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RISING PENSION AGE IN ITALY: EMPLOYMENT RESPONSE AND PROGRAM SUBSTITUTION

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RISING PENSION AGE IN ITALY: EMPLOYMENT RESPONSE AND PROGRAM SUBSTITUTION *

Chiara Ardito ♦

Abstract

This paper investigates the impact of the 1992 Italian Pension Reform tightening minimum pension age for men on several labour market outcomes. In particular, both its intended (on retirement and employment) and unintended effects (on other components of social welfare) are considered. The empirical analysis is based on a large administrative database and it exploits the quasi-natural experiment offered by the gradual phase in of the reform.

Results show that the reduced pension benefit claiming induced by the reform did not lead to a one-to-one increase in employment, inasmuch we find evidence of social support substitution. Workers facing stricter eligibility conditions demanded more disability and unemployment benefits and yet, the probability of inactivity increased the most. Sensitivity checks show that the results are very robust and that they are not driven by an extension of the receipt time of people already receiving alternative welfare benefits before the reform. The size of the effects vary across socioeconomic groups and individuals with poorer health, in manual occupations and with lower earnings resulted the most constrained by the new pension rules, experiencing the highest increase in employment and substitution between retirement and other social security programs.

JEL codes: J14 J26 I38

Keywords: Retirement, Policy reform, Labor supply, Disability, Unemployment, Ageing

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1. INTRODUCTION

The need to ensure long run financial sustainability of pension systems as the population ages has been the compelling factor behind most pension reforms promoted across European countries. In Italy, over the last 20 years, the old-age dependency ratio has been steadily increasing faster than the EU average, at approximately 2 percent per year (World Bank, 2017) and this factor, combined with a low participation rate, resulted in the highest economic dependency ratio (1.67 retiree per one worker in 2011) (Loichinger et al. 2017) and public pension expenditure (16.6 percent of GDP in 2012) in all Europe (OECD 2017). This might explain why Italy was among the first countries to reform its social security system, starting by tightening eligibility age for old-age pension by five years already in 1992.

In this paper, we study the effects of the 1992 pension reform on several labour market outcomes among older male employees[1]. In order to quantify the overall responses we adopt a difference-in-difference (DD) estimation strategy, exploiting the reform as a quasi-natural experiment. Our first objective is to examine whether this reform was successful in extending individuals' working life. Second, we investigate whether the increase in the statutory pension age generated also some unintended externalities, by eliciting an increase in the claiming of other social security benefits. In particular, we will look at the effect of the tightening of the eligibility conditions on the probability of claiming disability and invalidity pensions, unemployment subsidies and on the probability of becoming non-employed, i.e. relying on neither welfare nor work. Finally, we explore possible socioeconomic gradients in the pattern of reaction to the reform.

Our analysis, although limited to the Italian case, is of general interest, given that many other countries have taken similar measures to tackle the demographics and financial challenges posed by population ageing further compounded by the 2008 financial crisis (OECD 2015). In Europe, the number of pension reforms implemented has being growing from a few reforms per year at the beginning of the Nineties to almost 100 reforms at the end of 2000 (Arpaia et al. 2009) and increasing the statutory pension age has gained momentum as the key policy measure to promote the extension of working life. Nowadays, a retirement age of 65 is the new norm and yet in Italy, as well as in many other EU countries, future tightening are expected

[1] At this stage, we decide to focus on the men sample because their labour market participation was more stable during the last decades, while among female, cohorts' trends in labour market participation were stronger. However, additional analysis will investigate the impact of the reform on the female population too and will provide a global assessment of the fiscal consequences of the reform.

beyond 67 (OECD 2015)[2]. In this context, in order to inform current policy debate and guide future reforms it is crucial to evaluate the effectiveness of rising pension age as measure aimed at extending working life and to shed light on the possible unintended effects on other welfare programs and on social inequalities.

The analyses show that rising minimum age for claiming old-age pension from 60 to 65 years old resulted in a 25 percentage point drop in pension benefit claiming at the ages affected by the tightening. However, the growth in employment was modest (+4.7 percentage point), while the largest change occurred in the proportion of individuals who leave employment without any welfare support, rising concerns about social exclusion and poverty risks at older age. Moreover, important spillover onto other welfare provisions were found. In particular, disability pension enrolment almost doubled its pre-reform levels. Finally, the heterogeneity analyses suggest that rising statutory pension age posed inequalities challenges in that it hit more on the most unskilled and disadvantaged workers, who increased the most their labour supply and their welfare dependency in response to the reform.

The article is organized as follows. The next section reviews previous literature. The third section provides an overview of the Italian institutional social security system, focusing in particular on the 1992 Pension Reform and on the functioning of the benefits used in the analysis. The fourth section describes the data, the sample of analysis and inspects graphically how transitions to retirement changed with the reform. Details on the identification strategy and the results of the analysis are given in section 5. Section 6 discusses the results in relation to previous literature and conclusions and policy implications are offered in the last section.

2. LITERATURE

Our empirical analysis relates to the literature on the effects of changes in the statutory pension age on retirement behavior (Behaghel and Blau, 2012; Mastrobuoni, 2009; Weber et al. 2016; Brinch and Zweimuller 2016), and to the strand of empirical studies which investigate the substitution between social insurance programs. Most of these studies focus on spillover effects of changes in generosity of disability and unemployment programs (Autor and Duggan, 2003; Borghans et al., 2014; Staubli, 2011; Duggan et al. 2007; Inderbitzin et al., 2016). A growing literature is now turning the attention on the impact of pension eligibility age on program

[2] Due to current pension rules, normal retirement age is expected to be higher than 65 in 44% of the European OECD countries (OECD 2015, Figure 1.5).

dependence (Staubli and Zweimuller 2013; Cribb et al. 2016; Geyer and Welteke 2017; Atalay and Barret 2015).

The literature on the effects of changes in the statutory pension age on retirement in general agrees in confirming the effectiveness of this measure in order to delay pension claiming (Behaghel and Blau, 2012; Mastrobuoni, 2009; Manoli and Weber 2016; Brinch and Zweimuller 2016). On average, the aggregate effect is estimated to be smaller than the increase established by the law, because of possible alternative exit routes and competing incentives embedded in social security systems (Gruber and Wise 1999). Manoli and Weber (2016) estimate that, within a birth cohort, a one year increase in the early retirement age[3] leads to a 0.4 year increase in the average job exiting age and a 0.5 year increase in the average pension claiming age. The magnitude of these effects is similar to the one documented by Mastrobuoni (2009), who estimated for USA an increase in the average retirement age of about half as much as the increase in the normal retirement age. Yet, it is an empirical regularity that the spike in the benefit claiming hazard moved in lockstep along with the age of first eligibility for retirement benefits, since individuals tend to retire as soon as possible (Behaghel and Blau, 2012; Gruber and Wise, 2007).

The existing evidences on the effects of increasing pension age on program substitution are more limited and mixed. Staubli and Zweimüller (2013) and Atalay and Barrett (2015) found that gradual increases in the early retirement age led to increased program substitution in Austria and Australia. In contrast, Geyer and Welteke (2017), in evaluating the consequences of a German pension reform imposing a large one-time change of minimum age for early retirement, do not find evidence of "active" substitution from employment into social security programs among female employees. However, they yet show a significant increase in the take-up rate of unemployment and inactivity among women affected by the reform, since the reform increased "passive" substitution, i.e. persistency into their pre-reform states. Cribb et al (2016) analyzed how UK woman reacted to higher early retirement age and found negligible increase in unemployment rates but a substantial increase in the probability of claiming a disability benefit (+44 percent).

The studies of Staubli and Zweimuller (2013) and Duggan et al. (2007) are the closest to our work for several reasons. First, they also analyze the possible spillover effect among men of

[3] Early retirement age (ERA) is the first age at which the pension can be claimed at a reduced rate while individuals qualify for a full pension benefits at the normal retirement age (NRA).

rising retirement age on different welfare programs; second, the empirical strategy (difference-in-difference) exploits the variability induced between and within birth-cohorts at every single age, and finally, the phasing in of the reform is similar to the one considered here, given that it raised statutory pension age in a stepwise manner. Staubli and Zweimuller (2013) study the effect of the 2000 Austrian pension reform which increased by two years the early retirement age, while Daggan et al. (2007) analyses the effect of disability payroll of the US Social Security reform (1983) increasing by two years the normal retirement age. Daggan et al. (2007) documents that around one third of disability growth can be explained by a substitution between retirement and disability benefit for individuals treated by the reform. Staubli and Zweimuller (2013) found the increase in the minimum age for early retirement had in the short run a positive but relatively modest employment effect, which increased by 9.75 percentage points among men while the largest effect was on registered unemployment, which increased by 12.5. The effects were mostly driven by a significant increase in the persistence in the given states while small but significant increases in inflows into unemployment and disability were present.

For Italy, to the best of our knowledge there are not yet studies on the causal impact of pension reform on social security program substitution. Previous research has focused mainly on retirement transitions and savings decision (Brugiavini 1999; Brugiavini and Peracchi 2004 and 2012; Colombino 2000; Attanasio and Brigiavini 2003). The result most relevant to our work is that of Brugiavini and Peracchi (2012), who illustrate by graphical inspection that the old age exit route was gradually substituted by the early pension exit-route and point out a small increase of disability in the years after the 1992 Reform. Recently, scholars have moved their attention to more unexplored effects of rising statutory pension age. Coda Moscarola et al. (2016) have investigated the possible spillover effect on sick-leave utilization among women. They determined that in regions with poor caring facilities, low-income grandmothers display a significant excess risk of sick leave. This result speak to the research of Bratti et al. (2016) who document a significant employment drop among women with children whose mothers are not eligible for retirement.

3. THE ITALIAN SOCIAL SECURITY SYSTEM

The Italian social security system is based on a work insurance compulsory scheme, which through several institutions covers the universe of public and private workers. The majority of the workers population is insured within the National Institute for Social Security (INPS),

covering around 23 million among employees and self-employed individuals, corresponding to more than 80 percent of Italian workforce. Exception done for some professionals (e.g. lawyers, medical doctors, engineers, and architects) enrolled to specific funds managed by their professional orders. Among the funds administered by the INPS, the Private Sector Employees Fund, which covers private sector employees, is the largest.

The National Institute for Social Security (INPS) provides insurance in case of the risks of old age, invalidity, survivors', sickness, unemployment, maternity and paternity and means tested benefits for individuals and households in need[4]. All social security programs are of the pay-as-you go type, financed through the collection of compulsory contributions calculated as a percentage of labour income and the rates are fixed by legislative provision. For employees, the rate applicable in each case depends on the sector and the contractual arrangement; the employer is responsible for paying both his own and the employee's contributions.

Our description of the social security institutions will concentrate on the changes taking place on old age, disability, unemployment relevant to employees, since this paper focuses the attention on the effect of a pension reform affecting mainly private sector employees on these outcomes.

3.1 The 1992 Pension Reform

Before the 1992 Pension Reform, the system was a defined benefit scheme, with final benefit equals to a proportion (two percent) of the average of the last five years of salaries times the years of contributions, without any accrual correction for the age at retirement. The system had a contribution rate of 33 percent, of which about one-third is paid by the employee and two-thirds by the employer. There existed two main streams of access to a full pension benefit, which depends on various extent, on the worker's age and the number of years of contributions accrued during the working life. Where the age qualification prevails, it is called "Old age pension" (*pensione di vecchiaia*), where the contributions prevails, it is called "Seniority pension" (*pensione di anzianità*)[5]. The minimum pension age for an Old-age pension was 60 years old (55 years old) for men (women), with at least 15 years of contributions. Alternatively,

[4] The Institute in charge for coverage for work injuries insurance is the INAIL, Italian Institute for Insurance agains Injuries and Profesional Deseases.

[5] From January 2012, the former Seniority pension (*pensione di anzianità*) has been replaced by the Early retirement pension (*pensione* anticipata) (DL 201/2011, n.24).

35 years of contributions with no age limit for both men and women were required for being entitled of a Seniority pension[6].

The 1992 pension reform was the first act aimed to stiffen eligibility conditions and the new rules applied immediately to all the workers. In contrast, the interventions promoted by the next reforms were characterized by a differential treatment, since they applied only to workers who had not yet accrued a certain number of years of contribution at the emanation of the Pension Act. For example, the shift of the system from a defined benefit to a notional defined contributions scheme promoted by the 1995 Pension reform applied only to workers with less than eighteen years of contributions in 1995, hence typically to workers born after 1950 (Brugiavini and Peracchi 2012)[7]. Therefore, the 1992 Pension reform provides an excellent case study to analyse the effect of higher pension age on employment and welfare dependency of older workers, because workers with at least fifteen years of contributions in 1992 were exposed to a single policy change, i.e. the rise in the minimum age for old-age pension.

More specifically, the minimum pension age for claiming an old age pension (from now on, MPA) was gradually increased by one year every one year and half, starting from 1994, until reaching age sixty-five for men in the year 2000, and also the required minimum years of contributions raised from 15 to 20. In turn, the reform left completely unchanged the conditions to qualify for a seniority pension, i.e. 35 years of contributions with no age limit[8] (**Table 1**).

[6] In Italy, a third early retirement scheme (*prepensionamento*) have been used during the 80s and the 90s, as a legal exceptional instrument offered by the Government to manufactory firms of national interest under financial constrains to favor the workers turnover, relaxing in general by five years the eligibility conditions.

[7] The 1995 Pension reform not only changed the computational formula scheme but also modified the eligibility rules (See **Table A 1**). Moreover, also the extension of the reference period for computing pensionable earnings to the whole working life promoted by first reform (1992) applied only to workers with less than fifteen years of contributions in 1992.

[8] This is a crucial point and it will turn out from the analysis that leaving unchanged the requirements for the seniority pension posed a challenge to the success of the reform since many workers moved to this pension scheme for access anyway early retirement.

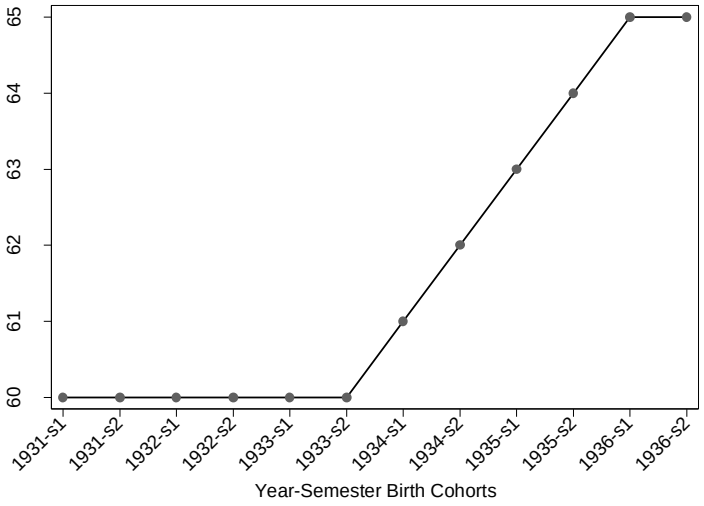
Table 1 Increase in the minimum age and contributions required for old-age pension as established by the 1992 Pension Reform (private sector male employees)

Reference Period	Age	Contributions
Before 01.01.1994	60 years old	15 years
From 01.01.1994 to 31.12.1994	61 years old	16 years
From 01.01.1995 to 30.06.1995	61 years old	17 years
From 1.7.1995 to 31.12.1996	62 years old	17 years
From 1.1.1997 to 30.6.1998	63 years old	18 years
From 1.7.1998 to 31.12.1999	64 years old	18 years
From 01.01.2000 to 31.12.2000	65 years old	19 years
From 1.1.2001	65 years old	20 years

Source: ISTAT (2011, p. 80)

Since the MPA increase was phase-in gradually at specific cut-off dates, it is possible to link birth cohorts to the new MPA and determine presisely the first age of eligibility faced by each single year-semester birth cohorts (**Table A 2**). The reform left men born in 1933 or earlier unaffected by the new old age eligibility rules (because they reached their 60th birthday before the reform was implemented) whereas workers of the following cohorts experienced a restriction in their eligibility conditions. This is why we will refer to the cohorts born before 1933 or earlier as the "before-reform cohorts", while those born in 1934 and onwards as the "post-reform cohorts". Among the post-reform cohorts, it is possible to distinguish different ages of first eligibility, as the MPA was not raised in a one-off manner. In particular, men born in the first half of 1934 could claim the old-age pension at 61 years old, while individuals born in the second half of the same year became eligible for the first time at 62 years old. Workers born in the first and second semester of 1935, could claim an old-age pension at 63 and 64 years old, respectively, and those born in 1936 could claim it at 65 years old (Figure 1).

Figure 1 First Age of Eligibility for Old-Age Pension Following the MPA Increases



Source: Author's elaboration based on Table 1

3.2 DISABILITY ALLOWANCE AND BENEFITS

The Italian social security system provides several types of disability benefits to support individuals who is unable to earn an income because of health condition and reduced work capacity (ISTAT 2009)[9].

- **Invalidity allowance** (*assegno ordinario di invalidità*), a temporary allowance payable to the insured person whose work capacity is permanently reduced by 66 percent because of sickness or infirmity (physical or mental).
- **Invalidity pension** (*pensione di inabilità*), a permanent pension, granted to the insured person or beneficiary of the invalidity allowance whose work capacity is permanently reduced by 100 percent, as a result of sickness or infirmity (physical or mental).
- **Civilian disability pension** (*pensione agli invailidi civili*), payable to all citizen aged 18-65 years old whose health condition (included deal and dumb) limits them completely and permanently and whose work capacity is reduced by at least 66 percent. For people older than 65 the civilian disability benefit is transformed into a permanent social allowance (*pensione sociale*).
- **War disablement pensions** (*pensione di guerra*) is a payment made to people who have been injured or disabled as a result of any veteran service in Italian Army Forces.

[9] We do not consider the work limitations due to certified work-related injuries or diseases which give anyway the right to a temporary benefits or employment injury annuity (rendita da infortunio sul lavoro – vitalizia) paid by the National Insurance Institute for Employment Injuries (Istituto Nazionale contro gli infortuni sul lavoro, INAIL).

- **Attendance allowance** (*assegno di accompagnamento*), a temporary allowance payable to disabled who need help to move around and/or permanent attendance to accomplish daily tasks

The first two invalidity benefits are available only to workers insured by the INPS who accrued at least five contribution years, whereas the other are not subject to any eligibility requirement. However, all these disability benefits require the presence of a certified health condition.

In Italy people with a disability are not necessarily encouraged to work, as most of the benefits are not compatible with any work activity (except done for the Invalidity allowance). Moreover, although interventions aimed at increasing the possibility of disabled people to get a job are available at local level, there are no national Supported Employment programmes (European Commission 2012) and the proportion of working age disables with a job remains low compared with their able-bodied peers (18 percent vs. 54 percent, ISTAT 2009). In general, the amount of the allowance and benefits are not enough to support an autonomous life and the burden of care is mostly borne by families (Micangeli et al. 2016; ISTAT 2016)[10]. The average invalidity allowance and pension was 47 percent the average old-age pension in 2016, corresponding to a monthly benefit of €755[11] and the civilian disability monthly benefit is 279.47€. For those who need permanent attendance, the additionally monthly benefit is €512.34 (MISSOC 2016).

3.3 Unemployment Allowance and Benefit

The Italian Unemployment insurance system is insurance based, and covers only workers who lost their jobs, not the first-time job seeker and neither all the categories of workers. More than 70 percent of unemployed in Italy are not covered by the Unemployment insurance system and the replacement rate has been until 2005 under the 45 percent threshold established by the ILO as minimum level for attaining social security (Leombruni et al. 2012). The current system replaces around 75-80 percent of the average earnings, which is close to the OECD average, but with a relatively shorter duration and not available to all categories of workers (OECD 2015).

[10] An important reform of the Italian disability system was a law passed in 1984 (Low 222/1984), i.e. years before the 1992 pension reform we are interested to evaluate. The Low 222/1984 restricted the access to the invalidity pension by narrowing the definition of invalidity and establishing the distinction between the temporary invalidity allowance (it subject to a three-time review every three years) and the permanent invalidity pension.
[11] In 2016, the average monthly benefit was €1,590 for old-age and €755 for invalidity pensions (INPS 2017a).

The system offers three broad categories of schemes: "Ordinary unemployment benefit", "Earning supplement schemes" and "Mobility benefit".

In order to qualify for the Ordinary unemployment benefit (*indennità di disoccupazione ordinaria*)[12], workers who lost their job, quit for just cause, or whose contract was terminated have to have been insured with the Social Security for at least two years and to have accumulated at least 52 weeks of contributions before their dismissal[13]. Furthermore, the worker must be registered to a public employment service and be immediately available for work. The benefit is stopped if the unemployed gets a new job or refused an offer for a job similar to the last one. The amount of benefit is calculated as a percentage of the gross income earned by a worker over their two previous years of work. An unemployed worker can expect to be paid 75 percent of their monthly earnings up to a ceiling of €1,180 per month in 2013. The replacement rate was increased over the years, starting from a very low 7.5 percent in 1988, 30 percent during the years 1999-2004, 50 percent between 2005 and 2007 and 60 percent in 2008. The duration of the benefit was gradually extended over the years, from six months in 1999 up to nine months for workers with less than 50 years, extended to twelve months for workers aged fifty and older, in 2012[14].

The Earnings supplement program (*cassa integrazione guadagni, CIG*) is an income supporting scheme for workers employed in industry or construction firms with fifteen or more employees which experience a temporary reduction or cease in the activity due to cyclical weakness or unforeseen events. Although workers under this scheme maintain formally their work attachment, they do not work and receive a benefit replacing around 80 percent of their last average earnings subject to monthly ceiling, up to maximum 12 months. An extension up to 3 years is available for workers employed in firms facing crisis and/or restructuring (cassa integrazione guadagni straordinaria, *CIG-S*)[15].

[12] The benefit has been replaced by the ASpI (Assicurazione Sociale per l'Impiego) since 2013, which in turn have been replaced by the NASPI (Nuova prestazione di Assicurazione Sociale per l'Impiego) and ASDI (Assegno di DIsoccupazione) in May 2015 (Anastasia et al. 2015).
[13] A reduced (ordinary) unemployment benefit can be also claimed by those who do not qualify for ordinary unemployment benefit but worked at least 78 days in the year leading up to their dismissal. The benefit has been replaced by the Mini-ASpI since 2013.
[14] Since information on this type of benefits is available in the archive only for the treated cohorts of workers we decided to disregard it. More details on this will be provided in the section 4.1.
[15] Although CIG beneficiaries formally retain their job, the CIG benefit is usually included among the unemployment benefits (OECD 2015).

The Mobility benefit (*Indennità di mobilità*), is a long-term unemployment benefit, available for dismissed workers already in CIG-S or/and to firms eligible for benefits from CIG. It was introduced in 1991 to facilitate the period of deep economic restructuring occurred in the late '80s. The duration of mobility benefit has a maximum period of time varying from 12 to 48 months, depending on worker's age (12 months below 40 years, 24 months between 40 and 50 years, 36 months above 50 years) and geographical area of residence (12 months longer in Southern Italy). The benefit amount is 100 percent of CIG-S for the first 12 months and then reduce to 80 percent for the subsequent months, subject to ceiling[16].

4. DATA AND METHODS

4.1 THE WORKING HISTORIES ITALIAN PANEL

For the empirical analysis, we used the Working Histories Italian Panel (WHIP), an administrative database developed by Laboratorio Revelli and University of Torino from a seven percent random sample of the National Institute of Social Security records (Bena et al. 2012). The sample is a representative of non-agricultural private sector workers, corresponding to more than 80 percent of Italian workforce. Only civil servants hired on an open-ended contract, some professionals (e.g. lawyers, medical doctors, engineers, and architects) and workers without a formal attachment to the labour market are excluded from the reference population.

The overall structure of WHIP builds upon a set of separated administrative archives on job spells, unemployment and pensions benefits. The archive on pensions includes both occupational pensions and disability and invalidity benefits. We linked deterministically the different archives by means of a unique individual identifier, and we constructed the whole career of insured workers by tracking all the above-mentioned administrative episodes, over which we built our set of labour market outcomes:

- **Retirement benefit**, with information about the starting date, the benefit and the number of insured years (years available: 1985-2012)
- **Employment spells** of any kind of employment contract (dependent employee, self-employment and atypical contracts), together with a set of job specific characteristics, i.e. duration, gross earnings, and for dependent employees only the sector of activity,

[16] This benefit will be phased out by 2017.

firm dimension, occupation (years available: 1985-2012). For employed individuals in non-clerical occupations, we also know the number of weeks of sick leave (for the years: 1989-2012)

- **Unemployment benefits**, with information on their duration and amount (years available: CIG 1985-2012; mobility benefit 1991-2012; ordinary unemployment benefit 1996-2012)
- **Disability benefits**, with information on their duration and amount (years available: 1985-2012)
- **Non-employment**, defined as a residual category for all the spells of "administrative silence", i.e. those in which individuals are not registered neither as workers nor as benefit recipients.

It is worth to highlight some data issues. First, our definition of unemployment (defined as receiving an unemployment benefit) is narrower than "statistical unemployment", in the sense that not all the individuals willing to work but without a job are included. In Italy, around 70 percent of unemployed individuals were not covered by unemployment benefit in those years (Leombruni et al., 2012); therefore, the residual category that we have defined as "non-employment" is likely to include both inactive individuals as well as most of the unemployed uncovered by unemployment subsidies. It is also important noticing that the unemployment benefit regulation was not constant across the years analysed. In particular, we decided to consider the "ordinary unemployment benefit" as "non-employment", since this subsidy was introduced only in 1996 and consequently it was available only to the post-reforms cohorts (those affected by the 1992 pension reform). Considering also that an economic crisis hit the Italian labour market during the years 1992-1994, it follows that results on unemployment should be interpreted with caution, even if time fixed effects are included in the econometric model to control for common shocks determined by business cycle fluctuations. A final consideration regards the residual category of "non employment". In principle, periods spent in the public sector or in other uncovered jobs (such as those of the informal sector) may contribute to this category. However, in the context of our study, absences from the archives can be labelled as non-work spells, given that, apart from the informal economy, for which no clear evidences are available, transitions back and forth to uncovered contracts are highly unlikely at older age (Contini, 2002).

4.2 Outcome and Sample Definition

Since the increase in the minimum pension age for old-age retirement (MPA) occurred on the 30th of June or on the 31st of December (every year and half) (**Table 1**), in order to evaluate the impact of the reform it is crucial to observe both individuals date of birth (the eligibility condition) and the timing of the labour market state (the outcome). This is generally feasible only using administrative data, which offer the possibility to distinguish between different benefits and economic states and to determine their date of start and termination, providing longitudinal work histories with a large sample size, a pre-requisite for a careful impact policy evaluation.

The outcome variable is defined on the extensive margin as a binary variable Y_{ijt} taking value one if the individual *i* spent at least one month (one week in case of the unemployment benefit) in the state *j* in the semester of year *t*. The *j* possible economic states are employment, retirement benefit, disability benefit, unemployment benefit and non-employment. We have also explored the possibility of defining the outcome as the prevalent economic state, i.e. the status lasting longer in each semester-year, but since results were almost unaffected, we decided to use the first definition as the adoption of a definition in line with previous research (Staubli and Zweimuller 2013) facilitates the comparability of results.

The estimation sample includes all men born in the years 1931-1936 who were employed for at least one month at 45-55 years old and who were retired at 67 years old (#individuals= 58,975) (**Table 2**). Hence, the sample of analysis is composed of a set of pre-reform cohorts, consisting of individuals who turned 60 prior to the reform (born in 1931-1933) and a set of post-reform cohorts, consisting of individuals who were younger than 60 prior to the reform (born in 1934-1936). The panel is balanced with respect to age and the career and welfare dependency histories are tracked for each individual from the age of 55 up to the age of 65 years old, at semester of year level. The advantage of working with a panel balanced on age is that we can carefully compare trends along the crucial dimension that was affected by the pension reform, i.e. the minimum age for Old age pension claiming.

Table 2 describes briefly the characteristics of the sample at 55-59 years old, separately for the pre- and post-reform cohorts. The pre-reform cohorts have higher employment rate and among those who were still at work at 55-59 the number of months spent at work was greater, too. However, this is driven by the fact that during the years in which the post-reform cohorts were 55-59 years old, the financial crisis was affecting Italian economy. Indeed post-reform cohorts

worked on average almost two years longer, as shown by the number of insured years, an indicator influenced by the whole career history. On average, actual retirement age increased by only eight months, which is a modest rise compared to the one to four years rise imposed by the 1992 pension reform. In line with previous literature (Brugiavini and Peracchi 2012), we connect this to the major shift from Old age to Seniority pension occurred in the years following the reform. As already discussed in the institutional framework, a full pension benefit could be claimed at any age through the seniority pension, subject to the accumulation of at least 35 years of contribution. Since the 1992 Reform tightened the minimum age for Old age pension while left unchanged the requisites for Seniority pension, the latter became relatively easier to access[17]. This tendency is shown clearly by the remarkable increase of the take-up rates of seniority pension, which almost doubled during the years under analysis, going from 27 percent among the before-reform cohorts to 51 percent among the post-reform cohorts. The two subsamples have in turn an equal proportion of weeks of sick leave per month of work at 58-59 ages[18], as both the groups claimed on average 0.28 week per month.

[17] A minimum age of 52 years old for claiming seniority pension was introduced for the first time in 1996, hence this new age limit results to be binding from the cohorts of workers born in 1944 onward.

[18] Sick leave benefit are available in the data only since 1989, hence sick leaves is measured at the available common ages before the pension reform intervention, i.e. 58 and 59 year old.

Table 2 Sample of analysis characteristics

	Pre-reform cohorts		Post-reform cohorts		T-test Diff=0
Variable	Mean	SD	Mean	SD	p-value
At work at 55-59 yrs. (%)	68.21		65.83		0.000
Occupation					
Blue (%)	48.34		45.07		0.000
White (%)	13.11		14.5		0.000
Manager (%)	0.44		0.59		0.000
Self-employed (%)	6.32		5.67		0.000
Months of work	20.49	6.59	19.02	7.29	0.000
Weeks of sick leave [a]	5.45	12.69	4.91	12	0.000
Sick-leave/work ratio [a]	0.28	0.90	0.28	0.88	0.861
Annual Earnings	19,254	15,439	21,031	16,415	0.000
Insured years at 55 yrs.	26.55	8.74	28.52	8.24	0.000
Insured years at retirement	30.46	8.40	32.26	7.83	0.000
Pension type					
Seniority (%)	27.04		50.97		0.000
Old age (%)	56.6		39.91		0.000
Early retirement (%)	16.36		9.11		0.000
Pension age	58.23	3.23	58.93	4.49	0.000
#Observations	667,172		630,278		
#Individuals	30,326		28,649		

Notes: Pre (post) reform cohorts refer to individuals born in 1931-1933 (1934-1936). Characteristics are measured at 55-59 years old on workers. [a] *Weeks of sick leave are measured at 58-59 years old on manual workers only. P-value is from a two-sample test of equal means (or proportions when relevant).*

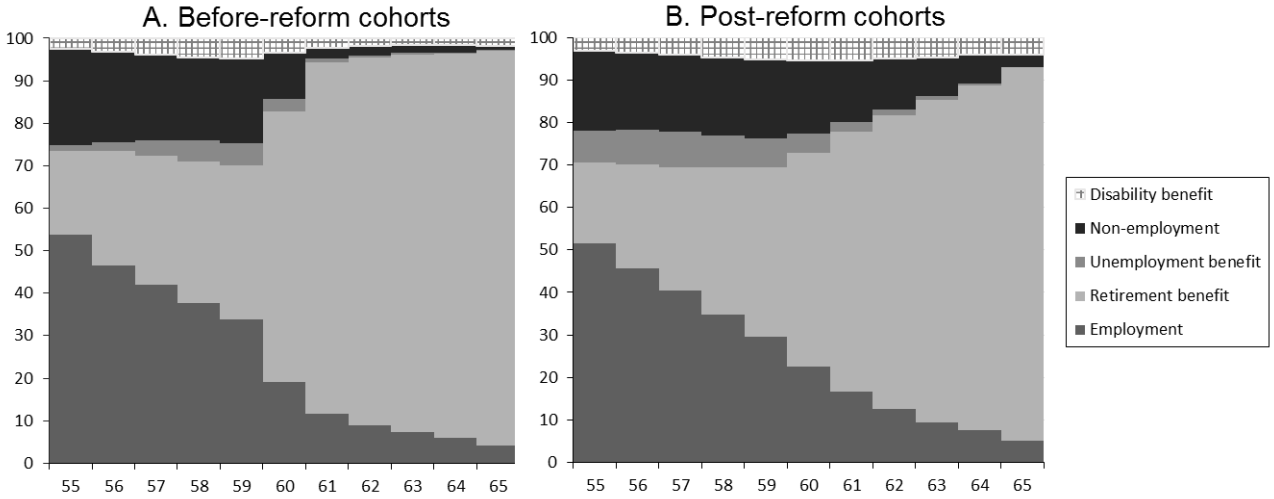
4.3 Descriptive Evidence on Work-to-Retirement Transitions

In this paragraph, we provide graphical evidences of how the work-to-retirement transitions changed with the reform. Since the increase of minimum pension age (MPA) was phased-in gradually, men born before the 1st of January 1934 could claim benefits at age 60 while those born starting from that date had to wait one to four years to become eligible for the Old age pension benefit, depending on their date of birth. On the base of this, we decided to compare the labour market behaviour of younger birth cohorts to older birth cohorts who were not affected by the increase in the eligibility conditions, first by pooling together all the unexposed and exposed cohorts, and secondly by looking at the variation between each post-reform cohort.

Figure 2 shows the changes in the economic activity by single year of age separately for the 1931-1933 and 1934-1936 cohorts. The most common economic state at 55-65 years old is receiving a pension benefit, followed by being in employment, for more than 70 percent of the individuals fall in one of these two states at any age. Two major common trends appear, i.e. the

decline of employment and the increase of pension claiming with ageing. However, we can highlight some differences between the two groups. Among the before-reform cohorts (panel A), whose minimum retirement age was 60, there is a 15 percentage point drop in the probability of being employed and a 30 percentage point increase in the percentage of retirees between age 59 and age 60. Both of these changes are bigger than any of the changes observed between other consecutive ages. Among the post-reform cohorts (panel B), the employment rate follows a smoother decline with age and we cannot detect any drop of similar magnitude. In comparison with panel A, in panel B the inflow into retirement shows a significant slow-down, which seems to be compensated only partly by an increased employment level. In fact, after the age of 60 among the post-reform cohorts the inflows into unemployment, non-employment and disability pension grow up. Moreover, among the post-reform cohorts the total number of individuals receiving unemployment and disability benefits or in the residual category of "non employment" exceeds the number of individuals in employment after the age of 60, while among the older cohorts the employment category has always been the second most important state at any age.

Figure 2 Labour market state (%) by age and exposure to pension reform



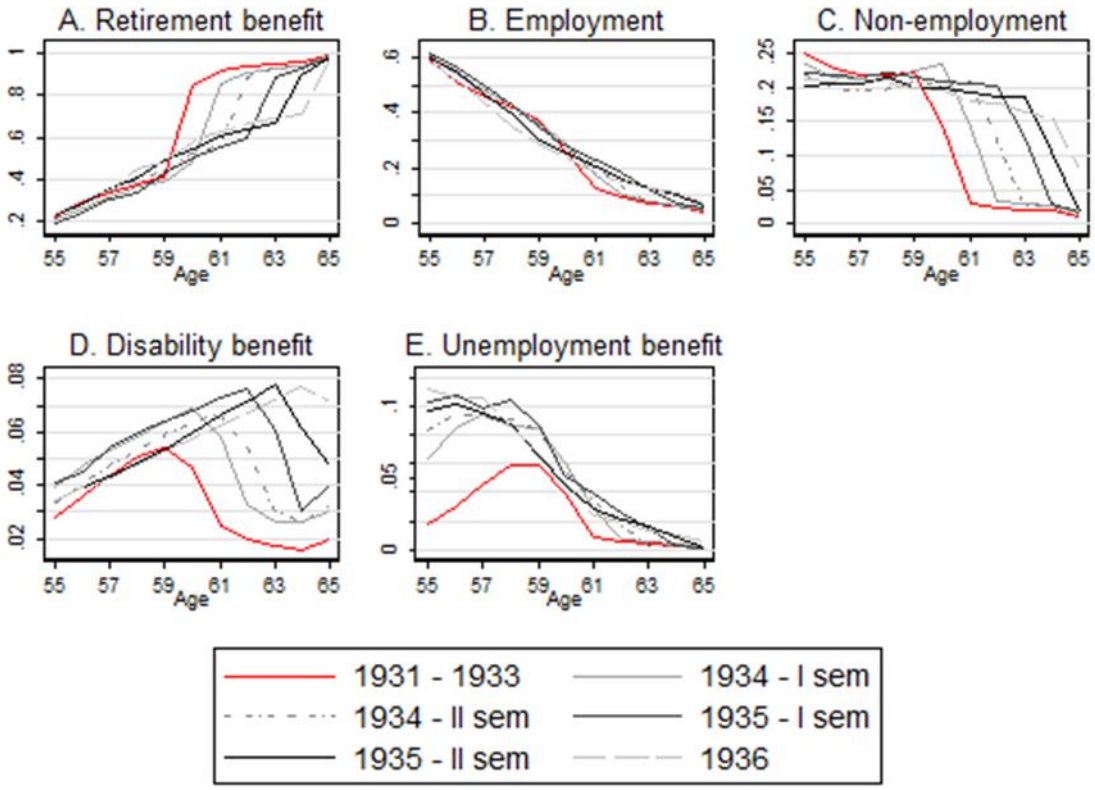
Note: The before (after) reform cohorts includes the 1931-1933 (1934-1936). The prevalence in each economic status are standardized to one hundred[19].

In **Figure 3**, we report separately the age profile of each economic status, looking at the possible differences in the behaviours between cohorts exposed to the gradual tightening of the eligibility rules[20].

[19] Cribb and colleagues have proposed a similar graphical inspection for the analysis of the effect of the UK pension reform on labour supply (2016).
[20] An enlargement of **Figure 3** is provided in the Appendix (Figure A 1-Figure A 5).

The pension benefit take-up rate (panel A) displays kinks in correspondence to the age of first eligibility faced by different birth cohorts of workers, confirming the empirical regularity observed also in several other countries (Behaghel and Blau, 2012; Gruber and Wise, 2007). This series of parallel stepwise lines is the result of the mechanical effect of the reform affecting differently individuals born in different semester of years. A very similar parallel stepwise pattern, with a series of delayed kinks in correspondence of the eligibility ages, is visible also for the non-employment and the disability benefit take-up rates (panels C and D). The proportion of individuals inactive and receiving a disability pension drastically drops when the year-semester of birth cohort reaches the new MPA for an old age pension.

Figure 3 Prevalence of Labour Market State by Age and Year-Semester Birth Cohorts



Panel B displays the evolution of the employment rate. Among the pre-reform cohorts (1931-1933) the probability of leaving employment follows a stepwise decrease, specularly to the inflow into retirement, while the corresponding figure for the post-reform cohorts is flatter. This is mainly due to the fact that post-reform cohorts substituted old-age retirement with the seniority pension, whose eligibility conditions does not depend on age. Consequently, for individuals born after 1933 the hazard rate does not display such clear drop in correspondence of the eligibility age thresholds, probably because this group responded to the pension reform

by leaving the labour market already before the achievement of the MPA, exploiting the Seniority pension exit routes. Such unintended "anticipation effects", documented for Italy also by Franco et al. (2002) and Brugiavini and Peracchi (2004), was common to many other European countries, which in the aftermath of the first round of pension reforms, faced a drop in male participation and a run on pension funds with the early retirement option (Arpaia et al., 2009; European Commission, 2009).

The unemployment panel (panel E) displays fuzzier age profiles, possibly because of the economic crisis and the data issues mentioned before. Anyway, it is still possible to detect some common features: unemployment levels tend to be higher among younger cohorts and the maximum is reached at different age which correspond to the years more severely hit by the economic crisis (1993 and 1994). Moreover, the proportion of individuals receiving an unemployment benefit tends to zero after the MPA is reached. This mechanical effect of the MPA moves forward the age in which a person becomes eligible and consequently increases the proportion of individuals receiving an unemployment benefit in the ages 60-65 among the post-reform cohorts.

5. The Effect of Rising Pension Age

5.1 Identification Strategy

The graphical evidence of section 4 shows clear responses to the increased minimum pension age (MPA) in terms of delayed pension claiming and increased employment and welfare dependency at older age. In order to precisely quantify the overall responses we adopt a difference-in-difference (DD) estimation strategy, exploiting the 1992 Italian pension reform as a quasi-natural experiment. The staggered phase-in of the new MPA allows comparing the outcome levels between the pre-reform and post-reform cohorts, exploiting the reform schedule that links semester birth cohorts to the new minimum pension age. The first difference is over age, because the tightening of MPA led people of 60-64 years old become for the first time ineligible for retirement. The second difference is across cohorts; only older workers born after January 1934 were affected by the reform[21]. The design is based on multiple treatment levels, i.e. the ineligibility at 60 to 64 years old, and multiple control/treatement

[21] Brinch and Zweimuller (2016) analysis of the effect on retirement decision of the Norwegian 2011 Pension Reform also adopts a difference a difference strategy similar to ours, where first difference is between before and after reform cohorts and the second difference is between before and after treated ages. However, their definition of post-reform cohorts and treated-ages is fixed, while for us it varies over time with the gradual increase of minimum pension age.

groups, which vary across time[22]. As in Staubli and Zweimuller (2013), we estimate the effect of rising MPA on the probability of being in a given outcome by the following equation:

$$(1) \qquad Y_{it} = \alpha + \boldsymbol{\beta} I(Age < MPA)_{it} + \gamma_a + \delta_c + X_t + \varepsilon_{it}$$

where i denotes individual, γ_a are age dummies (a being the corresponding set of ages between 55-65), δ_c semester of year birth cohorts dummies (c being the corresponding year-semester between 1931-I to 1936-II), X_t is a set of time dummies (t corresponding to year-semesters from 1986-I to 2002-I), and Y_{it} the outcome variable of interest. For example, when examining the effect of the reform on employment, Y_{it} is an indicator variable for whether the individual i is employed at time t. The set of age and cohorts dummies (γ_a , δ_c) allow controlling for pre-reform differences between treated and non-treated groups. The inclusion of semester of year fixed effects improves the estimate by controlling for time-specific levels in labour market states and allows capturing common time shocks in economic conditions such as the crisis of the mid-nineties. The key explanatory variable is the indicator $I(Age < MPA)_{it}$ that takes value one if the individual age in semester t is below the policy variable MPA, i.e. he is ineligible for claiming an old-age pension. This is our treatment variable, which results from the interaction between different treatment levels and treatment groups and which varies over time, age and cohorts groups. The DD estimator β measures the average difference in mean outcomes between before- and after-reform cohorts in the treated ages (60-64 years old) minus the before- and after-reform cohorts' differences in mean outcomes for the untreated ages. Hence, the coefficient (multiplied by 100) indicates by how many percentage points an ineligible person is more or less likely to be employed, retired, inactive, etc. at 60-64 years old with respect to a person who at the same age before the reform was eligible to claim an old-age pension.

It is important to notice that all workers have the possibility to retire via a seniority pension at any age, provided that they reach 35 years of contribution. This implies that some individuals who would have left anyway the labor market via a seniority pension or who, at the moment of the reform, have accrued many years of contribution, are not really "treated" by the tightening of the minimum age for the old-age pension, because not yet fully constrained by the new

[22] This means that our control group is not restricted to individuals who had never "been blocked" by the increased MPA. We implicitly take as the control group all individuals who are not treated at time t, even if they have already been treated before or will be treated later on. For example, a person born in January 1934 will be among the pool of treated up to 60 years old; he will be half year treated and half year a control at 61 years old and he will be enter definitively the pool of control at 62 years old (Table A 2 displays treated and control ages). The design is similar to the set-up of Bertrand and Mullainathan (2003), where treatment and control groups definition vary over time.

eligibility rules. Hence, our estimates should be interpreted as a lower bound estimate of the "true" effect of ineligibility on labor market outcomes. In the robustness checks we will replicate the analysis by excluding individuals with many years of contribution, who were more likely unaffected by the reform.

5.2 Main Results

Table 3 reports the results of equation (1) for the sample of men at age 55-65 who were employed at 45-55 and retired at 67. Each of the columns reports the DD estimate of the coefficient β associated to the indicator variable $I(Age < MPA)_{it}$. The coefficient is reported separately for each of the outcomes considered[23]. The specification includes year-semester birth cohorts and age fixed effects to net out pre-treatment permanent differences between cohorts and age groups. We also include semester-years fixed effects to control for common time shock that might influence labour market outcomes. Our results are consistent with the graphical inspections of previous section. The 1992 pension reform, by rising minimum pension age for claiming old-age pension (MPA) succeed in reducing the inflow into retirement and increasing employment levels among the elders workers. For those individuals who become ineligible due to the tightening of the MPA, the probability of claiming a pension reduced by 25 percentage points while the employment level increased by 5 percentage points. The condition that resulted more affected by the increased MPA is the status of non-employment, whose prevalence among post-reform cohorts aged 60-64 increased by 7.3 percentage points, corresponding to more than 150 percent grow. Becoming ineligible because of the tightening of the old-age pension rules, increased significantly also disability pension take-up rate, which doubled its pre-reform levels. In turn, both the size and significance of the unemployment coefficient suggest a negligible effect of rising statutory pension age on unemployment benefit at 60-64 years old.

[23] The full output table is available in the Appendix (**Table A 3**).

Table 3 Estimated impact of rising MPA on the probability of being in separate economic states

	Retirement benefit	Employment	Non employment	Disability benefit	Unemployment benefit
$Age < MPA$	-0.250***	0.047***	0.073***	0.024***	0.008*
	(0.017)	(0.007)	(0.007)	(0.001)	(0.003)
Adj.R2	0.34	0.18	0.06	0.01	0.03
#Persons	58,975	58,975	58,975	58,975	58,975
#Observations	1,297,450	1,297,450	1,297,450	1,297,450	1,297,450
Pre-reform mean	0.92	0.12	0.05	0.02	0.01
Percent change	27%	38%	155%	97%	67%

*Notes: The table displays the estimated DD coefficient β (SE) of equation (1) separately for each of the outcomes (columns). SE clustered at the semester of birth cohort level. All regressions include dummies for age, year-semesters and year-semester birth cohorts. Pre-reform means computed on the before-reform cohorts (1931-1933) at 60–64 years old. Significance levels: *** = 1%, ** = 5%, * = 10%.*

5.3 Parallel Trend Assumption

The key assumption in our DD strategy is that the outcome would follow the same trend in the absence of the treatment in both the intervention and control group (Abadie 2005). In our context, the parallel assumption would be violated if being born in different semester of birth cohorts would lead to a different age-trend in the outcomes already before the reform. Since the "ineligibility treatment" was only in effect for a limited group of ages, we are able to test the parallel trend assumption in absence of the policy, i.e. before and after the ages of 60-64. More specifically, we generalize equation (1) by replacing the indicator variable $I(Age < MPA)_{it}$ with a set of treatment group-age interactions for the ages 55 to 65, i.e. including both leads and lags to the age actually treated[24]. In this case, equation (1) can be rewritten as:

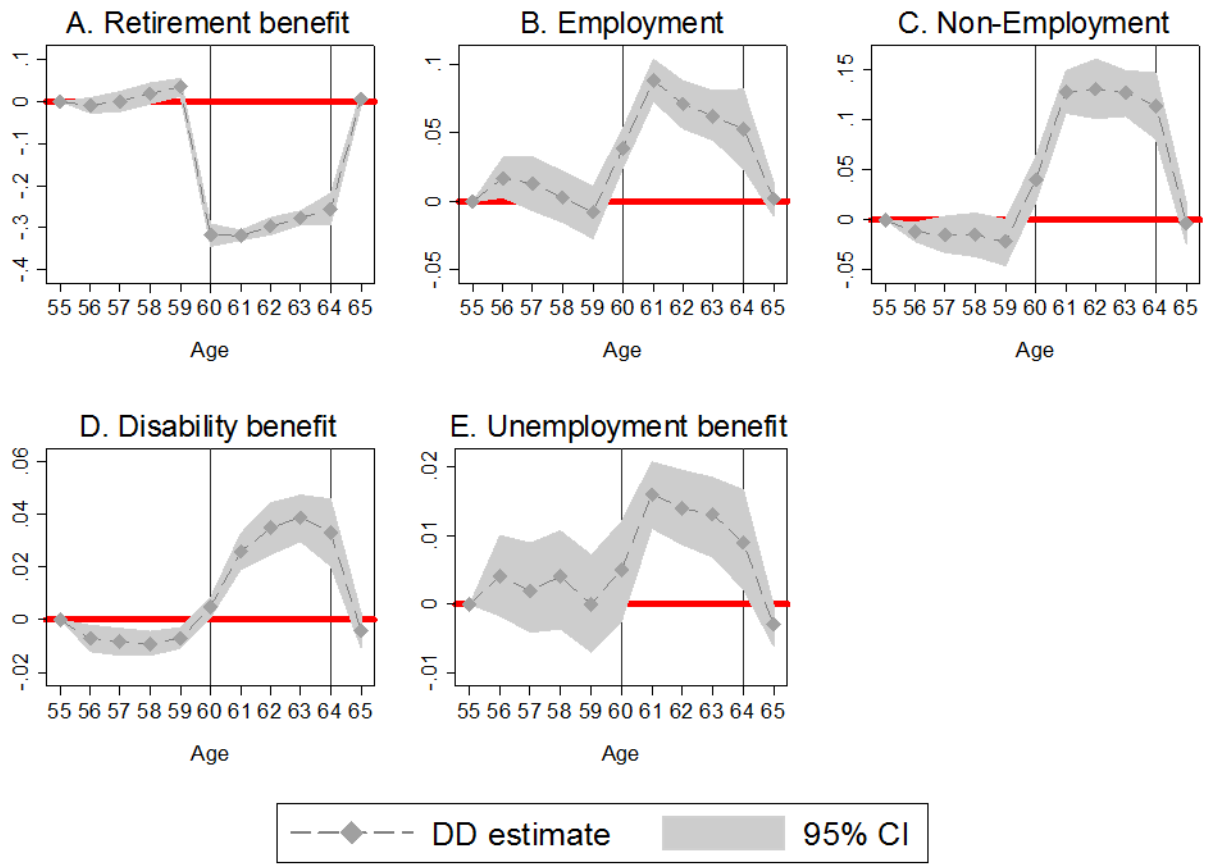
$$(2) \qquad Y_{it} = \alpha + \sum_{j=\{55,56,..,59\}\cup 65} \beta_j D_{jc} + \sum_{k=\{60,61,..,64\}} \beta_k D_{kc} + \gamma_a + \delta_c + X_t + \varepsilon_{it}$$

where D_{jc} is a dummy that quals one if the post-reform cohorts' age is j, i.e. the age at which nor the treated neither the control were treated[25]. D_{kc} is a dummy that equals one when the treatment is switched on in semester-of-year birth cohort c in the ages k. If the treated cohorts had a parallel trend to the pre-reform cohorts in absence of the treatment we should observe that $\beta_j = 0$ for any age j.

[24] This is the standard way of testing the difference-in-difference parallel trend assumption, also proposed for example by Autor (2003), Angriest and Pischke (2009), Inderbitzin et al. (2016).

[25] Non-treatment occurs either when both the groups are not yet eligible for retirement ($j = 55, 56, 57, 58, 59$) or because both groups already are eligible ($j = 65$)

Figure 4 Estimated Impact of Post-Reform Cohorts on Separate Outcomes for Ages Before, During, and After the Increased MPA



Notes: Coefficients and 95% CI of the Interactions D_{jc} and D_{kc} in equation (2). Vertical lines indicate first (60) and last (64) ages treated by increased MPA.

The estimated coefficients of the interaction terms of equation (2) are plotted in Figure 4, while the table of results is available in the online Appendix (**Table A 4**). These estimates provide strong support to our parallel trends assumption, since in all the five panels the point estimates fluctuate around zero before age of 60 and at age of 65, while the point estimates are significantly different from zero in the ages 60, 61, 62, 63 and 64. Hence, our DD strategy is not peaking up long-run trends in differences between younger and older cohorts but the effect of an increase in the MPA.

5.4 Serial Correlation

Another potential source of problem is outcome serial correlation. In a difference-in-difference set up with repeated observations, ignoring the fact that the economic status in time t can be correlated to economic status in time $t+1$ using conventional standard errors might understate the standard deviation of the estimator (Bertrand et al. 2004). To overcome this problem, when estimating equations (1) we account for the fact that the main source of

variation is at the semester-year-of-birth cohort level due to the gradual phase-in of the reform, and we have clustered the standard errors at this group level (n=12). Since recent econometric evidence (Cameron and Miller 2015) suggests that clustering may be still problematic when the number of clusters is smaller than 50, we have further explore the robustness of the results allowing error correlation at the semester-year, age, and individual levels in **Table 4**. The first row presents the main results of our baseline sample for comparison. The use of standard errors clustered at different levels left almost unchanged the significance level, exception done for the unemployment outcome, for which the standard errors decreased. Indeed, the effect of the policy on unemployment turned to be highly significant at 1 percent level when using these other clustering. Nevertheless, we decided to present the results with the most conservative specification, i.e. with standard errors clustered at semester-year-of-birth level.

Table 4 $\widehat{SE}(\beta)$ clustered at different levels

	Retirement benefit	Employment	Non employment	Disability benefit	Unemployment benefit
Year-sem. of birth (n=12)	0.017***	0.007***	0.007***	0.001***	0.003*
Year-semester (n=32)	0.019***	0.006***	0.013***	0.003***	0.002***
Age (n=11)	0.020***	0.008***	0.012***	0.003***	0.002**
Individuals (N= 58975)	0.002***	0.002***	0.002***	0.001***	0.001***
No cluster	0.002***	0.002***	0.001***	0.001***	0.001***
Adj.R2	0.34	0.18	0.06	0.01	0.03
#Persons	58,975	58,975	58,975	58,975	58,975
#Observations	1,297,450	1,297,450	1,297,450	1,297,450	1,297,450

*Notes: The table displays the estimated standard error of the DD coefficient β of equation (1) separately for each of the outcomes (columns). SE clustered at different levels (rows). All regressions include dummies for age, year-semesters and year-semester birth cohorts. Significance levels: *** = 1%, ** = 5%, * = 10%.*

5.5 SENSITIVITY

Table 5 presents the DD estimate of the coefficient β of equation (1) on different categories of individuals belonging to the baseline sample of men who were in employment at 45-54 years old and retired at 67. Moreover, different specifications of equation (1) are also tested. The first row presents the main results on our baseline sample for comparison.

In the first two robustness tests, we include individuals who exited employment before age of 55-59 (row 2) and those who at that age were still in employment (row 3). It turns out that regardless the fact that some workers left earlier the labour market, the policy reform influenced anyway their labour market behaviors by reducing pension claiming and increasing employment, inactivity and the take-up rates of disability benefits.

The robustness of row (4) aims to investigate the presence of an important mechanism that might be driving the results, i.e. "persistency". Since treated cohorts depended more on welfare benefits already during their 55-59, especially because of the contemporaneous economic crisis, their probability of future welfare dependency could depend on an increase in the persistence in those states rather than an increased probability of entry. To check for this we compare in row (4) subsamples of treated and controls who were continuously employed and who never received any welfare benefit at 55-59 years old. The coefficients are very close to those estimated on the baseline sample, suggesting that our main results are not picking up "persistency" and that the reform indeed caused an increased inflow into these unintended labour market states.

The next robustness tests in rows (5) and (6) compare eligible and ineligible among the individuals who had cumulated a low/high number of contributions at 55 years old, where high means higher than the third quartile in the distribution. Results from row (6) show that, among individuals with high contributions there is no significant difference between eligible and ineligible cohorts, and this holds true for all the outcomes. This is not surprising as workers who had accrued at least 35 years of contributions could claim pension anyway through the seniority retirement scheme.

The seventh and eighth rows split the individuals at work at 55-59 into two further sub groups, i.e. those who were (row 8) and were not (row 7) manual employees at that age. The occupation performed by the workers does not alter qualitatively the results, confirming the findings based on the baseline population. Nevertheless, those who were in manual jobs responded more to the pension reform, as suggested by estimated coefficients of significantly higher size in all the panels. Finally, the claiming of unemployment benefit increased only among manual workers.

Another important possible modifier effect is poor financial and health conditions, since it could be that more frail workers stop working early anyway and they might need to rely on welfare to bridge the gap between labour market exit and retirement. The following tests inform about their influence on the subsample of manual workers only (in fact, we could observe sick leave only among manual workers). By comparing the DD coefficients reported in row (9) and (10), we observe that the reaction to the reform was stronger among workers with low average wage at 55-59 years old.

Table 5 Effects of rising MPA on the probability of being in a given economic state

		Retirement benefit	Employment	Non employment	Disability benefit	Unempl. benefit	#Obs.
1	Main results	-0.250***	0.047***	0.073***	0.024***	0.008*	1,297,450
2	Not at work	-0.277***	0.002**	0.133***	0.030***	-0.003*	427,438
3	At work	-0.234***	0.069***	0.043***	0.020***	0.013*	870,012
	p test (3)=(2)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	
4	Only at work	-0.208***	0.044***	0.044***	0.018***	0.015***	684,242
5	Low Contrib.	-0.270***	0.080***	0.049***	0.023***	0.016*	749,958
6	High Contrib.	-0.003	-0.003	0.001	0.002	-0.004	120,054
	p test (6)=(5)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	
7	Non manual	-0.141***	0.024**	0.028***	0.004**	-0.001	263,428
8	Manual	-0.274***	0.087***	0.050***	0.028***	0.018*	606,584
	p test (8)=(7)	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	
9	High Wage	-0.172***	0.062*	0.009*	0.012***	0.019*	128,458
10	Low Wage	-0.302***	0.094***	0.062***	0.032***	0.018*	478,126
	p test (10)=(11)	*<0.01*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	
11	Good health	-0.231***	0.055**	0.065***	0.015***	-0.002	343,772
12	Poor health	-0.308***	0.097***	0.034***	0.038***	0.030***	262,812
	p test (12)=(11)	*<0.01*	*<0.001*	*<0.001*	*<0.01*	*<0.001*	
13	Good health+High w.	-0.117***	0.024	0.016*	0.003	0.008	69,168
14	Poor health + High w.	-0.216***	0.079**	0.004	0.019***	0.024**	59,290
	p test (13)=(11)	*<0.001*	*<0.001*	*<0.001*	*<0.05*	*<0.001*	
	p test (14)=(12)	*<0.001*	*<0.01*	*<0.001*	*<0.001*	*<0.001*	
15	Manual + X_i	-0.274***	0.087***	0.050***	0.028***	0.018*	606,584
16	No time FE	-0.250***	0.040**	0.093***	0.025***	-0.021**	1,297,450

*Notes: The table displays the DD treatment effect β of equation (1) separately for each of the outcomes (columns) run on different subsamples or specifications (rows). SE clustered at the semester of birth cohort level. Health is measured by the number of weeks spent in sick leave between ages 58 and 59 and the average annual earnings at 55-59 years old measure wage. An individual is considered having high contributions, health, wage if ⩾75th percentile in the distribution. Significance levels: *** = 1%, ** = 5%, * = 10%. P-value from interaction of the treatment indicator with the relevant category.*

Rows (11-14) check for the role of health and its possible interaction with high wage (High W.). By comparing results in rows (11) and (12) it is possible to notice that health conditions do not affect the direction and the significance of the effect of rising pension age on employment, pension benefits, non-employment and disability. However, the probability of claiming unemployment benefit turns out to be significantly higher only among the ineligible at 60-64 years old who were in poor health at 58-59 years old. When considering the interaction of health and income, it emerges that being in good health and with a high salary at baseline (row [13]) are two characteristics that identify a group of individuals whose labour market behaviors remained almost unaffected by the increased MPA. For them, the pension claiming went through the expected delay, while neither spillover effects on other welfare benefits nor

higher employment levels were detectable. This seems to suggest that for this selected group of "luckiest" workers, the decision of remaining in the labour market is less connected to social security regulations.

In the robustness of row (15), we then show how results are altered by the inclusion of a set of individual controls (i.e. wage, contributions and health measured at 55-59 years old). As expected, the estimated coefficients remain the same of row (8), confirming the randomness of our treatment and the fact that our DD estimate is the result of a group mean difference. Inasmuch, individual level controls do not affect the estimate, but only improved the overall model fit, as suggested by the adjusted R-square which increased by 78 percent on average[26]. We finally check the sensitivity of our main results when considering only age and cohorts-fixed effects, i.e. excluding the time dummies.

By comparing row (1) and (16), we conclude that the inclusion of time fixed effects gives unchanged DD estimates for pension benefits, employment, non-employment and disability benefits. In contrast, it turns out to be crucial for measuring the effect of rising MPA on unemployment, because time fixed effects allow controlling for the effect of the macroeconomic crisis that resulted in very high unemployment levels before treatment among the post-reform cohorts. In fact, as also shown by the graphical inspection, the unemployment levels were higher among the post-reform at ages 55-59 cohorts because of the contemporaneous crisis affecting Italian economy. If this shift in level due to a common shock (recession) is not netted out by including years dummies, the difference in unemployment level in the before-treated ages would be inflated, resulting in a negative DD coefficient, being the latter the difference between treated and controls groups in unemployment after the treatment minus the same difference computed before the treatment.

6. DISCUSSION

Our analysis (**Table 3**) documents that workers respond to tighter retirement rules reducing the benefit claiming. The likelihood of retirement at age 60-64, the age intervals affected by the MPA increase, was 25 percentage points lower among individuals who became ineligible for old age pension due to the reform. However, employment levels raised by a modest 5 percentage point (38 percent increase) and the largest adjustment occurred in terms of non-employment and disability enrolments, which heightened by 7.3 and 2.4 percentages points

[26] Regression output is available in **Table A 5** in the online appendix.

respectively (corresponding to a percentage increase of 155 percent and 97 percent with respect to pre-reform means). Most of the results are in line with the studies of Staubli and Zweimuller (2013), Geyer and Welteke (2017) and Cribb at al. (2016), all documenting that an increase in minimum retirement age has significantly delayed retirement pension claims and increased employment levels among men in Austria and female in UK and Germany. Focusing on the results on men, Staubli and Zweimuller (2013) document that the probability of receiving a pension benefit decreased by 25 percentage points, while employment probability increased by a moderate 9.75 percentage point. In our study, the employment response was even more modest, possibly, because the individuals affected by the Italian reform were older and we did not exclude individuals with high labour market attachment as they did, which tend to bias down our estimates[27]. In line with this hypothesis, when we also excluded individuals with high contributions the employment rise appears more marked (**Table 5**, row [5]).

Other interesting comparisons regard the spillover effects on other welfare programs. Staubli and Zweimuller (2013) and Geyer and Welteke (2017) document large unintended consequences of the reforms on unemployment, which increased by 12.5 and 5.2 percentage points respectively[28]. Instead, according to our results, the largest negative spillover of the reform was on the non-employment rate, a difference probably due to the weaker unemployment benefit coverage in Italy[29]. Another important difference is that we document for Italy an increase in the probability of *becoming* unemployed, while Geyer and Welteke (2017) and to a lower extent Staubli and Zweimuller (2013) highlight that the effect was due to higher persistence of individuals in their pre-reform statuses.

Finally, we found a 98 percent increase in the probability of claiming disability benefits as result of the rise in the minimum pension age. Similarly to us, Duggan et al. (2007) also find that in US restricting the access to pension benefit led to a significant increase in disability enrolment prior to the eligibility. In turn, Staubli and Zweimuller (2013) found only a marginal increase

[27] Staubli and Zweimuller (2013) excluded from the sample persons with more than 40 years of contributions, because they would have had access to retirement anyway via the so-called "corridor pension". This is a pension scheme, which allows workers with at least 40 years of contribution to get early access to full pension benefit. It is very similar to the Italian seniority pension.

[28] Staubli and Zweimuller (2013) include in their analysis all persons registered at unemployment office, thus also who does not necessarily receive unemployment benefits and persons with a minimum work attachment. Austria is indeed one of the few European countries where registered unemployment is higher than official unemployment statistics (Melis and Lüdeke, 2006).

[29] As we have already mentioned, it is estimated that only a minority of unemployed (15 percent-30 percent) are covered by unemployment benefit in the years under analysis (Leombruni et al., 2012)

in disability, possibly because in Austria most people in poor health already leave the labour market before the age of 60 (Staubli 2011).

The sensitivity analysis (**Table 5**) provided evidence that the association between increase retirement age and labour market response was very robust though different across socioeconomic groups. We observe a null effect of the reform on retirement and employment among workers with many years of contributions, in good health and with high earnings at baseline. These categories are highly correlated, since individuals with better health tend on average to have a more continuous career, hence gaining more contributions and higher salaries. Given that such individuals could easily claim the seniority pension, which in the years under analysis was available at any age subject to the accumulation of 35 years of contributions, the reform had no effect on them in terms of postponing retirement. Coherently, we observed a growth of the early retirement take-up rate by almost 90 percent (**Table 2**) and a significant excess risk of retirement at 59 years old among the treated cohorts (**Figure 4**), in line with the "run into seniority pension" noticed by previous literature in the aftermath of the 1992 reform (Franco 2002; Brugiavini and Peracchi 2012).

For individuals with poorer health and economic conditions, we found instead that they had to postpone retirement, given that this group was likely to be more constrained by the new eligibility rules. Moreover, the combination of financial constraints (limiting their ability to make ends meet without an income) and health limitations (limiting their ability to work), seem the driving factors behind the other results documented among these individuals, i.e. a greater reaction both in terms of labour supply and of take-up-rates of non-employment, unemployment and disability benefits. This pattern of reactions is coherent with the fact that in Italy, although poor health is associated in absolute terms to early retirement, its probability for people with poor health is lower among people with lower socioeconomic status, possibly because of insufficient financial resources to face a reduction in earnings consequent to retirement (Li Ranzi et al. 2013). These findings are likewise in line with De Wind et al. (2014) for Netherlands and Leanien et al. (2016) for Finland. They both have shown that both good health and financial opportunity are significant determinants for early exit from the labour market, as well as a research from the United States (Miah and Wilcox-Gok 2007), suggesting that people with chronic disorders tend to retire later because they have accumulated fewer assets during their working life.

7. CONCLUSIONS

This paper studies the short-run labour market effects of the 1992 Pension reform that tighten requirements to claim old age pensions by five years. The analysis takes the perspective of the workers and analyses how their behaviours in terms of pension claiming, labour supply and demand for alternative welfare support changed. The immediate objective of a policy increasing the minimum pension age is to delay claiming and reduce the number of pensions paid. Less obvious though equally desired, is a contemporaneous delay in the date of labour market exit, which would guarantee higher payroll taxes and employment level among the elders. However, employment opportunities of older workers might be limited, especially for the most disadvantaged in the labour market, those living in depressed areas, with limited skills or reduced work ability due to health conditions and physically demanding jobs.

Our results show indeed that increasing retirement age was not able to increase employment for all older workers in the same way. The tightening of the minimum pension age for old-age pension was successful in delaying retirement (-25 percentage point), however this outcome was far to transmit one-to-one in additional employment (increased by only 4.7 percentage points). Moreover, the employment response was smaller than other unintended consequences of denied access to retirement. After retirement, the largest change experienced by the older workers affected by the reform was found in the probability of becoming non-employed and without any welfare support ($+7.3$ percentage point). Moreover, disability benefits take-up rates also increased significantly ($+2.4$ percentage point), and although the magnitude might appear small, its percentage changes with respect to pre-reform levels is striking ($+155$ percent).

A factor accounts, in the main pension reform design, for its limited success, i.e. the possibility of retiring via an early retirement scheme (seniority pension). Since workers with many years of contributions were not fully constrained by the new old-age pension rules, they resulted completely unaffected and rather an excess early retirement was found among younger cohorts. Moreover, given that the early retirement option was available mainly to better off workers, a clear socioeconomic gradient in the strength of constraints and in the pattern of reactions emerged. Workers whose jobs were more demanding, with worst health and weaker financial conditions experienced the largest delay of pension claiming combined with more pronounced increase in employment at older age. However, compared with their better off counterparts who only experienced a negligible increase in other benefits claiming, they

become much more dependent on disability and unemployment programs, which served to bridge the gap to retirement for those who could not continue working. Hence, alternative welfare programs have played a crucial role in mitigating the labour market risks among older workers facing the unforeseen restriction to retirement. However, a large proportion of individuals could not rely on these safety nets as documented by the severe increase in the probability of becoming non-employed without any welfare support. This is also potentially alarming, since it rises the risk of increase poverty and social exclusion among the most vulnerable categories of workers.

In conclusion, the results suggest that rising statutory pension age poses challenges in that it hits more on the most unskilled and disadvantaged workers and generates spillover on other welfare funds. Hence, pension reform might exacerbate social and health inequality and higher welfare dependency at older age might offset the gains from reduced pension expenditures.

8. REFERENCES

Abadie, A. (2005). Semiparametric difference-in-differences estimators. The Review of Economic Studies, 72(1), 1-19.

Anastasia, B, Maschio, S., Rasera, M., and Vaglini, B. (2015). Monitoraggio di un biennio di ASpI e Mini ASpI e note sul passaggio alla NASpI. I tartufi, 42. Veneto Lavoro, Venezia.

Arpaia, A., Dybczak, K., and Pierini, F. (2009). Assessing the short-term impact of pension reforms on older workers' participation rates in the EU: a diff-in-diff approach, Economic Paper, 385. Directorate General Economic and Financial Affairs, European Commission, Brussels.

Atalay, K., & Barrett, G. F. (2015). The impact of age pension eligibility age on retirement and program dependence: evidence from an Australian experiment. Review of Economics and Statistics, 97(1), 71-87.

Attanasio, O.P. and Brugiavini, A. (2003) Social Security and Households' Savings. Quarterly Journal of Economics, 118(3): 1075-119.

Autor, D. H., and Duggan, M. G. (2003). The rise in the disability rolls and the decline in unemployment. The Quarterly Journal of Economics, 157-205.

Behaghel, L., and Blau, D. M. (2012). Framing social security reform: Behavioral responses to changes in the full retirement age. American Economic Journal: Economic Policy, 4(4), 41-67.

Bena, A., Giraudo, M., Leombruni, R. and Costa, G. (2012). A new Italian surveillance system for occupational injuries: characteristics and initial results. American Journal of Industrial Medicine, 55(7), 584-592.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How Much Should We Trust Difference-in-Differences Estimators. The Quarterly Journal of Economics, 119(1), 249-275.

Borghans, L., Gielen, A. C., and Luttmer, E. F. (2014). Social support substitution and the earnings rebound: Evidence from a regression discontinuity in disability insurance reform. American Economic Journal: Economic Policy, 6(4), 34-70.

Bratti M, Frattini T and Scervini F. (2016) Grandparental availability for child care and maternal employment: pension reform evidence from Italy, IZA Discussion Paper Series N.9979, Institute for Study of Labour.

Brinch, C. N., Vestad, O. L., and Zweimüller, J. (2015). Excess Early Retirement? Evidence from the Norwegian 2011 Pension Reform. Mimeograph.

Brugiavini A. and Peracchi F. (2012) Health Status, Welfare Programs Participation, and Labour Force Activity in Italy. In: Wise David (ed.) Social Security Programs and Retirement Around the World: Historical Trends in Mortality and Health, Employment, and Disability Insurance Participation and Reforms, University of Chicago Press. Chicago.

Brugiavini, A and Peracchi, F. (2004) Micro-Modeling of Retirement Behavior in Italy. In: Gruber, Jonathan and David A. Wise (eds.) Social Security Programs and Retirement Around the World: Micro-Estimation. Chicago: University of Chicago Press. Chicago.

Brugiavini, A. (1999). Social security and retirement in Italy. In: Gruber, Jonathan and Wise, David A., (eds.) Social security and retirement around the world, University of Chicago Press. Chicago

Cameron, A. C., and Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. Journal of Human Resources, 50(2), 317-372.

Colombino, U. 2000. Un modello per la valutazione degli effetti degli incentivi individuali sulle decisioni di pensionamento (A model for evaluating the effects of individual incentives on retirement decisions). University of Turin, Department of Economics. Mimeograph.

Contini B. (2002), Labour Mobility and Wage Dynamics in Italy (ed. by), Rosenberg & Sellier Publishing. Torino

Cribb, J., Emmerson, C., & Tetlow, G. (2016). Signals matter? Large retirement responses to limited financial incentives. Labour Economics, 42, 203-212.

de Wind, A., Geuskens, G. A., Ybema, J. F., Blatter, B. M., Burdorf, A., Bongers, P. M., and van der Beek, A. J. (2014). Health, job characteristics, skills, and social and financial factors in relation to early retirement–results from a longitudinal study in the Netherlands. Scandinavian journal of work, environment & health, 40(2), 186-194.

Duggan, M., Singleton, P., and Song, J. (2007). Aching to retire? The rise in the full retirement age and its impact on the social security disability rolls. Journal of Public Economics, 91(7), 1327-1350.

European Commission (2009) Joint Report on Social Protection and Social Inclusion 2009. Office for Official Publications of the European Communities, Luxembourg.

European Commission (2012), Supported Employment for people with disabilities in the EU and EFTA-EEA, Publications Office of the European Union, Luxembourg.

Franco, D. (2002). Italy: A never-ending pension reform. In: Feldstein, M. and Siebert, H. (eds.). Social security pension reform in Europe. The University of Chicago Press, 211-262. Chicago.

Geyer, J., and Welteke, C. (2017). Closing Routes to Retirement: How Do People Respond?. IZA Discussion Paper Series No. 10681.

Gruber, J. and Wise, D. A. (Eds.), 2007. Social Security Programs and Retirement around the World: Fiscal Implications of Reform. University of Chicago Press. Chicago.

Gruber, Jonathan and David A. Wise (1999). Social Security and Retirement Around the World. University of Chicago Press. Chicago.

Inderbitzin, L., Staubli, S., and Zweimüller, J. (2016). Extended unemployment benefits and early retirement: Program complementarity and program substitution. American Economic Journal: Economic Policy, 8(1), 253-288.

INPS (2017a) Complesso delle pensioni liquidate Anno 2016, online at: https://www.inps.it/webidentity/banchedatistatistiche/liq1/index01.jsp?CMDNAME=NAV20. (Accessed on 5 May 2017)

INPS (2017b) Pensione anticipata. A chi spetta (Early retirement: eligibility criteria), online at: http://www.inps.it/portale/default.aspx?sID=%3b0%3b5614%3b8040%3bandlastMenu=8040andiMenu=1andiNodo=8040andp4=2. (Accessed on 28 March 2017)

ISTAT (2009) La disabilità in Italia. Il quadro della statistica ufficiale. Argomenti n. 37. Roma. http://www3.istat.it/dati/catalogo/20100513_00/arg_09_37_la_disabilita_in_Italia.pdf. (Accessed on 28 March 2017)

ISTAT (2011) Statistiche della previdenza e dell'assistenza sociale. I-I trattamenti pensionistici – Anno 2008. Collana Annuari, n. 15. Roma.

ISTAT (2016) Disposizioni in materia di assistenza in favore delle persone affette da disabilità grave prive del sostegno familiare. Audizione del Presidente dell'Istituto nazionale di statistica Giorgio Alleva. 11a Commissione "Lavoro, previdenza sociale" del Senato della Repubblica. Roma, 5 aprile 2016. Roma.

ISTAT (2017) I.Stat. Tasso di attività – serie ricostruite dal I 1977 –livello ripartizionale. http://dati.istat.it/index.aspx?queryid=5147. (Accessed on 28 March 2017)

Leinonen, T., Laaksonen, M., Chandola, T., & Martikainen, P. (2016). Health as a predictor of early retirement before and after introduction of a flexible statutory pension age in Finland. Social Science & Medicine, 158, 149-157.

Leombruni, R., Paggiaro, A. and Trivellato, U. (2012) Per un pugno di euro. Storie di ordinaria disoccupazione. Politica Economica, 28(1).

Li Ranzi, T., d'Errico, A., and Costa, G. (2013). Association between chronic morbidity and early retirement in Italy. International archives of occupational and environmental health, 86(3), 295-303.

Loichinger, E., Hammer, B., Prskawetz, A., Freiberger, M., and Sambt, J. (2017). Quantifying Economic Dependency. European Journal of Population, 1-30.

Manoli, D. S., and Weber, A. (2016). The Effects of the Early Retirement Age on Retirement Decisions. National Bureau of Economic Research, No. w22561.

Mastrobuoni, G. (2009). Labor supply effects of the recent social security benefit cuts: Empirical estimates using cohort discontinuities. Journal of public Economics, 93(11), 1224-1233.

Melis, A., and Lüdecke, B. (2006). Registered unemployment (RU) compared with harmonised unemployed (LFS). Office for Official Publications of the European Communities. Luxemburg.

Miah, M. S., & Wilcox-Gök, V. (2007). Do the sick retire early? Chronic illness, asset accumulation and early retirement. Applied Economics, 39(15), 1921-1936.

Micangeli A., Puglisi A. and Vignola R. (2016) Report on the social inclusion and social protection of disabled people in European countries. Country: Italy. Technical Report. Academic Network of European Disability experts (ANED). Leeds, UK.

MISSOC (2016) Mutual Information System on Social Protection database, available on line t: http://www.missoc.org/MISSOC/INFORMATIONBASE/COMPARATIVETABLES/MISSOCDATABASE/comparativeTableSearch.jsp. (Accessed on 21 June 2016)

MISSOC (2017) Mutual Information System on Social Protection database. Available online at: http://www.missoc.org/MISSOC/INFORMATIONBASE/COMPARATIVETABLES/MISSOCDATABASE/comparativeTableSearch.jsp. (Accessed on 28 March 2017)

Moscarola, F. C., Fornero, E., & Strøm, S. (2016). Absenteeism, childcare and the effectiveness of pension reforms. IZA Journal of European Labor Studies, 5(1), 1.

OECD (2015) OECD Economic Surveys: Italy 2015. OECD Publishing, Paris.

OECD (2017), Pension spending (indicator). doi: 10.1787/a041f4ef-en (Accessed on 19 April 2017)

PensioniOggi (2017) PensioniOggi.it Sito Italiano sulla Previdenza, website on Italian pension laws: http://www.pensionioggi.it/dizionario/pensione-anticipata-come-funziona-la-penalizzazione. (Accessed on 28 March 2017)

Staubli, S. (2011). The impact of stricter criteria for disability insurance on labor force participation. Journal of Public Economics, 95(9), 1223-1235.

Staubli, S., and Zweimüller, J. (2013). Does raising the early retirement age increase employment of older workers?. Journal of Public Economics, 108, 17-32.

World Bank (2017) World Development Indicators, Extracted from: http://data.worldbank.org/indicator/SP.POP.DPND.OL?locations=IT. (Accessed on 26 May 2017)

WHO – World Health Organization (2014) Health in all policies: Helsinki statement. Framework for country action. World Health Organization, Geneva.

9. APPENDIX

Table A 1 Major Italian pension reforms for private sector male employees

Year	Pension formula	Seniority pension conditions	Old-age pension conditions
Pre-1992	Defined Benefit: average of last 5 years earning* 0.02 * Yrs. of contributions	Age: no limit Contributions: 35 Yrs.	Age: 60 Contributions: 15 Yrs.
1992	Defined Benefit: average of lifetime earning * 0.02 * years of contributions	Unchanged	Age: 65 Contributions: 20 Yrs.
1995	Notional Defined Contributions: lifetime contributions capitalized and converted into annuity with actuarially fair coefficient	Age: 57 (no age limit) Contributions: 35 Yrs. (40)	Age: 57-65 Contributions: 5 Yrs. If accrued pension >1.2 the minimum old age allowance
2004	Unchanged	Age: 61 (no age limit) Contributions: 35 Yrs. (40)	Unchanged
2007	Unchanged	Age: 61 (any) Contribution: 35 (40) If Age + Contributions ⩾96	Age: 61 Contribution: 35 If Age + Contributions ⩾96
2009	Introduction of an automatic increase of the age and contribution conditions linked to increases in life expectancy every three (two) years until 2019 (after 2019)		
2012	Unchanged	Contributions: 41 Yrs. Age: no age limit "Early retirement" substitutes seniority pension. Permanent benefit reduction if pension claimed before age of 62.	Contributions: 20 Yrs. Age: 66 and 7 months
State Stability Law 2016 and 2017	Unchanged	Abolishment of the benefit penalty for "Early retirement" New Early/Partial retirement schemes: age 63, seniority 20 Yrs. (with penalty but for disadvantaged categories)	Unchanged

Notes: Author elaboration based on ISTAT (2011, pp. 71-79). Only final new rules' conditions are reported.

Box: Old age pension today

The Italian pension system is today a notional defined-contributions (NDC) scheme, with workers' contributions paid monthly to the INPS flowing into a notional individual account[30]. The notional accounts system has a contribution rate of 33 percent, of which about one-third is paid by the employee and two-thirds by the employer. Contributions earn a rate of return related to real GDP growth and at retirement, the accumulated notional capital is converted into an annuity taking into account average life expectancy at retirement.

There exist two main streams of access to a full pension benefit, which depends on various extent, on two qualification criteria: the worker's age and the number of years of contributions accrued during the working life. Where the age qualification prevails, it is called "Old-age" pension (*pensione di vecchiaia*), where the contributions prevails, it is called "Seniority" or "Early" retirement pension (*pensione di anzianità o anticipata*)[31]. Both the Old-age and the Seniority retirement give the right to a full-pension benefit.

The minimum pension age for an old age pension is 66 years old (65 years old) for men (women), with at least 20 years of contributions in 2017. The normal pension age will increase gradually for men and women, according to an automatic adjustment to life expectancy at 65 years old, every three years up to 2019 and every two years later on (the last revision added four months in January 2016). Starting from 2019, the minimum pension age will be 67 years old for both men and women.

The minimum number of years of contributions for a Seniority pension is 42 years (41 years) and 10 months for men (women) in 2017, with no age limit. Although the 2011 Pension Act established initially a permanent reduction in amount for pensions claimed before the age of 62, since January 2015 the penalty no more applies[32]. The minimum number of years will also increase gradually according to the increase in the life expectancy[33].

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[30] Workers who insured first before 1st January 1996 and at that date accrued *more* than 18 years of contributions fall under a full defined benefit (DB) system; those who insured first before 1st January 1996 and at that date accrued *less* than 18 years of contributions fall under the hybrid system (DB + NDC); workers insured first since 1st January 1996 fall fully under the NDC scheme.

[31] From January 2012, the former Seniority pension (*pensione di anzianità*) has been replaced by the Early retirement pension (*pensione* anticipata) (DL 201/2011, n.24).

[32] The cancelation of the benefit penalization has been first introduced by the law 208/2015 (Art. 1 co.299) till December 2017 and then made permanent by the 2017 Budget Law (Art. 1 co. 194) (PensioniOggi 2017).

[33] An Early retirement pension can be also obtained at 63 years and 7 months old with a minimum length of 20 years of contributions and whether the pension claimed is not lower than 2.8 times the old age social allowance (Inps 2017b).

Table A 2 Cohorts' specific age and old-age pension eligibility in each year: 1986–2002

		Year-semester of birth cohort											
MPA by year-semester		1931-1	1931-2	1932-1	1932-2	1933-1	1933-2	1934-1	1934-2	1935-1	1935-2	1936-1	1936-2
60	1986-1	55	-	-	-	-	-	-	-	-	-	-	-
60	1986-2	55	55	-	-	-	-	-	-	-	-	-	-
60	1987-1	56	55	55	-	-	-	-	-	-	-	-	-
60	1987-2	56	56	55	55	-	-	-	-	-	-	-	-
60	1988-1	57	56	56	55	55	-	-	-	-	-	-	-
60	1988-2	57	57	56	56	55	55	-	-	-	-	-	-
60	1989-1	58	57	57	56	56	55	55	-	-	-	-	-
60	1989-2	58	58	57	57	56	56	55	55	-	-	-	-
60	1990-1	59	58	58	57	57	56	56	55	55	-	-	-
60	1990-2	59	59	58	58	57	57	56	56	55	55	-	-
60	1991-1	60	59	59	58	58	57	57	56	56	55	55	-
60	1991-2	60	60	59	59	58	58	57	57	56	56	55	55
60	1992-1	61	60	60	59	59	58	58	57	57	56	56	55
60	1992-2	61	61	60	60	59	59	58	58	57	57	56	56
60	1993-1	62	61	61	60	60	59	59	58	58	57	57	56
60	1993-2	62	62	61	61	60	60	59	59	58	58	57	57
61	1994-1	63	62	62	61	61	60	60	59	59	58	58	57
61	1994-2	63	63	62	62	61	61	60	60	59	59	58	58
61	1995-1	64	63	63	62	62	61	61	60	60	59	59	58
62	1995-2	64	64	63	63	62	62	61	61	60	60	59	59
62	1996-1	65	64	64	63	63	62	62	61	61	60	60	59
62	1996-2	65	65	64	64	63	63	62	62	61	61	60	60
63	1997-1	-	65	65	64	64	63	63	62	62	61	61	60
63	1997-2	-	-	65	65	64	64	63	63	62	62	61	61
63	1998-1	-	-	-	65	65	64	64	63	63	62	62	61
64	1998-2	-	-	-	-	65	65	64	64	63	63	62	62
64	1999-1	-	-	-	-	-	65	65	64	64	63	63	62
64	1999-2	-	-	-	-	-	-	65	65	64	64	63	63
65	2000-1	-	-	-	-	-	-	-	65	65	64	64	63
65	2000-2	-	-	-	-	-	-	-	-	65	65	64	64
65	2001-1	-	-	-	-	-	-	-	-	-	65	65	64
65	2001-2	-	-	-	-	-	-	-	-	-	-	65	65
65	2002-1	-	-	-	-	-	-	-	-	-	-	-	65

Notes: Each column of the table lists the age of a given semester-cohort in a particular semester. Grey cell identify the ineligibility in a particular semester of year and at each age. With reference to the specification in equation (1), cells identify treatment if $Age < MPA$ *(grey) and control if* $Age \geqslant MPA$ *(white) groups. The average DD treatment effect* β *is identified only for the ages 60-64 (cells within the rhombus).*

Table A 3 Main effect of rising MPA on the probability of being in a given economic state (equation 1)

	Retirement benefit	Employment	Non-employment	Disability benefit	Unemployment benefit
	b	b	b	b	b
Age<MPA	-0.250***	0.047***	0.073***	0.024***	0.008*
Year-semester of birth dummies (Ref. Category: 1931 - I sem)					
1931 - II sem	-0.021***	0.028***	0.015***	0.004***	0.003***
1932 - I sem	-0.068***	0.064***	0.051***	0.010***	0.009***
1932 - II sem	-0.087***	0.086***	0.068***	0.008***	0.013***
1933 - I sem	-0.148***	0.123***	0.103***	0.017***	0.019***
1933 - II sem	-0.155***	0.149***	0.115***	0.017***	0.022***
1934 - I sem	-0.221***	0.203***	0.154***	0.028***	0.040***
1934 - II sem	-0.248***	0.234***	0.176***	0.028***	0.046***
1935 - I sem	-0.311***	0.281***	0.216***	0.037***	0.057***
1935 - II sem	-0.307***	0.293***	0.234***	0.035***	0.055***
1936 - I sem	-0.340***	0.318***	0.260***	0.037***	0.063***
1936 - II sem	-0.354***	0.330***	0.283***	0.038***	0.068***
Year-semester dummies (Ref. Category: 1986 - I sem)					
1986 - II sem	0.047***	-0.055***	-0.027***	0.002	0
1987 - I sem	0.089***	-0.114***	-0.053***	0	0
1987 - II sem	0.114***	-0.133***	-0.082***	-0.001	-0.002
1988 - I sem	0.163***	-0.176***	-0.114***	-0.002	-0.010**
1988 - II sem	0.189***	-0.199***	-0.146***	-0.003	-0.012***
1989 - I sem	0.237***	-0.245***	-0.177***	-0.006	0.019***
1989 - II sem	0.261***	-0.266***	-0.209***	-0.008	0.018***
1990 - I sem	0.298***	-0.297***	-0.240***	-0.011*	0.032***
1990 - II sem	0.324***	-0.320***	-0.271***	-0.014*	0.030***
1991 - I sem	0.367***	-0.350***	-0.286***	-0.017*	0.037***
1991 - II sem	0.400***	-0.381***	-0.325***	-0.020**	0.038***
1992 - I sem	0.452***	-0.424***	-0.351***	-0.023**	0.026***
1992 - II sem	0.490***	-0.458***	-0.385***	-0.028**	0.030***
1993 - I sem	0.518***	-0.513***	-0.405***	-0.031**	0.022***
1993 - II sem	0.540***	-0.542***	-0.433***	-0.035***	0.027***
1994 - I sem	0.616***	-0.604***	-0.473***	-0.043***	0.007
1994 - II sem	0.625***	-0.635***	-0.489***	-0.045***	0.007
1995 - I sem	0.655***	-0.669***	-0.497***	-0.045***	-0.005
1995 - II sem	0.697***	-0.698***	-0.536***	-0.051***	-0.01
1996 - I sem	0.703***	-0.726***	-0.542***	-0.050***	-0.015
1996 - II sem	0.731***	-0.747***	-0.550***	-0.050***	-0.018*
1997 - I sem	0.790***	-0.792***	-0.586***	-0.054***	-0.030**
1997 - II sem	0.799***	-0.813***	-0.595***	-0.052***	-0.032**
1998 - I sem	0.832***	-0.846***	-0.599***	-0.049***	-0.039***
1998 - II sem	0.903***	-0.888***	-0.650***	-0.056**	-0.046***
1999 - I sem	0.908***	-0.919***	-0.656***	-0.053**	-0.054***
1999 - II sem	0.937***	-0.945***	-0.667***	-0.048**	-0.060***

2000 - I sem	1.027***	-0.978***	-0.724***	-0.054**	-0.071***
2000 - II sem	1.017***	-0.998***	-0.728***	-0.047**	-0.075***
2001 - I sem	1.028***	-1.015***	-0.708***	-0.031	-0.076***
2001 - II sem	1.048***	-1.034***	-0.739***	-0.027	-0.080***
2002 - I sem	1.078***	-1.058***	-0.820***	-0.040*	-0.088***
Age dummies (Reference Category: 55 years old)					
56	-0.007	-0.008*	0.045***	0.012***	0.004**
57	-0.03	0.006	0.099***	0.024***	0.008***
58	-0.053*	0.019*	0.155***	0.037***	0.009***
59	-0.080*	0.033**	0.210***	0.048***	0.007*
60	-0.003	0.033***	0.253***	0.064***	-0.003
61	-0.002	0.015	0.234***	0.061***	-0.017*
62	-0.038	0.047***	0.263***	0.063***	-0.012
63	-0.082	0.090***	0.292***	0.064***	-0.002
64	-0.136*	0.136***	0.320***	0.062***	0.009
65	-0.168*	0.180***	0.346***	0.065***	0.020*
_cons	0.433***	0.602***	0.195***	-0.006***	0.001
Adj.R^2	0.34	0.18	0.06	0.01	0.03
#Observations	1,297,450	1,297,450	1,297,450	1,297,450	1,297,450

*Notes: The table displays the estimated DD coefficient β of equation (1) separately for each of the outcomes (columns). SE clustered at the semester of birth cohort level. Significance levels: *** = 1%, ** = 5%, * = 10%.*

Table A 4 Fully interacted (lead and lag) model (equation 2)

	Retirement benefit	Employment	Non-employment	Disability benefit	Unemployment benefit
	b	b	b	b	b
Interaction of Post-reform cohorts (Tr) and Age dummies (Ref. Category: TrXAge55)					
TrXAge56	-0.01	0.017*	-0.012*	-0.007*	0.004
TrXAge57	0	0.013	-0.015	-0.008**	0.002
TrXAge58	0.019	0.003	-0.015	-0.009**	0.004
TrXAge59	0.034**	-0.008	-0.022	-0.007**	0
TrXAge60	-0.317***	0.039***	0.040**	0.005*	0.005
TrXAge61	-0.318***	0.088***	0.127***	0.026***	0.016***
TrXAge62	-0.296***	0.071***	0.130***	0.035***	0.014***
TrXAge63	-0.276***	0.062***	0.126***	0.039***	0.013***
TrXAge64	-0.255***	0.053**	0.113***	0.033***	0.009*
TrXAge65	0.006	0.002	-0.003	-0.004	-0.003*
Year-semester of birth dummies (Ref. Category: 1931 - I sem)					
1931 - II sem	0.011***	-0.003	-0.010***	0.003***	0
1932 - I sem	-0.005	0.003	0.003	0.007***	0.004***
1932 - II sem	0.005	-0.004	-0.003	0.004***	0.006***
1933 - I sem	-0.024**	0.004	0.009	0.012***	0.010***
1933 - II sem	-0.012	0.002	0.002	0.012***	0.011***
1934 - I sem	-0.046**	0.025	0.028*	0.027***	0.025***
1934 - II sem	-0.033*	0.022	0.021	0.025***	0.029***
1935 - I sem	-0.060**	0.037	0.033	0.032***	0.036***
1935 - II sem	-0.023	0.019	0.024	0.027***	0.031***
1936 - I sem	-0.011	0.011	0.019	0.025***	0.036***
1936 - II sem	0.008	-0.01	0.017	0.025***	0.038***
Year-semester dummies (Ref. Category: 1986 - I sem)					
1986 - II sem	-0.01	0.014	0.024	0.004***	0.006
1987 - I sem	-0.008	-0.006	0.026	0.002	0.009*
1987 - II sem	-0.008	0	0.015	0.002	0.009*
1988 - I sem	0.005	-0.009	0.01	0.002	0.004
1988 - II sem	0.007	-0.007	-0.003	0.001	0.004
1989 - I sem	0.023	-0.02	-0.009	0	0.037***
1989 - II sem	0.02	-0.016	-0.021	-0.002	0.039***
1990 - I sem	0.024	-0.017	-0.023	-0.002	0.055***
1990 - II sem	0.023	-0.014	-0.033	-0.004	0.056***
1991 - I sem	0.027	-0.013	-0.019	-0.004	0.064***
1991 - II sem	0.028	-0.016	-0.036	-0.006*	0.068***
1992 - I sem	0.043	-0.027	-0.032	-0.006*	0.058***
1992 - II sem	0.05	-0.033	-0.042	-0.010*	0.064***
1993 - I sem	0.037	-0.052	-0.033	-0.011*	0.059***
1993 - II sem	0.031	-0.053	-0.037	-0.013**	0.067***
1994 - I sem	0.06	-0.077	-0.044	-0.016***	0.051***
1994 - II sem	0.067	-0.084	-0.041	-0.017***	0.053***
1995 - I sem	0.067	-0.086	-0.027	-0.017**	0.044***

1995 - II sem	0.063	-0.086	-0.042	-0.019***	0.041***
1996 - I sem	0.069	-0.092	-0.038	-0.021***	0.038***
1996 - II sem	0.068	-0.085	-0.026	-0.019***	0.037***
1997 - I sem	0.077	-0.098	-0.039	-0.022***	0.027***
1997 - II sem	0.078	-0.097	-0.039	-0.024***	0.026***
1998 - I sem	0.076	-0.097	-0.018	-0.020**	0.022***
1998 - II sem	0.083	-0.103	-0.041	-0.024***	0.019**
1999 - I sem	0.088	-0.11	-0.038	-0.025***	0.012*
1999 - II sem	0.081	-0.104	-0.023	-0.018*	0.01
2000 - I sem	0.085	-0.097	-0.042	-0.018**	0.004
2000 - II sem	0.085	-0.094	-0.039	-0.014*	0.002
2001 - I sem	0.061	-0.081	0.011	0.005	0.003
2001 - II sem	0.035	-0.064	0.02	0.015	0.004
Age dummies (Reference Category: 55 years old)					
56	0.061***	-0.075***	0	0.012***	-0.002
57	0.096***	-0.118***	0.006	0.021***	-0.003
58	0.128***	-0.160***	0.012	0.030***	-0.007**
59	0.163***	-0.202***	0.017	0.036***	-0.012***
60	0.587***	-0.306***	-0.051*	0.032***	-0.033***
61	0.638***	-0.402***	-0.151***	0.017**	-0.057***
62	0.653***	-0.421***	-0.163***	0.014**	-0.056***
63	0.658***	-0.433***	-0.170***	0.014**	-0.050***
64	0.661***	-0.443***	-0.176***	0.013**	-0.043***
65	0.702***	-0.462***	-0.192***	0.016***	-0.037***
_cons	0.226***	0.595***	0.229***	0.017***	0.005
Adj.R^2	0.34	0.18	0.06	0.01	0.03
#Observations	1,297,450	1,297,450	1,297,450	1,297,450	1,297,450

*Notes: The table displays the estimated coefficient β of equation (2) separately for each of the outcomes (columns). SE clustered at the semester of birth cohort level. Significance levels: *** = 1%, ** = 5%, * = 10%. The dummy category "2002 - I sem" is omitted because perfectly collinear with the interaction term "TrXAge65"*

Table A 5 Robustness of the effect of rising MPA on the probability of being in a given economic state

	Retirement benefit	Employment	Non employment	Disability benefit	Unemployment benefit
			Row (8) **Table 5**: manual workers		
Age<MPA	-0.274***	0.087***	0.050***	0.028***	0.018*
	(-0.0191)	(-0.0135)	(-0.0053)	(-0.0017)	(-0.0068)
Adj.R^2	0.45	0.36	0.04	0.01	0.08
#Obs.	606,584	606,584	606,584	606,584	606,584
			Row (15) **Table 5**: manual workers + Xi		
Age<MPA	-0.274***	0.087***	0.050***	0.028***	0.018*
	(-0.0191)	(-0.0135)	(-0.0053)	(-0.0017)	(-0.0068)
Adj.R^2	0.46	0.40	0.10	0.03	0.10
#Obs.	606,584	606,584	606,584	606,584	606,584
%Change Adj.R^2	+2%	+11%	+150%	+200%	+25%

*Notes: The table displays the estimated DD coefficient β (SE) of equation (1) separately for each of the outcomes (columns). SE clustered at the semester of birth cohort level. All regressions include dummies for age, year-semesters and year-semester birth cohorts. Individual controls: weeks of sick leave and average wage at 58-59 years old and years of contributions at 55 years old. Significance levels: *** = 1%, ** = 5%, * = 10%.*

Figure A 1 Pension Rate by Age and Birth Cohorts (**Figure 3**)

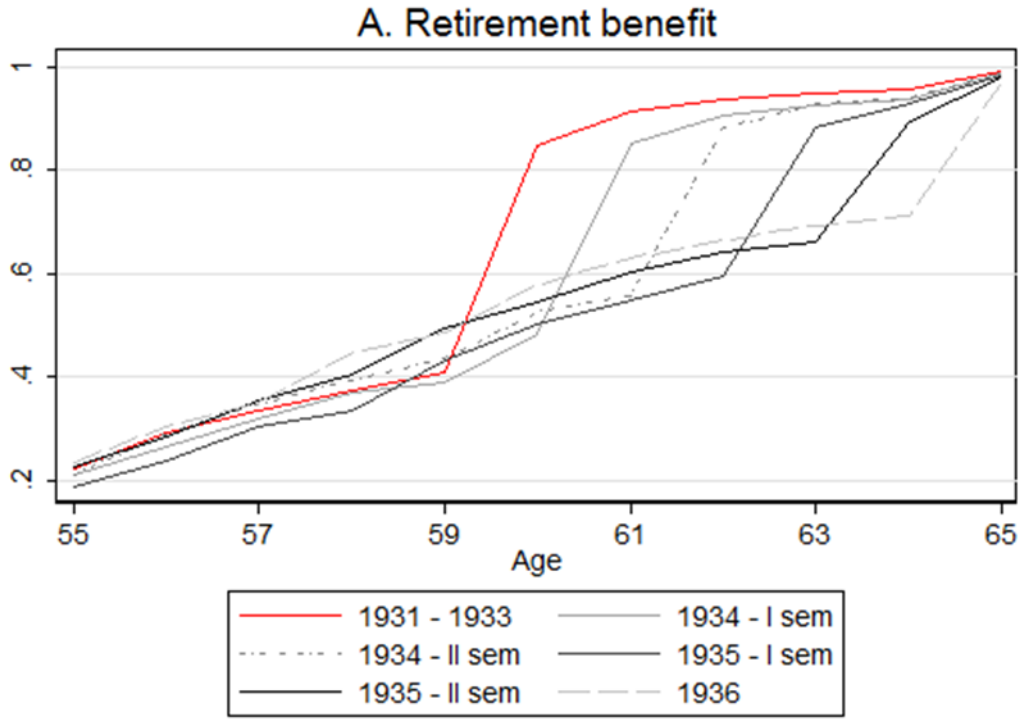

Figure A 2 Employment Rate by Age and Birth Cohorts (**Figure 3**)

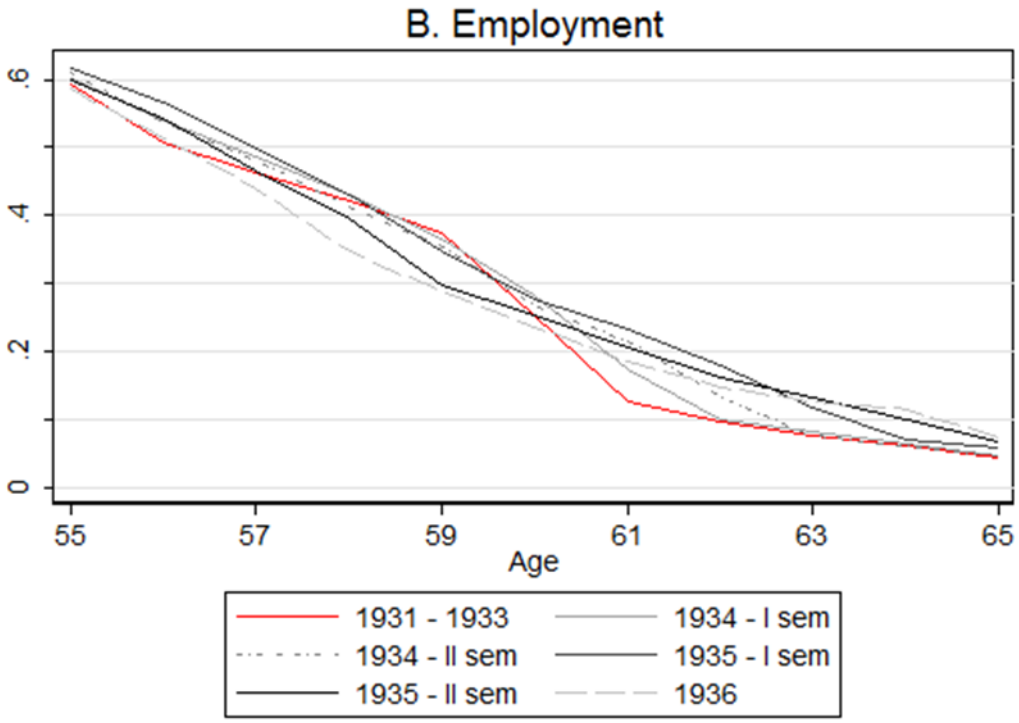

Figure A 3 Non-Employment Rate by Age and Birth Cohorts (**Figure 3**)

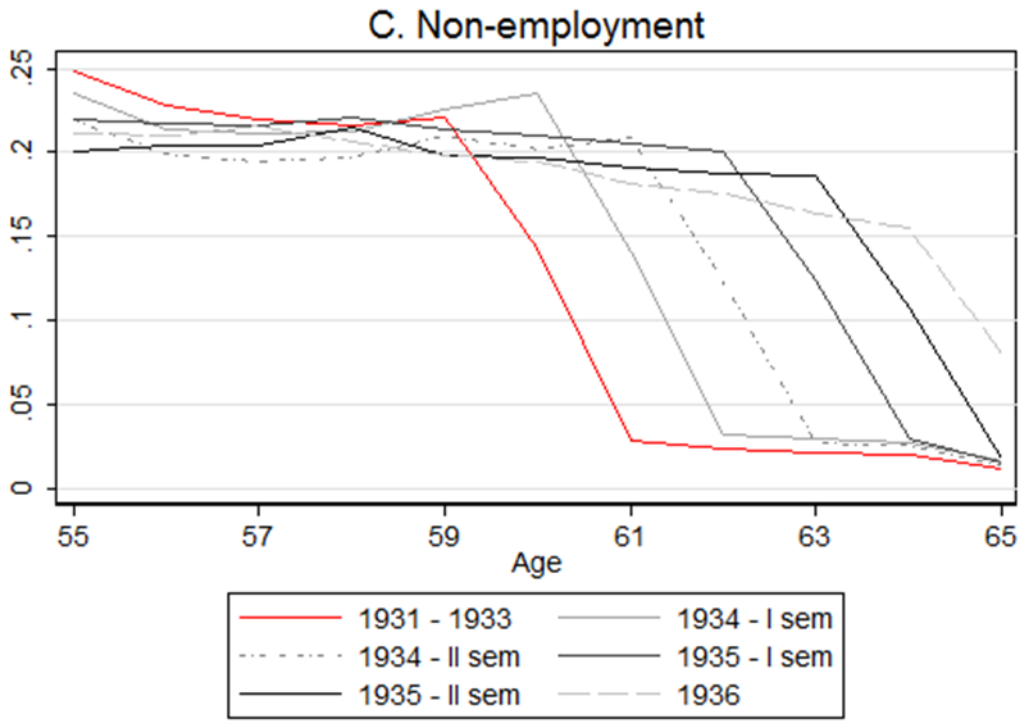

Figure A 4 Disability Benefit Rate by Age and Birth Cohorts (**Figure 3**)

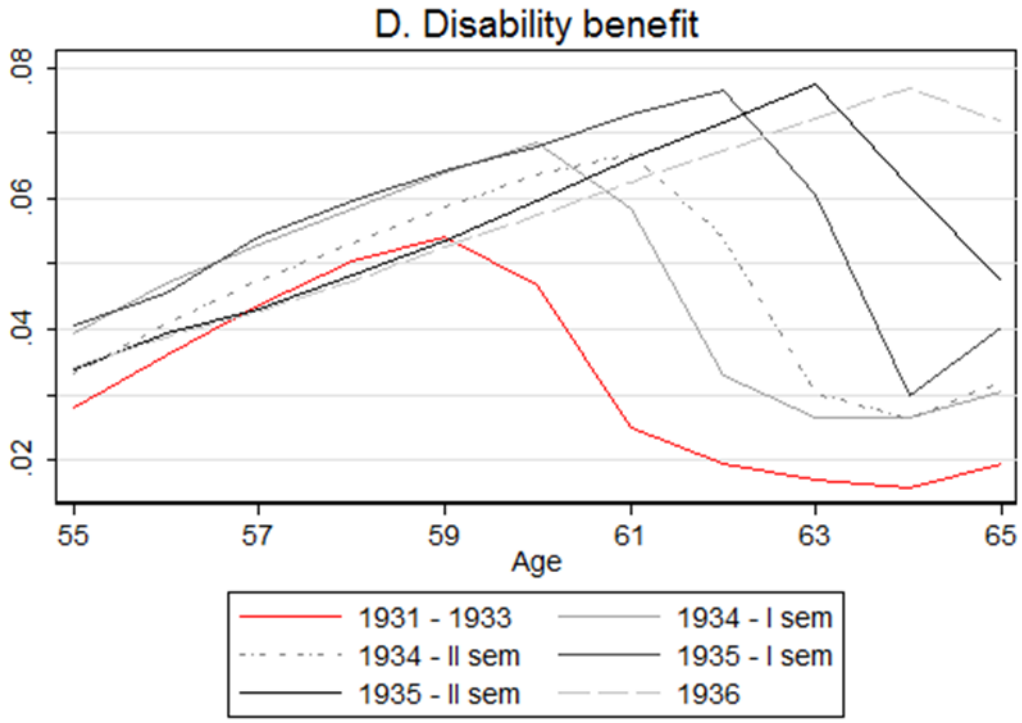

Figure A 5 Unemployment Benefit Rate by Age and Birth Cohorts (**Figure 3**)