, SHARELIFE or INPS). In addition, we control for the cohort of birth and a set of interaction variables between the cohort of birth and age (variable X). Standard errors are cluster-adjusted by individuals. Based on this specification, we predict earnings and impute them in the years when the respondent was working but the earnings information was missing.

Figure 4 describes the predicted versus the actual average earnings by age and gender, separately and for the INPS and for the SHARE-SHARELIFE samples.

Figure 4. Predicted versus actual earnings, INPS sample (left panel) and SHARE sample (right panel)



Overall our model fits the data well both for the INPS and for the SHARE samples. When comparing the actual with the predicted values a slight underestimation for women emerge for ages above the age 55, an age spell in which labor force participation of women is lower and the number of observations declines[4]. In terms of precision: the left panel (INPS sample) is based on a much larger sample and therefore the two lines are quite close to each other, while the right panel is based on the SHARE and SHARELIFE samples, which are relatively small, so that the actual figures are quite volatile when compared with the fitted values. We experimented with the different specifications of the age-earnings profile which could retain some flexibility while making use of the relevant variables, and decided to present the estimates that are coherent with the other countries presented in this volume, as results do not differ significantly. These estimates are the building block for the measure of financial incentives, as they allow us the project expected pension benefits at each future age/year, given the appropriate pension rules.

3.2 The econometric specification for the probability to retire and the role of financial incentives

The core of the present work is to assess the impact of the financial incentives on the probability to retire at the individual level: this exercise requires estimating future pension benefits at each possible age, given the prevailing legislation. In this section of our chapter we only retain observation of the individuals from the SHARE survey, who also took part in the retrospective SHARELIFE wave. This is because the SHARE (augmented with the SHARELIFE data) include all the relevant information to perform a proper estimation procedure up to the year 2017. We also drop individuals who always worked as self-employed workers, because they are subject to very different eligibility requirements for retirement, which cannot easily be implemented. Our final sample includes 39869 records for 2552 individuals. In a first step, given the generated age-earnings profiles and given the retirement rules in place in each year, we compute the future pension benefits for every respondent who is at risk of retirement at that specific age and year. In

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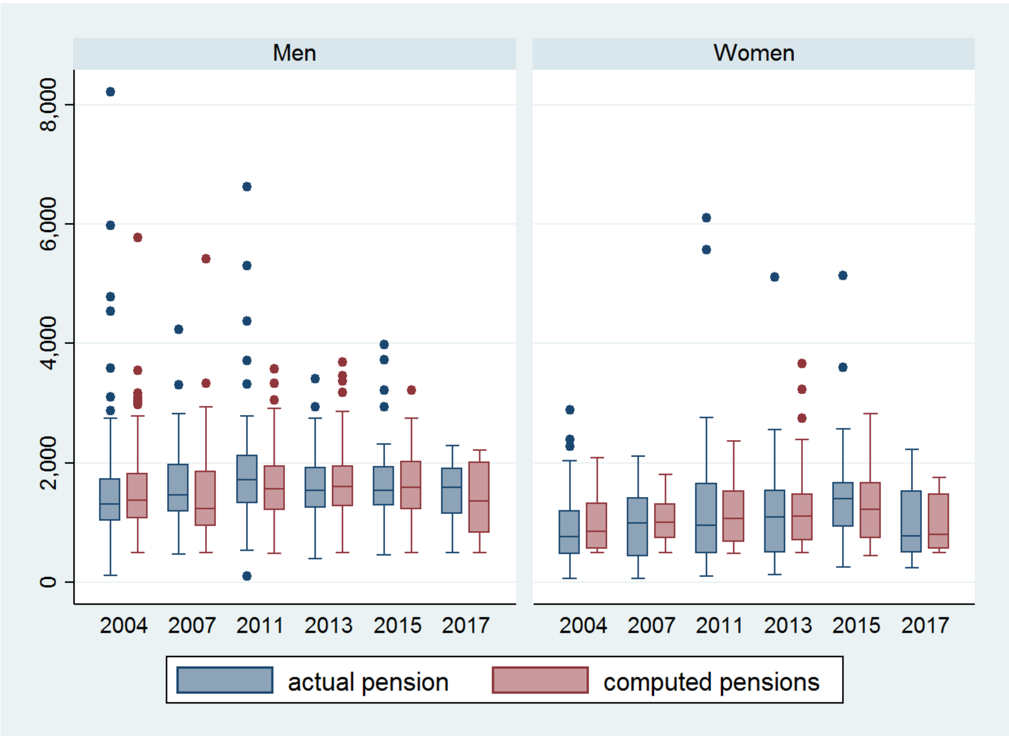
[4] This may also be due to the fact that for the INPS sample, we only have information until the year 2004 so that we might miss some recent changes in the participation of women and in their wages.

this preliminary estimation, we which call the "pension calculator" we distinguish between respondents who are always working during the entire observation period and individuals who retired during the observation period. For the former group we have to impute pension benefits according to all possible changes in the legislation, for the latter group SHARE provides the self-reported amount of the monthly/typical pension benefit actually awarded, so that we can carry out a simple validation exercise.

Figure 5 presents the distributions of the amounts of the actual and of the computed (imputed) monthly gross pension benefits by year of survey and separately for men and women. Overall, the graph suggests that our pension calculator performs well, while there are some differences by gender. The median values of actual and computed benefits are very close, but some differences emerge for the years 2007 and 2017 (for men) and 2015 (for women). In these years, the median of the computed benefits is slightly lower than that of the actual ones, indicating a slight underestimation in our pension calculator methodology. While the interquartile ranges exhibit in general comparable magnitudes for men (except for the year 2017), they are sensibly larger for women in almost all years. This is most likely due to the fact that the working career of women is characterized by interruptions, changes from part-time to full time or vice-versa, etc. which cannot be easily captured in our model.

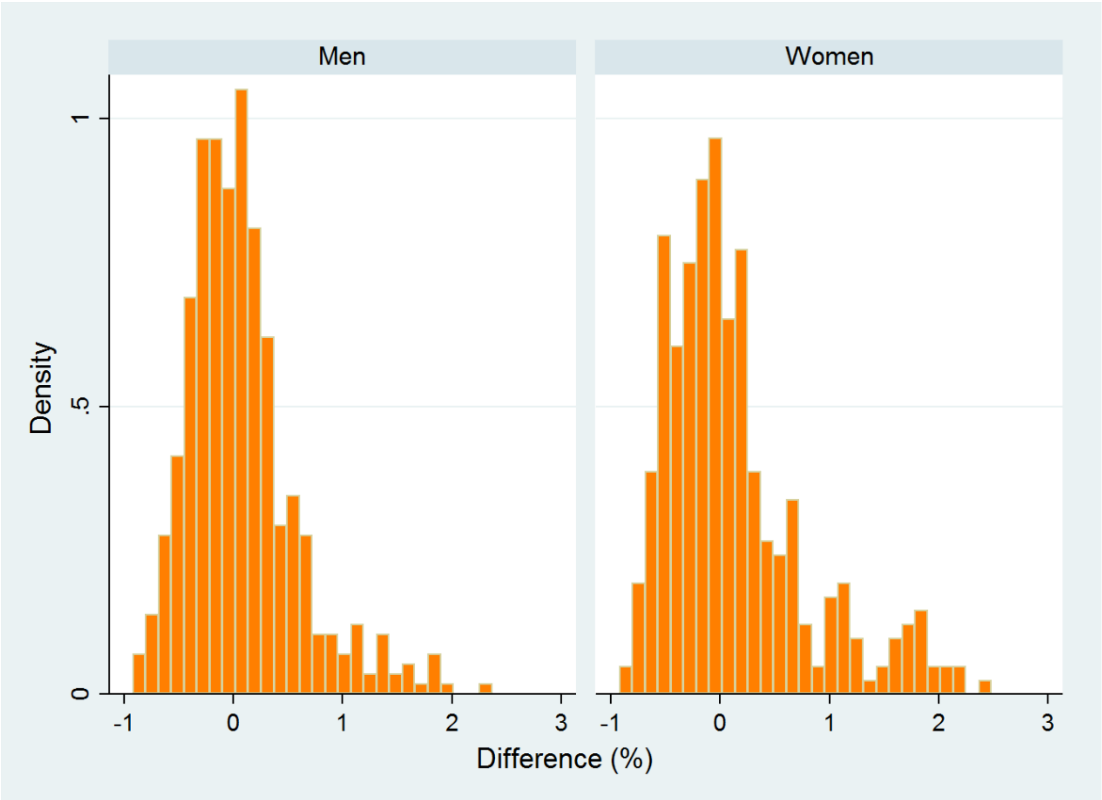
Figure 5. Distributions of the actual versus computed pension benefits



A comparison of the dispersion of actual benefits and computed benefits shows a good degree of similarity for men (apart from the year 2015), but a higher dispersion in actual pension benefits for women. However, it should be pointed out that the presence of outliers in actual benefits is more marked for men than for women, especially in the first waves when data on earnings were recorded often in pre-Euro currencies. Overall, actual pension benefits and imputed pension benefits are more divergent and less accurate for women than for men, probably due to the higher variability and more frequent gaps, which characterize female labor market experiences. Also: the sample of women is significantly smaller than the sample of men, which makes the result less precise for this group of workers.

Another validation check of the pension calculator is carried out by looking at the distribution of the percentage variation between the computed and actual pension benefits, reported in Figure 6 separately by gender. The histograms highlight that there are larger differences between computed and actual benefits for women, while the distribution for men is more concentrated around the value of zero. Indeed, only 1.2% of the sample of men displays a difference between computed and reported pensions larger than 2.5%, while this percentage reaches the value of 9% for women. In any case, the difference between computed benefits and actual benefits remains below 5% for more than 97% of women in the sample. Since the median benefit is between 1500 and 1800 euro per month for men, and between 900-1700 for women, a 1% difference should be thought as being on average about 15-18 euros per month for men and 9-17 euros for women.

Figure 6. Distribution of the difference between the computed and the actual pension benefits.

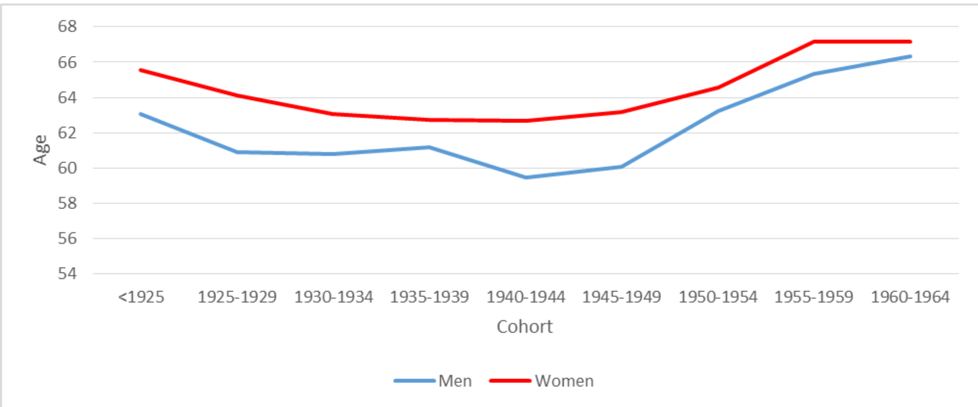


Before turning the attention to the econometric model that estimates the retirement probability, it is useful to provide some descriptive evidence for the Italian-SHARE sample.

Figure 7 describes the average retirement ages observed (or expected for the younger cohorts) in our sample, by cohort of birth, separately for men and women. There is a clear U-shape for both men and women. The cohorts born between 1930-1950 retired at younger ages than the older ones and those born after 1955 will retire much later than their predecessors. Although the statutory retirement ages (old age) used to be lower for women, the effective retirement age of females has always been above that of men. This difference is due, once again, to the labor market experience of female workers. While the main retirement route for men has been early retirement, because their working careers started generally in early life and was rather stable, the pathway to retirement of women has been old age, because women hardly qualify for early retirement, which requires many years of uninterrupted contributions (Figure 8).

Figures 7,8 and 9 also hint to the effects of the reforms on the retirement ages.

Figure 7. Average retirement age for men and women by cohort of birth



Further evidence on these points is provided by Figure 9, which shows the variation in the actual retirement age over time, separately for men and women. The graphs show a gradual but distinctive shift from a lower retirement age in the years 1990-1993, i.e. the years before the main reforms, when the retirement ages were around 50-57 for men and 54-58 for women, to significantly higher retirement ages after the three major pension reforms, between 59-66 for men and 58-65 for women.

Finally, Figure 10 exploits a specific question of the SHARE survey aimed at understanding reasons for retirement (asked to all retirees). The picture shows that the main motivation is becoming eligible for public first pillar pension or occupational pension, both for men and for women. Other reasons are much less relevant: “retiring at the same time with the spouse” is almost negligible, poor health of relatives or friends and the desire to spend more time with the family is also a minor motivation, but these latter are relatively important for women than for men.

Figure 8. Pathways to retirement

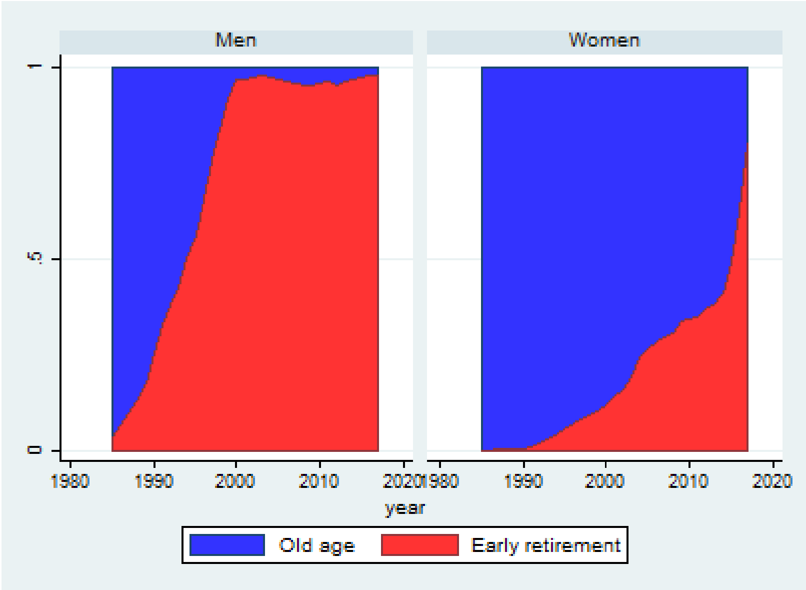


Figure 9.1 Actual retirement age, men

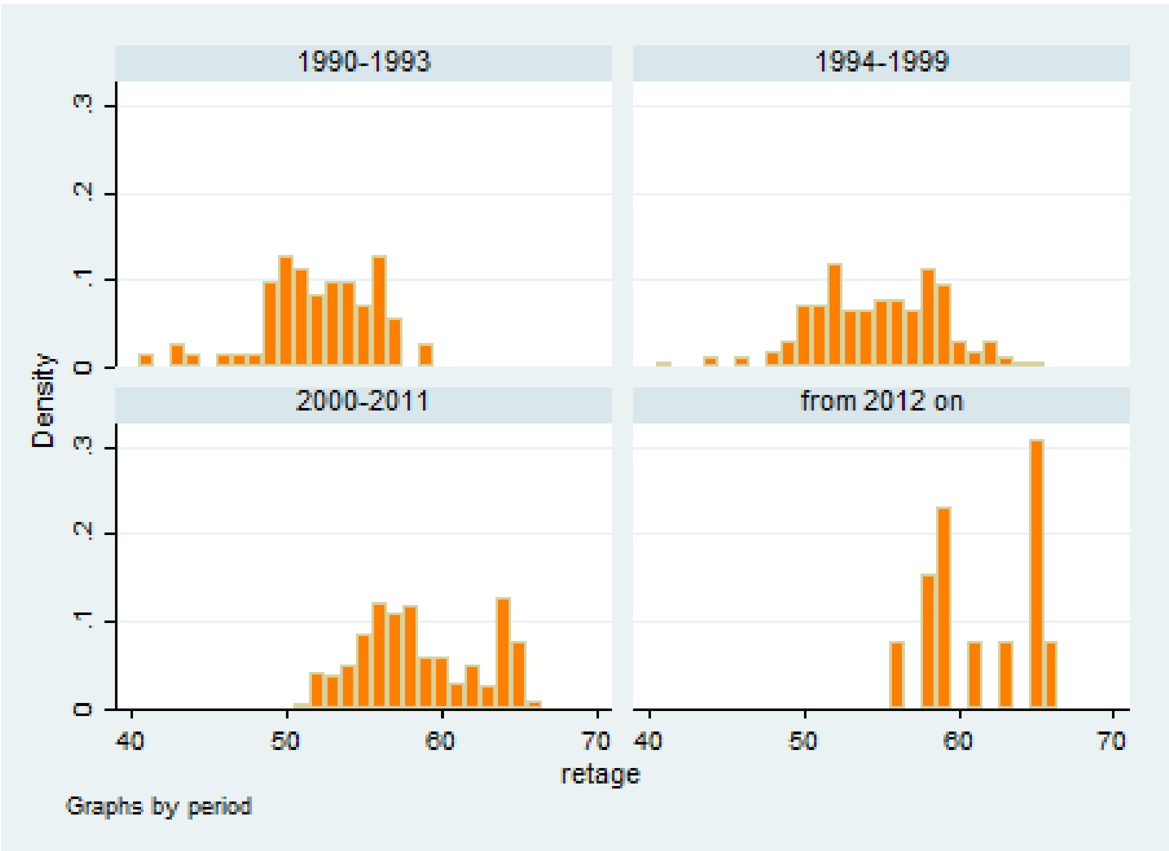


Figure 9.2 Actual retirement age, women

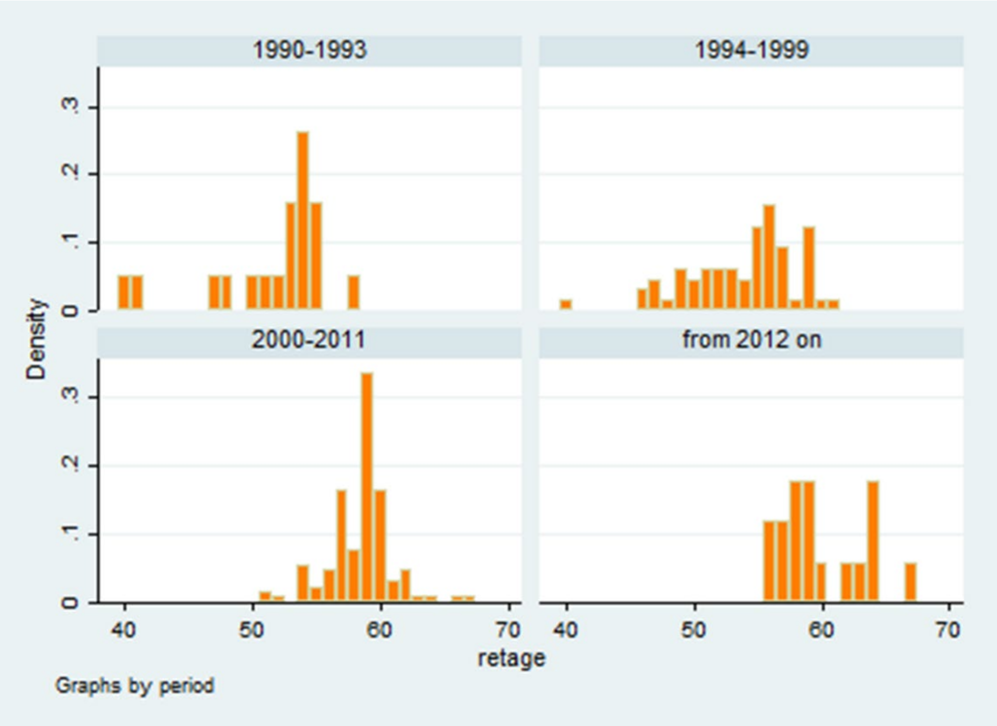
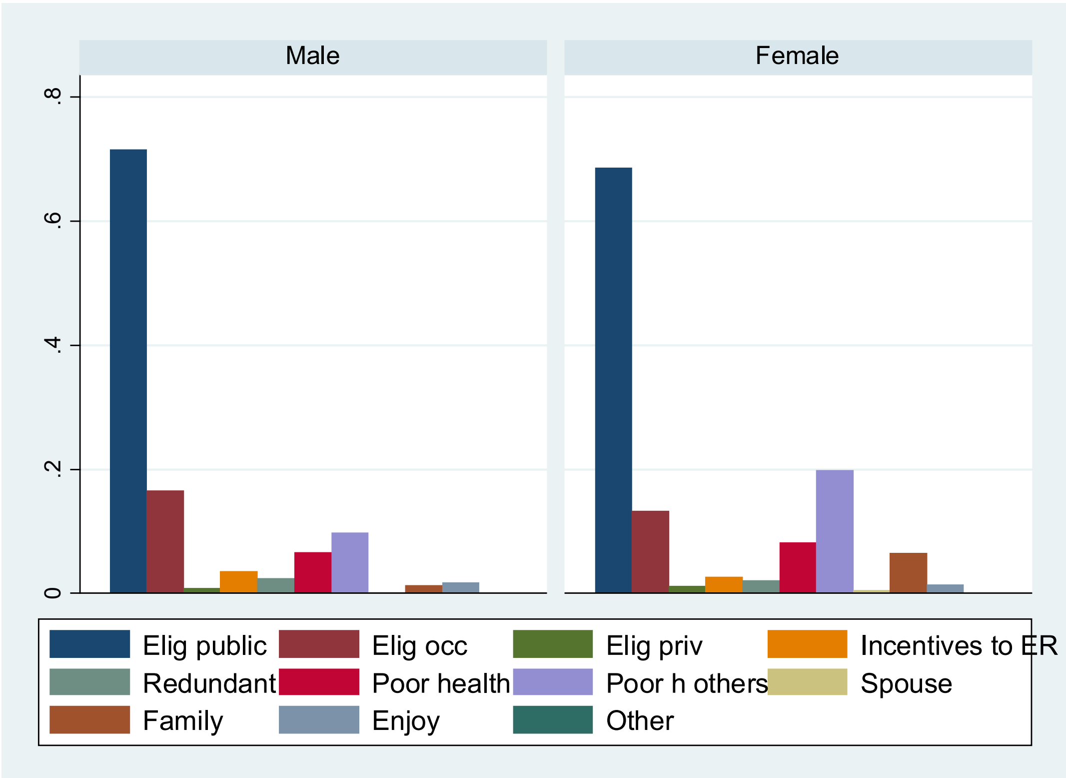
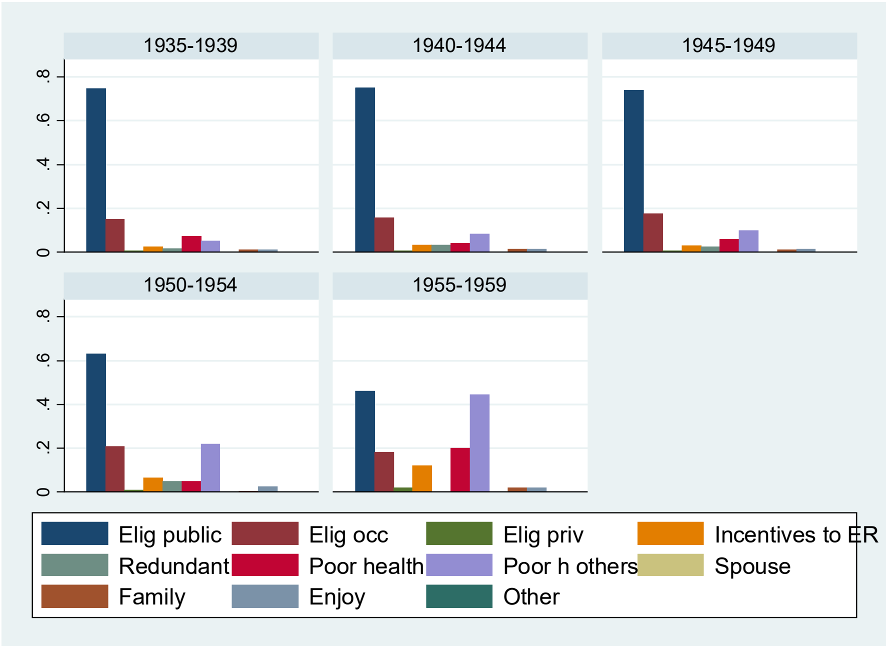


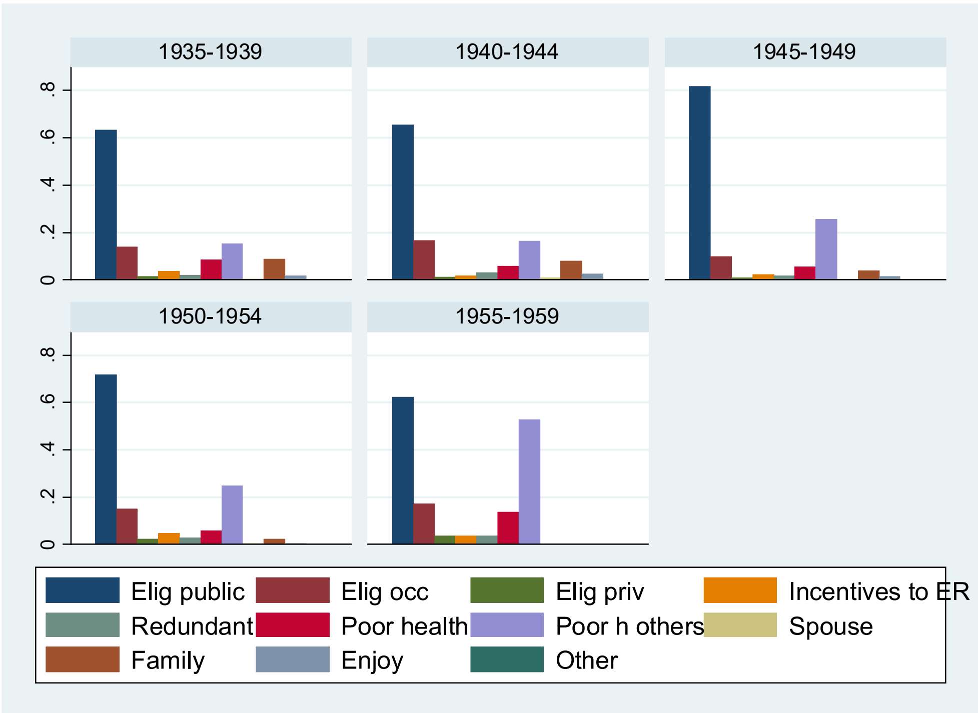
Figure 10. “Reasons for retirement” by gender



It is interesting to further disaggregate the “reasons for retirement” answers, by cohort and gender because these are the characteristics that are used by the legislator in setting pension rules (Figure 11). Looking at the results for men, the distribution is similar for the three oldest cohorts but vary substantially for the younger ones. For those born between 1935-1949 the “eligibility” answer counts for about 80% of the retired men, while own health and poor health of relatives become more important for younger cohorts. We propose two possible explanations: on the one hand, the sample of retirees is right censored for younger cohorts (men born in 1955-1959 who become of age 58-62 in 2017); on the other hand, younger cohorts are strongly affected by the recent reforms and experience tighter eligibility requirements. Finally, becoming a caregiver for close relatives in poor health for some of the younger individuals may have become an alternative to other pathways, given that in 2017 some of the eligibility requirements relaxed slightly for the persons providing care to a close relative under certain circumstances.

Figure 11. Reasons for retirement by cohort and gender, men top panel and women bottom panel





3.1 Estimating the probability to retire

The probability to retire is specified in a simple and flexible way as given below. It is important to recall that we are using data on transitions into retirement, hence capturing the actual incidence and not just the prevalence of retirement. If this is the correct approach to estimating the retirement probability, one drawback is that, in the absence of constant refreshments of younger cohorts, the sample is ageing and the population at risk includes a gradually smaller number of people at older ages.

(2) $$T_i = \alpha + \beta * age_i^2 + \gamma * age_i + \delta * ITAX_i + \mu * SSW_i + \theta * X_i + \varepsilon_i \ ,$$

where:

- T_i represents the transition to retirement
- $ITAX_I$ is the implicit tax of working
- SSW_i= Social Security Wealth/100000
- X_i is a vector of socio-economic characteristics of the individual

The dependent variable is the transition from work to retirement (a 0/1 indicator that takes value 1 in the year of retirement). Retirement is an absorbing state, so we drop the records for the years after the retirement date, for the respondents who exit the labor market during the observation period. The key explanatory variables are the implicit tax of working (ITAX) and the social security wealth (SSW). In addition, we control for a set of demographic and socio-economic indicators: age, gender, marital status, health status, education, region of residence, number of children, as well as for a measure of lifetime earnings (the logarithm of the average lifetime earnings). To take into account macroeconomic trends we also include in the regressions the GDP growth rate.

Although these are measures that have been widely used also in previous volumes, it is worth recalling the definitions of Social security wealth and of Itax. Social security wealth for an individual *i* which retires at age *t* is the present discounted sum of the future stream of pension benefits that he will be entitled to, adjusted by the survival probability:

$$SSW_t = \sum_{a=t}^{T} B_a \sigma_{ta} \beta^{a-R}$$

where: σ_{ta} represents the survival probability at age *a* in time *t* and β is the discount factor.

The accrual of SSW represents the difference between the SSW that the individual expects to receive if he postpones retirement to age/time *t+1* and the SSW that he would expect, were she/he to retire at age *t*.

$$ACC_t = SSW_{t+1} - SSW_t$$

If retirement is postponed to next year (t+1), this produces two effects of opposite sign on the SSW at time t+1. On the one hand, the individual would forgo one year of benefits, on the other hand, the amount of every single benefit may increase, according to the computation rules. For example, if the benefit depends directly on the number of years of contribution or on the total amount of contributions paid, a longer working life mechanically provides higher benefits. Hence, the sign of the accrual can be positive or negative, depending on which effect prevails.

The implicit tax of working is the ratio between the negative of the accrual and the earnings from work at time *t+1* if the individual postpones retirement:

$$ITAX_t = -\frac{ACC_t}{Y_{t+1}}$$

It is important to stress that we define it as "a tax on work" at time t, so that in terms of incentives a positive correlation with the probability to retire at time t, means that the higher the tax the more likely is retirement in that year. We perform estimates of equation (2) using different methodologies: (i) a linear probability model (LPM), which we characterize with fixed effects (LPM-FE) and with random effects (LPM-RE); (ii) and two probit estimates, one standard probit and a probit with random effects. Age is included in the regressions in two ways: on the one hand we use a quadratic polynomial specification, on the other hand we only include a set of dummy variables for five years age bands. The estimates using these last specifications are reported in the appendix. We run all the regressions first on the entire sample and then separately by gender. In all the estimations the standard errors are clustered by individual. Table 2 presents the results of the main regressions using the entire sample, with the quadratic polynomial specification in age.

Table 2. Estimates of the probability of transition to retirement

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit RE
age^2	-0.00091***	-0.00053***	-0.00076***	-0.01131***	-0.01131***
Age	0.10784***	0.07639***	0.09505***	1.34547***	1.34545***
Female	-0.01868***		-0.02211***	-0.17383***	-0.17382***
ITAX	0.00839	0.04452***	0.03028***	0.02858	0.02857
SSW/100000	0.02377***	0.06398***	0.03957***	0.17299***	0.17299***
Logearnings	-0.02388***	-0.89284***	-0.03116***	-0.18684***	-0.18683***
abovemedian educ	-0.00114	(omitted)	0.00101	-0.0315	-0.0315
Married	0.00149	0.01114	0.00688	0.01612	0.01612
Nchildren	-0.00211	-0.01526	-0.00755**	-0.0179	-0.0179
North	0.00634	0.03518	0.01404*	0.06297	0.06296
South	-0.00961*	0.03169	-0.01084	-0.09493*	-0.09493*
Growth	-0.19979*	-0.20750*	-0.39282***	-1.51592*	-1.51583*
_cons	-2.91086***	5.99085***	-2.60240***	-39.79017***	-39.78971***
N	**20276**	**20276**	**20276**	**20276**	**20276**

In all the specifications, both the age and the age square coefficients are strongly significant and point to a concave relationship between the retirement probability and age. Analysing the variables that measure the incentives to continue work/to retire, that is, the implicit tax of working (ITAX) and social security wealth (SSW) we observe that the effect of both is positive in all the estimations with some variation among the specifications. While the impact of the ITAX is not significant in the simple linear probability model and in both probit specifications, it is strongly significant in either the LPM with fixed effects and in the LPM with random effects. The SSW has an important positive effect on the probability to retire in all specifications.

Table 3.1 Estimates of the retirement probability, men

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
age^2	-0.00066***	-0.00046***	-0.00061***	-0.00775***	-0.00775***
age	0.07833***	0.07158***	0.07734***	0.92422***	0.92422***
ITAX	-0.01125	0.04288***	0.01477	-0.10687*	-0.10687*
SSW/100000	0.02907***	0.06126***	0.04154***	0.20377***	0.20377***
logearnings	-0.03309***	-1.14071***	-0.03255**	-0.24895***	-0.24895***
abovemedian educ	-0.00404	(omitted)	-0.00041	-0.05577	-0.05577
married	0.01703*	0.02373	0.02776*	0.16340*	0.16340*
nchild	-0.00326	-0.01405	-0.00869**	-0.02572	-0.02572
north	0.00961	0.0118	0.01674	0.07799	0.07799
south	-0.00937	0.03394	-0.01191	-0.09727*	-0.09728*
growthm	-0.18433	-0.00055	-0.33836**	-1.31417	-1.31422
_cons	-1.98653***	8.61429**	-2.10411***	-26.99607***	-26.99629***
N	**11239**	**11239**	**11239**	**11239**	**11239**

Table 3.2 Estimates of the retirement probability, women

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
age^2	-0.00114***	-0.00071***	-0.00091***	-0.01711***	-0.01711***
age	0.13473***	0.09508***	0.11178***	2.03547***	2.03552***
ITAX	0.02215***	0.04805***	0.04126***	0.14209**	0.14211
SSW/100000	0.02040***	0.06357***	0.03790***	0.15983***	0.15985
logearnings	-0.01782**	-0.84522***	-0.03074***	-0.15025*	-0.15027
abovemedian educ	0.00156	(omitted)	0.00132	-0.00223	-0.00223
married	-0.01398	-0.00896	-0.01458	-0.15141*	-0.15142
nchild	-0.00058	-0.00253	-0.0059	-0.01024	-0.01025
north	0.00354	0.06145	0.01174	0.0508	0.05081
south	-0.01004	0.03546	-0.009	-0.09466	-0.09467
growthm	-0.20552	-0.38677**	-0.45579***	-1.90528	-1.90571
_cons	-3.75488***	4.89071**	-3.08259***	-60.59201***	-60.59362***
N	**9037**	**9037**	**9037**	**9037**	**9037**

Women have a significantly lower probability to retire from work, as we pointed out in our previous discussion this is due to discontinuities in their working careers, which prevent them from meeting seniority-eligibility requirements, especially for early retirement. In order to emphasize the dynamic of the incentives between genders, we also perform all the regressions separately for men and for women.

Table 4.1 Estimates using an age spline, entire sample

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
ages1	0.00344**	0.01586***	0.00504***	0.05892***	0.05892***
ages2	0.01032***	0.02172***	0.01428***	0.08493***	0.08494***
ages3	-0.00827***	0.00478**	-0.00409*	-0.05793***	-0.05793***
ages4	-0.01883***	-0.00715	-0.01601***	-0.29821***	-0.29821***
ages5	-0.00333	0.00229	-0.00257	-0.23532	-0.23533
female	-0.01270***		-0.01655***	-0.12648***	-0.12648***
ITAX	-0.00447	0.02677***	0.00532	-0.06129	-0.06129
SSW/100000	0.01365***	0.04830***	0.02163***	0.11230***	0.11231***
logearnings	-0.01117**	-0.75191***	-0.01437**	-0.09608*	-0.09608*
abovemedian edu	-0.00118	(omitted)	-0.00262	-0.02372	-0.02372
married	0.00085	0.00719	0.0034	0.00621	0.00621
nchildren	-0.00212	-0.01458	-0.00423*	-0.01869	-0.01869
north	0.00503	0.02187	0.0074	0.047	0.047
south	-0.00841*	0.04123	-0.01162*	-0.09004*	-0.09004*
growth rate	-0.00223**	-0.00296***	-0.00332***	-0.01740*	-0.01741*
_cons	-0.05573	6.35984***	-0.11475	-4.16497***	-4.16501***
Obs	24112	24112	24112	24112	24112

Table 4.2 Estimates using an age spline, men

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
ages1	0.00343	0.01943***	0.00510**	0.04311*	0.04310*
ages2	0.00639***	0.01602***	0.00929***	0.05435***	0.05434***
ages3	0.00223	0.01390***	0.00476*	0.0203	0.02029
ages4	-0.03078***	-0.01544**	-0.02784***	-0.36759***	-0.36760***
ages5	-0.00348	0.0014	-0.0033	-0.31521	-0.31521
ITAX	-0.02573***	0.02314**	-0.01767*	-0.21641***	-0.21642***
SSW/100000	0.01455***	0.05127***	0.01913***	0.11557***	0.11556***
logearnings	-0.01194*	-0.64843**	-0.01145	-0.0955	-0.0955
abovemedian edu	-0.00384	(omitted)	-0.00525	-0.04789	-0.04788
married	0.01247	0.02182	0.01569	0.12409	0.12408
nchildren	-0.00248	-0.01263	-0.00364	-0.02109	-0.02108
north	0.00671	0.04208	0.00786	0.0545	0.0545
south	-0.00974*	0.05576	-0.01252*	-0.10344*	-0.10343*
growth rate	-0.00215	-0.00183	-0.00273*	-0.01592	-0.01592
_cons	-0.06074	5.21502*	-0.15861	-3.41917**	-3.41905**
Obs	13792	13792	13792	13792	13792

Table 4.3 Estimates using an age spline, women

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
ages1	0.00214	0.01078***	0.00299	0.08421**	0.40143**
ages2	0.01731***	0.02954***	0.02184***	0.13978***	0.50003***
ages3	-0.02207***	-0.00918***	-0.01616***	-0.17322***	-0.02713
ages4	0.0004	0.0055	0.0008	-0.16215	-0.26253
ages5	-0.00282	0.00353	-0.00112	-0.12245	-0.02115
ITAX	0.00927*	0.02900***	0.01941***	0.053	0.36289*
SSW/100000	0.01565***	0.03942***	0.02759***	0.13982***	0.53325***
logearnings	-0.01400**	-0.86073***	-0.02277***	-0.13496*	-0.38410*
abovemedian edu	0.00152	(omitted)	0.00105	0.00853	-0.01277
married	-0.0112	-0.01426	-0.01053	-0.12638	-0.38829
nchildren	-0.0015	-0.00512	-0.00526	-0.01644	-0.13066
north	0.00428	0.00043	0.00817	0.05113	0.26119
south	-0.00749	0.02066	-0.01026	-0.07617	-0.31737
growth rate	-0.00239*	-0.00446***	-0.00437***	-0.02105	-0.05852**
_cons	0.03114	7.56580***	0.06054	-5.31562***	-22.54430*
Obs	10320	10320	10320	10320	10320

Tables 3.1 and 3.2 present the estimates separately by gender: the age-profile is similar across genders, it is concave in age, though with a different maximum of the parabola. The impact of the implicit tax of working on the retirement decision is positive for both genders, but it is larger and more significant in the case of women. The effect of the SSW is stronger for men in almost all the specifications, except for the LPM with fixed effects. The measure of the lifetime earnings is negatively related to the probability of retirement and the magnitude of the effect is larger for men. The aggregate growth rate of the economy seems to be more important for women and has a negative impact on the retirement decision: a higher economy growth is associated to a lower probability to exit the labour market. Similar patterns, with differences in the magnitude of the estimated coefficients, emerge when we perform the same regressions with an important change in the specification: we use age splines rather than age polynomials (Tables 4.1, 4.2 and 4.3). Finally, we also present in the appendix results using age-group dummies instead of the age polynomial (Tables A.1, A.2, A.3). Our preferred specification is the one which makes use of age splines, rather than the specification based on the age polynomial, because splines are more flexible and lend themselves to modelling pension reforms which introduced explicit changes in the retirement eligibility ages. In particular, we considered as knots (points of change in the spline) the statutory old age pension ages over the relevant time span, that is: 55, 60, 65 and 67 taking account both the rules for men and for women.

It should be noted that we also run all the specifications including as control variable a health measure. Despite the fact that SHARE has several health measure, we have to restrict the attention to the only measure that is present for all individuals over their entire working career: i.e. an index that counts the number of illnesses at each point in time. In fact, SHARE provides self-reported health and the information useful to generate the Poterba, Venti and Wise health index (Poterba, Venti e Wise, 2013), but these are only available for the years of the regular SHARE waves, that is starting in 2004, which would imply reducing significantly our estimation sample. In the specification that controls for health, the estimates of our key variables do not change significantly. An interesting point is that the health variable has the expected sign (indicating that a higher number of illnesses determines an increase in the probability to retire), however the estimated coefficient is not significant in the fixed effects setup.

In what follows, we present the predictions and the counterfactual simulations using the age spline specification within a linear probability model with fixed effects. Before showing these results, it is useful to discuss how our estimates fit the actual data. Figures 12 and 13 describe the observed retirement versus the predicted probability of retirement over time, by age group and gender, while Figures 14-15 the predictions versus the counterfactuals over time. When analysing the predictions versus the actual transitions to retirement we note that our model performs better for the age group 55-59, with respect to the older one (60-64) both for men and women. In particular, it fails to capture two spikes around the years 2008-2009 and in 2015, respectively. This may be due to the many temporary measures introduced in the years between the major reforms, aimed at alleviating the transitions for particular categories of workers, and lasting only for a few months in a revolving fashion. These could not be taken into account due to the high frequency of the events and the low frequency of data collection.[5]

The core of the paper is to assess the contribution of pension reforms to changes in retirement behaviour, this could be due to strict eligibility requirements typically related to age, which basically prevent workers from exiting the labor force, or financial incentives that make retirement less (or more) appealing. In order to evaluate the effects of pension reforms this volume makes use of "counterfactual analysis", in this chapter we identify as relevant counterfactuals the most recent reforms. In particular, out of the three major reforms we single out the Dini reform of 1996 and the Monti-Fornero reform of 2011, in such a way that after the year 2011 we see the joint cumulative effects of the two sets of rules. In other words the counterfactual simulation assumes that these reforms did not take place.

[5] For example, after the Monti-Fornero reform of 2011, there have been eight additional measures (spread in several years, between 2013-2016) named "salvaguardia" ("safeguard") introduced for some small categories of workers who, as a result of the reform, became unemployed and at the same time they were no longer eligible for retirement. These provisions essentially exempted these workers from the application of the new rules. Because these provisions have short spells, while we observe respondents every two years, we are bound to see the cumulative effect of the safeguarding rules.

Our results show that the reforms had important effects on the transition to retirement, especially for workers in the younger age group, 55-59. The effects of the Dini reform of 1995 are already showing up starting in the years 2006-2007 for the age group 55-59, albeit rather small (Figure 12). To interpret these results it should be recalled that the Dini reform had a long transitional period and for the generations observed in our sample, the post-1995 rules affected the eligibility for early retirement, but had very limited effect on the computation of benefits. As a result, the simulated probabilities and the predicted ones are very close before the year 2011.

After 2011 we observe the compound effect of the Dini reform and the Monti-Fornero reform. The pattern of the predicted probability and simulated probability is similar, but the gap between the model predictions and the counterfactual simulated probabilities increase sharply with time, for both age groups and for both genders. The dynamic incentives clearly drive these differences: men in the age group 55-59 would have experienced, in the absence of reforms, retirement probabilities which are almost twice as large as the post reform probabilities. Indeed younger men have been mostly affected through sharper and continuous tightening of the eligibility requirements between 2012 and 2017, as well as the shift to the pro rata Notionally Defined Contribution methodology. This is true, but on a smaller scale, also for men belonging to the older age group 60-64.

Not surprisingly, the effect of dynamic incentives on retirement probabilities for women is smaller. This is because, as we have already argued, women do not easily qualify for early retirement, hence the age group 55-59 exhibits a limited difference between the two set of probabilities. Also, women who exit the labor force through the old-age retirement route (60-64) have a very limited share of the Notional Defined Contribution benefit pay out, meaning that they are almost unaffected by the reforms.

Figure 12. Actual vs. predicted retirement probabilities, men, age group 55-59 (left) and 60-64 (right)

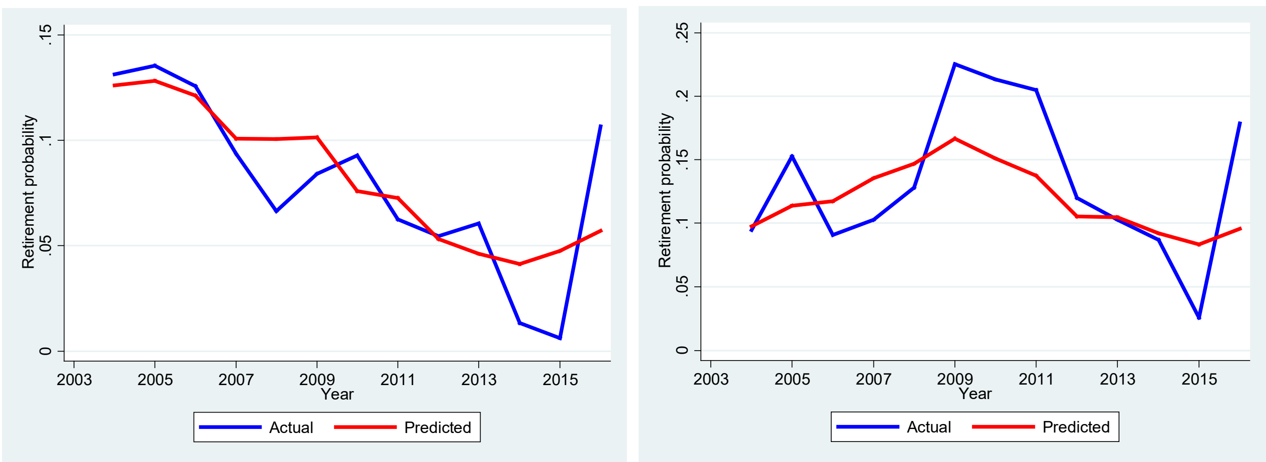


Figure 13. Actual vs. predicted retirement probabilities, women, age group 55-59 (left) and 60-64 (right)

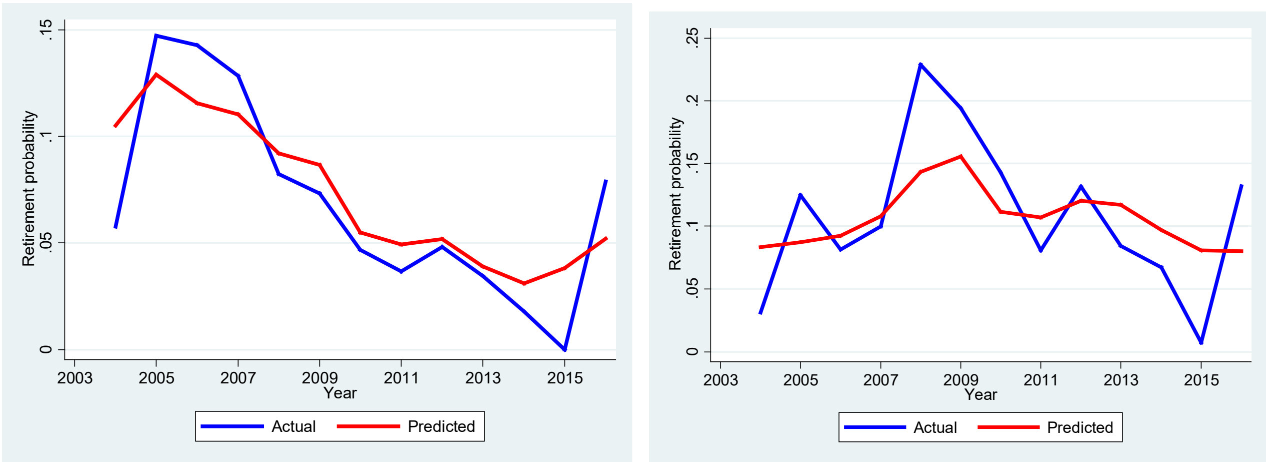


Figure 14. Predictions vs. counterfactuals, men, age group 55-59 (left) and 60-64 (right)

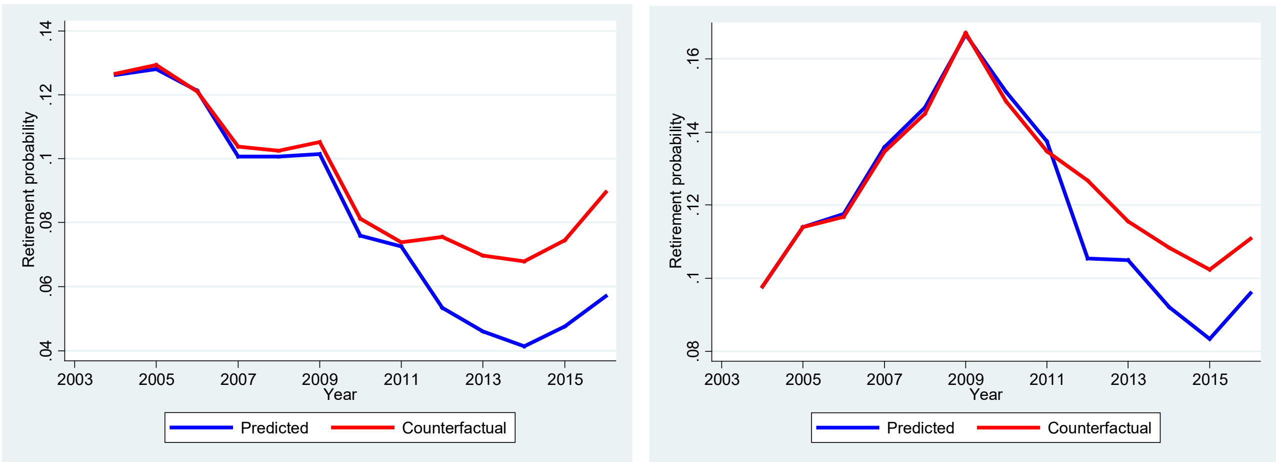
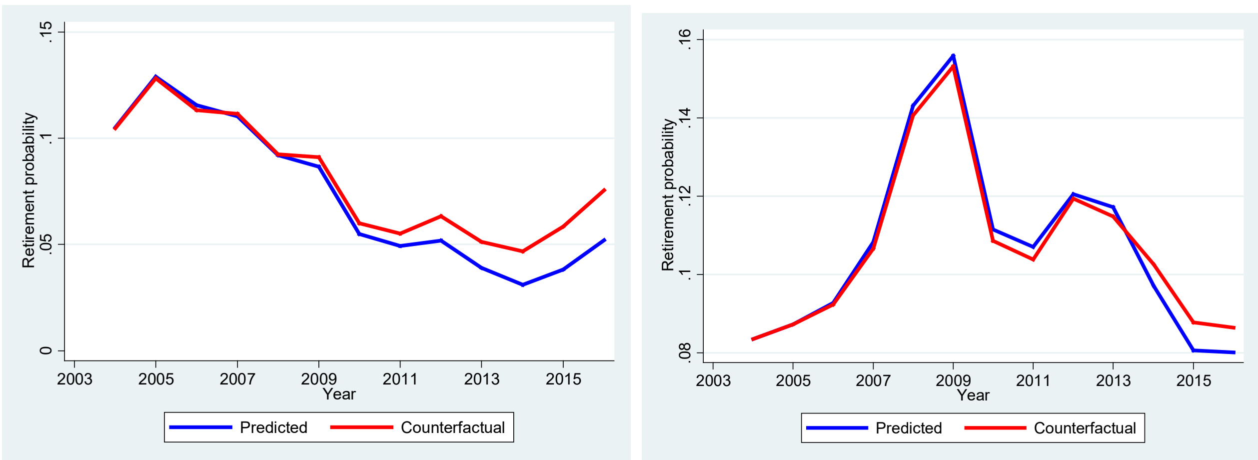


Figure 15. Predictions vs. counterfactuals, women, age group 55-59 (left) and 60-64 (right)



4. Conclusions

This chapter has discussed the Italian evidence on pension reforms, which took place starting in the early 1990s until recently. The restriction of eligibility to early retirement and old age imply a progressively lower incentive to retire for individuals in their 50s or early 60s, as captured by our measures of dynamic incentives (Social Security Wealth and ITax). We have computed retirement financial incentive measures in the public pension system under the different regimes and related these to the probability to retire, controlling for other relevant features such as age and health. We have made use of a flexible specification to capture dynamic changes and other possible trends taking place in the relevant period of time and then predict retirement probabilities. We perform a counterfactual analysis, which assumes a pre reform "status quo" configuration and compare the simulated probabilities with the predicted probabilities. The key message of this chapter is that pension reforms in Italy had in impact in raising effective retirement age by restricting access to financially advantageous public pension schemes.

Both the 1995 Reform and the 2011 Reform start being particularly effective after the year 2011, in fact the 2011 Reform was explicitly designed to address the financial imbalance of the public pension system in a short period of time, which is why the effects of these reform were immediately reflected in retirement decisions.

It restricted the possibility to claim a pension at relatively young ages (less than 62) even for those individuals with 40 or more years of contributions, and introduced straight away a calculation methodology based on a pro rata share of defined contribution pension benefits. As a result we see that the simulated probability of retirement is much higher (especially for me aged 55 to 59) if the restrictions are lifted. To some extent even older men (60-64) and women aged 55 to 59 respond to these changes. Hence we can conclude that the Italian pension system has significant financial incentives embedded in the eligibility rules and pension benefit calculation rules.

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Appendix

Estimates using age dummies, entire sample

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
agegr<55	-0.03271***	-0.04075***	-0.03904***	-0.38104***	-0.38104***
agegr 60-64	-0.01023	0.03907***	0.01711**	-0.06145	-0.06146
agegr 65-70	-0.05976***	0.06482***	-0.00422	-0.56216***	-0.56217***
female	-0.02030***		-0.02567***	-0.18415***	-0.18414***
ITAX	0.01235**	0.05561***	0.03590***	0.07117	0.07117
SSW/100000	0.02696***	0.08055***	0.04827***	0.20169***	0.20168***
logearnings	-0.02789***	0.06288	-0.04248***	-0.22641***	-0.22640***
abovemedian educ	-0.00091	(omitted)	0.00091	-0.02474	-0.02473
married	0.00224	0.01462	0.00882	0.02576	0.02576
nchildren	-0.00196	-0.016	-0.00749**	-0.01663	-0.01663
north	0.00662	0.01947	0.01421*	0.06632	0.06632
south	-0.00988*	0.02177	-0.0115	-0.09191*	-0.09190*
numberillness	0.00715**	0.0031	0.01346***	0.06714**	0.06713**
growthm	-0.20687*	-0.38955***	-0.44062***	-1.66429*	-1.66421*
_cons	0.30724***	-0.70189	0.43275***	0.44582	0.44579
N	20264	20264	20264	20264	20264

Men

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
agegr<55	-0.01994***	-0.03530***	-0.03138***	-0.22267***	-0.22267***
agegr 60-64	-0.00059	0.04052***	0.02130*	0.02639	0.0264
agegr 65-70	-0.03829***	0.08407***	0.01233	-0.34411***	-0.34410***
ITAX	-0.00903	0.05366***	0.01997*	-0.09441	-0.09441
SSW/100000	0.03243***	0.07942***	0.05050***	0.23740***	0.23740***
logearnings	-0.03780***	0.33339	-0.04595***	-0.30207***	-0.30207***
abovemedian educ	-0.00427	(omitted)	-0.0008	-0.0539	-0.0539
married	0.01860**	0.02861	0.03041**	0.17765**	0.17766**
nchildren	-0.0031	-0.01322	-0.00842**	-0.02483	-0.02483
north	0.0106	-0.00365	0.01736	0.08584	0.08585
south	-0.00956	0.02669	-0.01251	-0.09597	-0.09597
numberillness	0.01334**	0.00634	0.02335***	0.10854**	0.10854**
growthm	-0.18553	-0.24762	-0.39880**	-1.41569	-1.41577
_cons	0.36821***	-3.4024	0.43361***	0.88616	0.88619
N	11227	11227	11227	11227	11227

Women

Variable	LPM	LPM with FE	LPM with RE	Probit	Probit with RE
agegr<55	-0.04293***	-0.04438***	-0.04395***	-0.59882***	-0.59882***
agegr 60-64	-0.01704	0.03405**	0.014	-0.14254*	-0.14255
agegr 65-70	-0.07667***	0.03370**	-0.02216*	-0.83674***	-0.83675***
ITAX	0.02831***	0.05801***	0.04812***	0.24038***	0.24037
SSW/100000	0.02332***	0.08247***	0.04595***	0.17985***	0.17984
logearnings	-0.02060***	-0.15297	-0.03915***	-0.15709*	-0.15709
abovemedian educ	0.00162	(omitted)	0.00098	0.00411	0.00411
married	-0.0139	-0.00614	-0.01359	-0.14204*	-0.14204
nchildren	-0.0003	-0.00045	-0.00556	-0.00669	-0.00668
north	0.00337	0.0468	0.01147	0.05091	0.05091
south	-0.01042	0.0272	-0.01018	-0.08972	-0.08972
numberillness	0.00241	0.00211	0.00633	0.02887	0.02887
growthm	-0.22406	-0.53742***	-0.49739***	-2.14224	-2.14214
_cons	0.24805***	1.35694	0.40736***	-0.111	-0.11103
N	**9037**	**9037**	**9037**	**9037**	**9037**