How raising the Full Retirement Age affects early retirement choices: insights from the interaction of two policies*

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Abstract

This paper assesses how a recent and unexpected Italian pension reform changed the incentive to early retirement for women. The analysis uses rich Italian administrative data and it is based on a differences-in-discontinuities design. Identification exploits the facts that (i) women with just above 35 years of contributions are eligible for early retirement; (ii) women born in 1952 are the first cohort affected by the retirement age increase, while women born in 1951 are unaffected. The results indicate that the differential in retirement age between women with more than 35 years of contributions and women with less than 35 years of contributions decreases by 2 months when statutory age increased. As the early retirement option entails a penalty in the annuity, we also evaluate the reform effect on women's pension amount. The findings indicate that the differential in annuity between the two groups decreases by about 5% for a lifetime. The effect is stronger for women with low labor market attachment and low education.

JEL Classification: J16, J20, J22, J26, H55

Keywords: retirement; pension, women's labor market participation, policy evaluation

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1 Introduction

In the context of ageing societies, the length of working careers has become crucial for ensuring the sustainability of public pension systems. Western governments have intervened in the last decade by increasing the retirement age requirement to become eligible for a pension. However, the prolonged working path has come with costs for individuals about to retire, as disutility from work increases with age (Gruber & Wise 1998), especially for socio-demographic groups less attached to the labor market. Indeed, sudden pension reform may have critical implications for close-to-retirement women since their careers are already affected by labor market interruptions and weaker attachment due to caring activities.

In this paper, we exploit a unique and unexpected pension reform in Italy to identify how a sharp and sudden increase in retirement eligibility affects women's incentives to early retirement. While the reform increased the retirement age by at least four years, it left the early retirement option unchanged: women with a sufficiently large number of years of contributions could opt for early retirement at the cost of receiving a substantially lower pension amount.

Our analysis takes advantage of a pension reform enacted in Italy in 2011 (the Monti-Fornero reform henceforth), which sharply and unexpectedly tightened the eligibility requirements for claiming full retirement benefits. The mandated increase in retirement age was highly heterogeneous across genders: while for men retirement age increased from age 65 to age 67, for women the first cohort affected by the reform faced an increase from age 60 to 64, while for the subsequent cohorts retirement age was set at 67. The number of years of contributions to access old age pension remained at a minimum of 20 years. The reform was largely unexpected due to the swift implementation as it came into force on 1st January, 2012, only 25 days after its presentation in the Parliament. The reform left untouched the so-called "Opzione Donna" (OD henceforth), an early retirement option available since 2008 only for women: according to this scheme, women could retire at 57 years of age and with at least 35 years of contributions; OD entails a penalty in the annuity, because it is computed according to a defined-contribution and not a defined-benefit scheme.

The analysis focuses on women for two main reasons. First, the reform implied a larger

increase in retirement age for women than for men: the requirement jumped from age 60 to 64 (and to 67 for following cohorts), while for men it increased only from age 65 to 67. Second, the early retirement scheme was (and still is) available only for women. Yet, understanding how women's retirement behaviour is specifically affected by increasing retirement age is of crucial importance, because women tend to live longer than men and they are likely to spend much of their retirement in widowhood, without sufficient savings accumulation or annuities (Bettio et al. 2013). Moreover, although women's employment has risen throughout the 20th century (Olivetti & Petrongolo 2016), women value job attributes compatible with household responsibilities, such as flexible work schedules and shorter commutes, which may result in worse earning opportunities than those observed for men (Petrongolo & Ronchi 2020), which may translate later into smaller pensions. From a policy perspective, this is also a concern given the increasing longevity and changes in public pension generosity (Börsch-Supan & Coile 2021). Finally, it has been shown that women have lower financial literacy compared to men (Lusardi & Mitchell 2008), as well as lower pension information awareness (Angelici et al. 2022), which may influence the way they react to sudden increase in retirement age.

This paper aims at assessing whether the Monti-Fornero reform has changed the incentive for early retirement for women, and estimates the effects of the reform on retirement age and annuity. We adopt a Differences-in-Discontinuities design, by comparing the first cohort of women affected by the reform with the one just before who was not affected, above and below the threshold of 35 years of contributions, which is the number of contributions required for being eligible for OD. Table 1 summarises the requirements pre and post-reform for the 1951 and 1952 cohorts, which are considered in the analysis: the Monti-Fornero reform changed the full retirement age for old age pension, while leaving OD unaffected.

Our analysis leverages the rich set of Italian administrative data on the private sector, allowing us to observe women's working history and retirement choices. We also take advantage of individual demographic characteristics and career spell information such as sick leave, family leave, unemployment spell, sector and earnings evolution.

We provide two main sets of findings. First, the differential in retirement age between women

Table 1: Age requirements before and after the Monti-Fornero reform by cohort

		Cohort			
Type of pension	# contributions	1951		1952	
		before	after	before	after
Old age	c$\geq$ 20 years	60	60	60	64
Early retirement	c$\geq$ 35 years	57	57	57	57

Notes: This table provides the age required before and after the Monti-Fornero Reform to be eligible for the old age (c$\geq$ 20 years contribution) and the early retirement pension "Opzione Donna" ($\geq$ 35 years contribution) **Sources**. Authors' elaborations based on information from National Social Secuirity Institute (INPS), Circolare INPS n35 (2012)

with more than 35 years of contributions and women with less than 35 years of contributions decreases by 2 months with the increase in retirement age induced by the reform, which suggests a negligible effect on retirement age. However, the second result on the annuity amount indicates that the differential in annuity between women eligible for OD and women who are not eligible for OD decreases by 800 euros per year for the cohort treated by the reform. This implies a 5% yearly lifetime reduction in their annuity compared to women with less than 35 years of contributions. Given that the effect on retirement age is negligible, we interpret this finding as evidence of the penalization implied by the OD early retirement scheme, which dictates that the annuity should be computed according to the defined-contributions scheme. These results are robust to several sensitivity analysis, including more demanding specifications, changes in the bandwidth selection and the use of placebo cutoffs. We also test the specification on women's social security wealth and found that the penalty for those retiring earlier (i.e., above 35 years of contribution) is 11% compared to women with less than 35 years of contribution. Furthermore, we uncover heterogeneous effects based on women's characteristics for the age at retirement and annuity outcomes. We show that women with low labor market attachment and low education are those more likely to retire earlier, which suggests that women who were already among the most disadvantageous groups are those retiring earlier at the price of smaller annuities.

We also investigated the interaction between the retirement scheme, career progression, and retirement choice. We find that women with salaries above the median values, which fell under the defined-benefit scheme before the Fornero reform, were the most penalized once they took the early retirement benefit. This evidence further confirms that women do not only account for monetary compensation when taking pension resolution, while they might also weigh other

non-pecuniary factors into their decision.

The findings highlight two main policy implications. First, the Reform, which aimed to extend women's working lives, has pushed some affected women toward early retirement, even at a financial cost. This indicates that women do not only consider financial incentives when making pension choices. Rather, timing and other non-monetary factors also influence their decisions. Second, women from disadvantaged groups— such as those with low education, work interruptions, and weak labor market attachment — are more likely to exit earlier the labor market. This suggests that these already vulnerable women may be more responsive (and sensitive) to a pension reform that aims to enhance their participation in the labor market. These groups could face a higher risk of poverty in old age because of these early pension choices.

This paper contributes to three strands of the literature that seek to understand how individuals respond to pension reform.

First, as far as we know, we are the first to provide causal estimates of the impact of the increasing retirement age on close-to-retirement women and how this has affected women's incentive to early retirement. This is particularly important from a policy perspective, since in OECD countries, among individuals above the age of 50 who are providing informal care, 60 percent are women (OECD 2023). So, women are more likely to bear caring responsibilities at an older working age. Thus, understanding older working women's response to changes in incentives for early retirement is crucial.

Only a few recent studies have looked at the increase in statutory retirement age (Mastrobuoni 2009, Behaghel & Blau 2012, Staubli & Zweimüller 2013, Manoli & Weber 2016*a*, Seibold 2021, Lalive et al. 2023), while others have focused on changes in the benefit generosity close to retirement (Krueger & Pischke 1992, Song & Manchester 2007, Liebman et al. 2009, Manoli & Weber 2016*b*). These studies find that people react to pension reform by increasing the labor supply and delaying retirement, which is the opposite of what we document in this paper.

For the Italian setting, most studies focus on the effect of the Monti-Fornero reform on the

labor market attachment of relatively young women and find that women respond by increasing the labor supply (Carta & De Philippis 2023). Other scholars evaluate the spillover effects of the reform from older workers who were locked-in, to young workers who experienced a block in their career development (Bianchi et al. 2022, Carta et al. 2021, Boeri et al. 2022). One study focused on the reform effect on individuals at least five years from retirement and found that sick leave increased only for women (Brunello et al. 2023). Our paper differs from the previous studies since we assess the impact of the reform on women who were about to retire by the time the reform was enacted, and we evaluate their response, provided that they were eligible for early retirement.

Second, we contribute to the studies looking at changes in the computation rules of pension benefits (Boeri & Brugiavini 2008, French 2005, Engels et al. 2017, French et al. 2022). Because OD allows early retirement under the defined-contribution scheme, which is significantly less generous than the defined-benefit scheme, we are able to assess how women respond to this type of financial dis-incentives.

Third, this paper refers to a recent strand of the literature Behaghel & Blau (2012), Lalive et al. (2023), Seibold (2021), Laun & Palme (2023), Rabaté et al. (2024), where individuals are found to respond to pension reforms in a behavioural fashion compared to the one suggested by the standard optimal retirement model. Our results show that women do not base their retirement choices on financial incentives only, suggesting that other dimensions may play a role (e.g. disutility from continuing working). This result suggests that, similarly to what has been largely documented for the labor market, where women tend to value jobs that allow a better work-life balance and that are less remunerated Felfe (2012*a*,*b*), Petrongolo & Ronchi (2020), also retirement choices may be based on dimensions other than remuneration, which further contribute to the existing gender gap in pension amount (OECD 2021).

The paper proceeds as follows. Section 2.1 describes the institutional setting. Section 3 presents the econometric analysis and discusses the main assumptions needed for identification. Section 4 describes the data, Section 5 the results and Section 5.1 shows the robustness analyses. Finally, Section 7 concludes.

2 Institutional framework

2.1 The Italian pension system and the Monti-Fornero reform

The Italian pension system is primarily based on public pension provision, as alternative, mandatory or voluntary, pension funds play a negligible role (COVIP 2022). Individuals can claim their pension by taking either the "old age pension", which is based on the age of retirement and a minimum number of years of contribution, or the "seniority" scheme, based on the years of contribution only. Both schemes ensure the full annuity benefit to retirees. In the Italian system, individuals are considered retired when they start claiming the first pension benefit.

The Italian pension system has been largely reformed since the 90s in order to ensure its sustainability: several reforms gradually increased full retirement age, while others changed the pension computation method, from a defined-benefit scheme to a defined-contribution scheme.[1] The Italian pension system has usually secured generous pension benefits to its contributors waiting for full retirement, and this is part of the reason why workers retire as soon as they reach the eligibility requirements (Brugiavini 1997, 2001, Battistin et al. 2009), especially under the defined-contribution scheme.

In this paper, we consider the so-called Monti-Fornero reform, from the name of the Prime Minister and of the Ministry of Labor who enacted it. The reform was largely unexpected due to the swift implementation as it came into force only 25 days after its presentation in the Parliament. The quick application was due to the pressure Italy was facing from the European Union to keep public spending under control. The right-wind government resigned on 12th November, 2011, and the subsequent "technocratic government" stepped in on 16th November. The pension reform was presented on 6th December and approved on 22nd December. The

[1]The Amato's reform (1992) increased the aged of retirement for women in the private sector from age 55 to 60, gradually, and also the minimum number of years of contribution from 15 to 20. The Maroni (2004), Prodi (2007) and Sacconi(2010) reforms gradually increase the retirement age for the seniority pension. A critical reform was enacted in 1995 (the so-called "Dini Reform"), which changed the pension computation method: before 1995 individuals retired under the defined-benefit scheme, according to which the annuity was an average of the last five to ten years of gross earnings; after the reform, individuals with less than 18 years of contribution fell under the "mixed scheme", while those starting working from 1996 were put under the full notional defined-contribution scheme, which is based on the amount of social security contributions accrued during the careers (OECD 2021).

reform implied a sharp and unexpected increase in the eligibility requirements for pensions, which aimed at reducing the pension burden on the public balance sheets.

The pension requirements were amended mainly for women. The reform changed the requirements for the old age pension[2], which is the full pension. It increased the statutory retirement age from 60 to 64 for the first cohort treated (women born in 1952) and from 60 to 67 for all subsequent cohorts.[3]

For private sector workers, under the pre-reform regime (Sacconi 2010), the *old age* pension scheme allowed women to retire at age 60, conditional on having at least 20 years of contributions. Under the new reform rules, the age requirement swiftly increased from age 60 to age 67 for women by 2020. Women who were eligible to retire under the pre-reform rules by December 31, 2011, were considered as exempted from the Reform, and thus, could still retire at age 60, provided that they had 20 years of contributions.[4] This exemption was valid until the 1951 cohort, who turned 60 in 2011, and were thus eligible to retire according to the pre-reform rules. Women born the next year, in 2012, were instead the first cohort affected by the reform, and, for them, the retirement age was increased to 64.[5] Women born in 1953 or later were fully affected by the increase in retirement age, because for them retirement age was postponed to 67 years.[6] The reform was sharp and unexpected, after its implementation the public debate was intense as it is documented by the media attention that the reform obtained. This suggests that women were aware of the changes of the retirement eligibility and understood the stakes of the reform. Recent evidence suggest indeed that individuals understand pension reforms and keep up with

[2]The reform intervened also on the *seniority* pension scheme. Under pre-reform rules, individuals could retire with at least 60 years of age and 35 years of contributions, the so-called "quota system", or 40 years of contribution and no minimum age. The new rules abolished the quota system, and the paid contribution was raised from 40 to 42 for women. For this reason, in our analysis we exclude individuals with 40 years of contributions or more.

[3]In this study we do not consider subsequent cohorts for several reasons. First, the 1953 cohort became eligible for the old age pension only in 2020, when the pandemic hit, and this could confound the results. Second, subsequent cohorts from 1954 onward became eligible from 2021 onward and we do not have enough years of data available to observe if they enter retirement through the full pension scheme.

[4]This clause is known as the "Grandfathering clause".

[5]This peculiar treatment for women born in 1952 was specified in *Circolare INPS 35* (2012), and was meant to provide a temporary implementation of the reform.

[6]Some categories were exempted from the increase in retirement age induced by the reform, and could retire under special ad-hoc rules. This group included individuals who were placed in mobility, solidarity contracts, those belonging to the public train service, the flight service, the maritime service and strenuous jobs. In our analysis, we drop these special categories.

the changes in regulations (Ciani et al. 2022). However, Italian women have been found to lack awareness of their pension rights and have limited retirement planning (Angelici et al. 2022).

Table 2 summarizes the changes in age requirements for statutory retirement introduced by the Monti-Fornero reform for women.

Table 2: Statutory retirement age in the private sector by cohort

Cohort	Women		
	Before	After	Reform
1951	60	60	NO
1952	60	64	YES
1953	60	66+11m	YES

Notes. This table summarizes the statutory retirement age in place before and after the Monti-Fornero for private sector workers, faced by different cohorts who were affected or not by the reform (as indicated by the column *Reform*). In order to retire with the *old age* pension scheme, individuals had to reach the age thresholds indicated above and to have at least twenty years of contributions. **Sources**. Authors' elaborations based on information from National Social Security Institute (INPS), Circolare INPS n35 (2012)

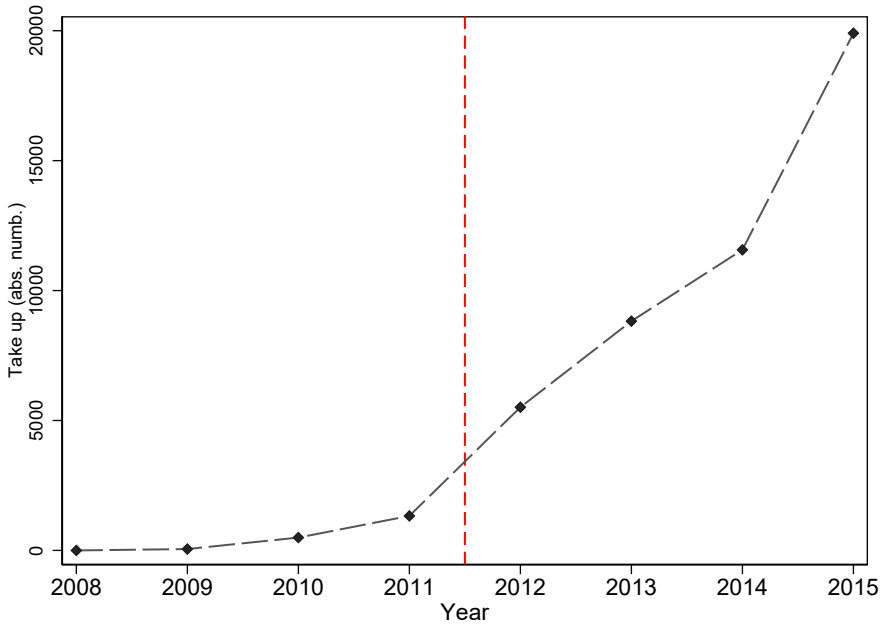
Importantly, the reform did not change the early retirement option available for women, which is called "Opzione Donna" (OD henceforth) and is still in place nowadays. Since 2008, women could retire with 35 years of contributions and at least 57 years of age, if working in the private sector.[7] This early retirement scheme comes with a penalty in the annuity obtained, as under this option, women have to retire following the defined-contribution scheme, which translates into a permanent penalty of the annuity of about 15% (INPS 2023).

In this paper, we exploit the implementation of the Monti-Fornero reform and the fact that OD was not changed, to analyze whether women responded to the increase in SRA by exiting the labor market earlier thanks to the OD availability. Intuitively, despite the monetary penalty associated with the early retirement scheme, the increase in SRA represents a strong incentive for a woman to exit the labor market earlier than requested. Figure 1 shows the increase in the take up of OD over time, since its implementation in 2008, and indicates that the largest

[7]The age requirements for the self-employed was 58 years, and it was raised by one additional year for all women in 2018.

increase in take up seems to have occurred after the enactment of the Monti-Fornero reform at the end of 2011.

Figure 1: Take up of early retirement scheme *Opzione donna*



Notes. The graph reports the number of women working in the private sector who retired with the *Opzione Donna* early retirement scheme from 2008 until 2015. The red dashed line indicates the year (2012) in which the Monti-Fornero reform took place. **Source**: own elaborations on INPS (2016, Table 3.1)

2.2 Descriptive evidence

Before describing in details the paper identification strategy and data, in what follows, we present some preliminary evidence that motivates our analysis. The figures below refer to women born in 1951 and 1952 who retired between 2011 and 2020.

Figure 2 shows the distribution of the years of contribution at retirement age by cohort. First, women born in 1952 display a more right-skewed distribution than those born in 1951, suggesting that they stayed in the labor market longer, as the reform envisioned. Second, at the 20-year-of-contributions cutoff, which is the threshold required to claim full pension benefit, the 1951 cohort shows a higher bump than the 1952 cohort. This aligns with the "Grandfathering rule", which enabled women born in 1951 with at least 20 years of contribution to retire under the ex-ante reform rules. Finally, the figure documents that for the 1952 cohorts more women

retired with a number of years of contribution above 35, which suggests that they used more than the 1951 counterpart the possibility of exiting earlier the labor market.

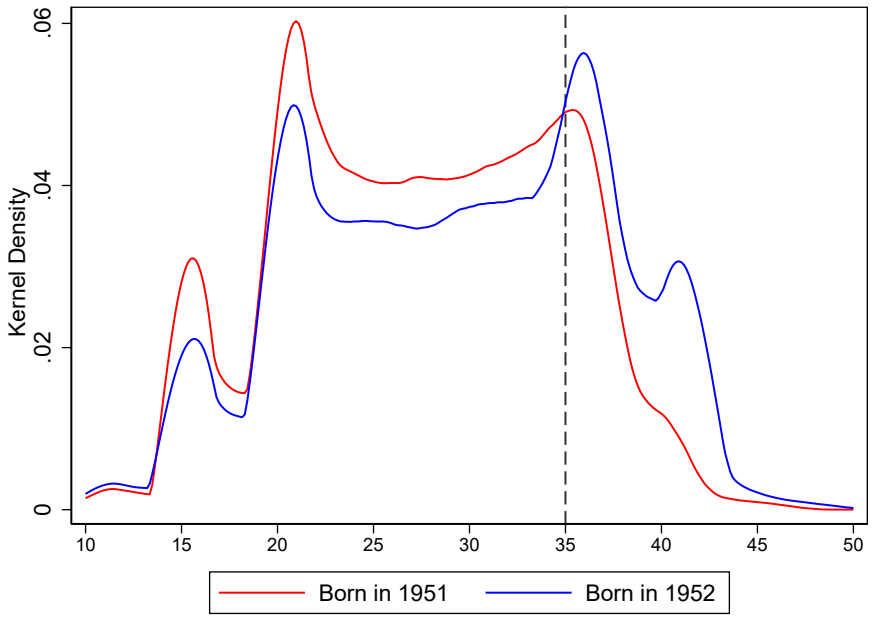
Figure 3 displays the cumulative age at retirement by cohort. By comparing the red line (cohort 1951) with the blue line (cohort 1952), we can see that the vast majority of women born in 1951 retired by age 61.5, where the cumulative distribution reaches about 90%; on the other hand, about 40% of women born in 1952 retired between 60 and before age 64, which suggests that the 1952 cohort of women did not comply completely with the reform and also opted for early retirement options.

3 Identification Strategy

This paper aims at assessing the effect of the Monti-Fornero pension reform on the likelihood that women retire early by using OD, and on the annuity they eventually obtain.

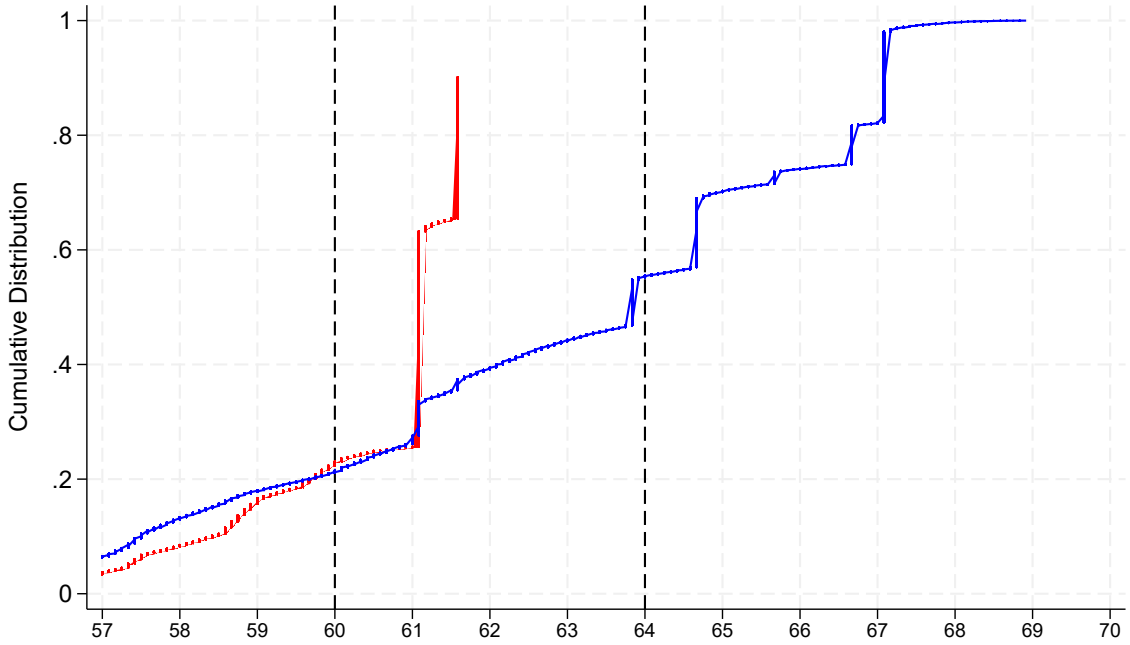
Because having 35 years of contribution is the minimum requirement for eligibility to "Opzione Donna" (OD), we want to understand how women around the 35 years cutoff responded to the reform. Thus we focus on women born in 1952, i.e. affected by the increase in SRA induced by the Monti-Fornero reform, around the 35 threshold. However, if we were to use a classic regression discontinuity design, we could not capture the reform effect, since all women born in 1952 who are above and below the threshold were treated by the reform. Furthermore, given that OD was in place from 2008, we could see a jump at the 35 year threshold which is due by the fact that the early retirement policy was in place before the enactment of the Monti-Fornero reform. To overcome these issues, we apply a Difference-in-Discontinuities (Diff-in-Disc) approach and include the 1951 cohort as a control group. The 1951 cohort was not treated by the reform and this strategy allows us to account for the *baseline* take-up of OD, which would have occurred in absence of the reform. This methodology compares the change in retirement behaviour from below to above the 35-year-of-contribution cutoff of women who were treated by the reform (i.e. born in 1952) with the same change occurred for women who were not treated (i.e. born in 1951).

Figure 2: Distribution of years of contribution at retirement, by cohort



Notes: The graph show the number of years of contribution by cohort at the retirement age. We select women who retired from 2011 to 2020. **Source**: own elaborations on INPS data

Figure 3: Cumulative Age of retirement by cohort



Notes: The graphs show the cumulative distribution of the retirement age for each cohort, for women who retired from 2008 to 2020. Cohort 1951 is in red, while cohort 1952 in blue. **Source**: Own elaborations on INPS data.

We estimate the model parametrically. The baseline Diff-in-Disc analysis is defined as follows:

$$Y_{ij} = \gamma_0 + \gamma_1 Above35_{ij} + \gamma_2 f(C_{ij} - c) + \gamma_3 f(C_{ij} - c)(Above35_{ij}) + \gamma_4 f(C_{ij} - c)(Above35_{ij} - 1) + \gamma_5 Treat_{ij} + \gamma_6 Above35_{ij} Treat_{ij} + \xi_{ij} \quad (1)$$

Where Y_{ij} is the outcome for woman i born in cohort j, which can be either the retirement age or the pension annuity. The variable C_{ij} is our running variable, which is the number of months of contributions at age 60. The running variable is measured on 31st December 2011 for the 1951 cohort, and on 31st December 2012 for the 1952 cohort, and those dates where explicitly mentioned in the laws implementing the Monti-Fornero reform.[8] The running variable is normalized around the cutoff of 35 years of contributions (which correspond to 420 months), so that $c = 0$ at the cutoff. The dummy variable $Above35_{ij}$ indicates whether the woman has more than 35 years of contributions at age 60. $Treat_{ij}$ is a binary variable indicating whether the woman belongs to the 1952 cohort, affected by the Monti-Fornero reform. In the specification, we allow for different slopes on both sides of the cutoff, which are captured by the coefficients γ_3 and γ_4.

The coefficient of interests for our analysis is the one of the interaction term $Above35_{ij} Treat_{ij}$, i.e. γ_6, which captures the effect of being affected by the reform and of having more than 35 years of contributions. This coefficient tells us whether women subject to the increase in SRA, who had more than 35 years of contributions at age 60, opt for the early retirement scheme OD, at the cost of a penalty in the annuity induced by the defined-contribution scheme. We expect that women with less than 35 years of contributions who are not eligible for any form of early retirement scheme, are thus forced to stay in the labor market. On the contrary, women who are just above the 35-year-of-contribution cutoff have the option to exit from the labor market before reaching the new SRA.

[8] According to Law 214/2011, as reported by INPS interpretative norms number 35/2012, paragraph 6.(b), Exceptional provisions (Art. 24(15-bis)):"female employees in the private sector who are members of the A.G.O. (Compulsory General Insurance) and its substitutes may alternatively receive old-age benefits upon having contributions at 31st December 1995; and upon reaching the age of 64, if they have, as at 31 December 2012, a contribution period of at least 20 years and an age of at least 60."

The model is estimated using first-order polynomial (Gelman & Imbens 2019), and we use a triangular kernel (Cheng et al. 1997). Standard errors are clustered at the running variable level (i.e. months of contributions).

Given that we estimate the effect of the reform parametrically, the choice of the bandwidth is of crucial importance. In the baseline analysis, we adopt a bandwidth of one year of contribution, but we repeat the analysis using a bandwidth of 9 to 15 months of contribution.

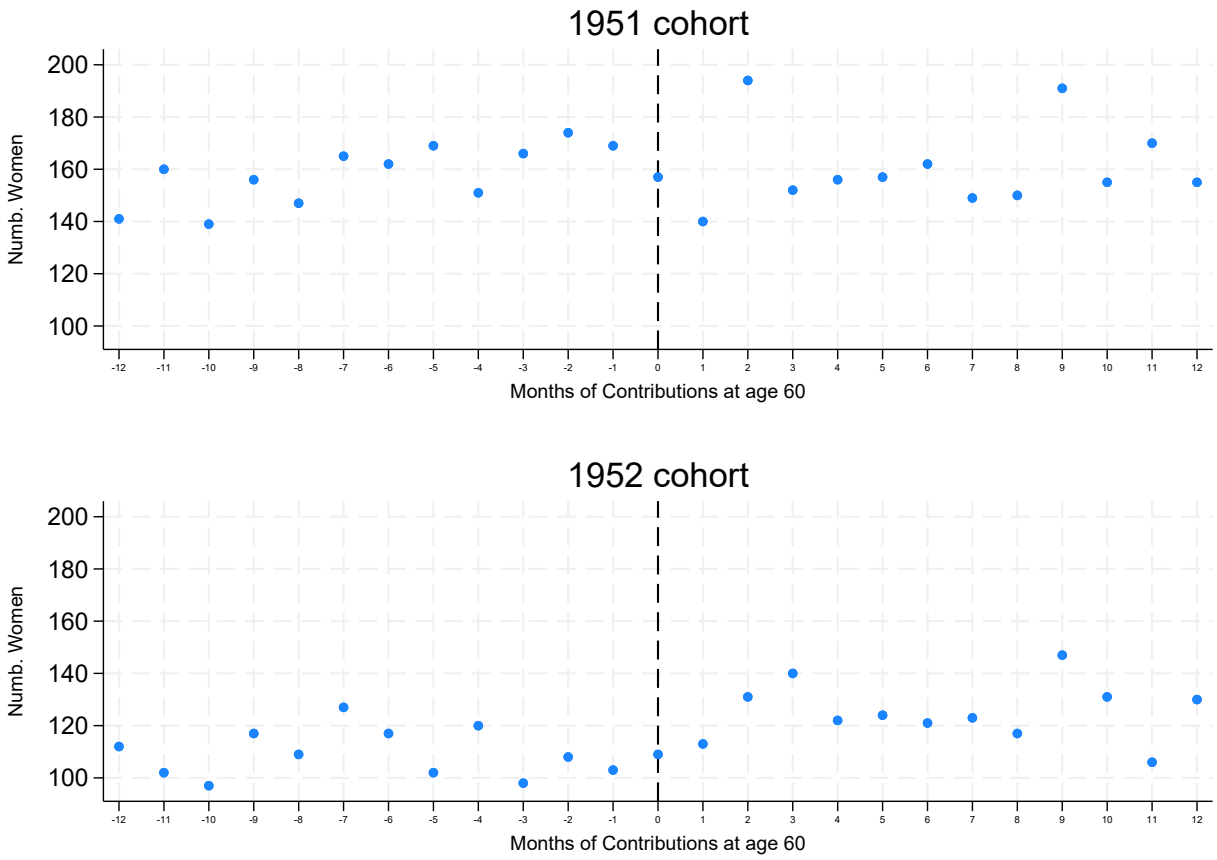
The coefficients of the interaction terms give the effect of the Monti-Fornero reform γ_6 in Equation 1, under the assumptions that (i) the running variable is continuous at the cutoffs, (ii) women below and above each cutoff are similar on many dimensions, and (iii) the 1951 and 1952 cohorts are similar in observed and unobserved characteristics.

We test the first assumption by plotting the running variable (months of contributions) separately for the 1951 and the 1952 cohorts. Figure 4 shows no discontinuity in the number of years of contributions for both cohorts. A complementary assumption requires that there is no manipulation in the running variable, but given that our running variables depend on the actual months of work performed during the woman's life cycle we do not expect this to be easily manipulated once retirement age approaches.[9]

In order to check for the second assumption, we conduct a balance test and run a regression-discontinuity by cohort and use the same contribution threshold of Equation 1. We use as dependent variables the woman's characteristics that we observe in the administrative data, such as geographical residence, whether married, whether having a survival pension, the presence of sick leave, of family leave, the education level, whether in a high paid job and whether the

[9]We also consider whether the reform introduced other instruments that could be used to retire earlier. The Italian pension system gives the possibility to workers to pay out the years spent in tertiary education in order to consider them as "years of contributions", from 1974 (Law 114/1974). However, this feature is unlikely to matter in our context, considering that we focus on women born at the beginning of the 1950s, and that very few of them completed tertiary education. According to EUROSTAT, only 10% of Italian women between 55 and 64 years of age had completed tertiary education (ISCED levels 5-8) in 2011; the same figure in France or Germany was about 20%. Furthermore, the Monti-Fornero reform did not change this possibility of accounting for years spent in tertiary education, and, in our data, we can control for this information because it is available for individuals who decided to count these years of contributions. Other forms of early retirement scheme such as the so called "APE" (State Pension Advance, Social or Voluntary) was introduced only in 2017, when women born in 1952 were already eligible for the old age pension. Thus, they were not affected by this early retirement option.

Figure 4: Density of the running variable



Notes. The graphs report the number of women by cohort at the years of contribution at age 60, following the running variable specification. The cutoff of 35 year is reported at 0, and correspond to the dashed line. We consider 12 months at each side of the cutoff. **Source**: own elaborations on INPS data

woman had any unemployment spell [10] Results are available in Appendix Figure A-1, and do not indicate differences among cohorts in most cases considered. Notice also that in the baseline specification we control for regional fixed effects, as well as for the woman's marital status and for the information on whether she receives a survival pension. Furthermore, we perform robustness analysis in which we control for all the variables reported in Figure A-1.

Figure 5 shows, graphically, the variations in age at retirement and annuity induced by the 35-year-of-contribution cutoff for each cohort. Regarding retirement age in Panel (a), we do not observe any jump for the 1951 cohort. This suggests that women not affected by the Monti-Fornero reform have no incentive to retire earlier, i.e. their SRA was 60. For women born in 1952, for whom SRA was increased until 64, we observe a decrease in retirement age once the 35-years-of-contribution threshold is passed from below, which suggests that for these women, early retirement may be more appealing despite the penalty. The implications of such a decision become more apparent in Panel (b), in which we observe that women of the 1952 cohort treated by the Monti-Fornero reform, which had more than 35 years of contributions at age 60, face a drop in the annuity they receive, compared to women with less than 35 years of contributions which were forced to stay in the labor market longer.

4 Data

For the analysis, we use two sources of administrative data from the Italian Social Security Institute (*Instituto Nazionale di Previdenza Sociale*, INPS): (i) data on the universe of retirees, and (ii) data on the working careers history of individuals.

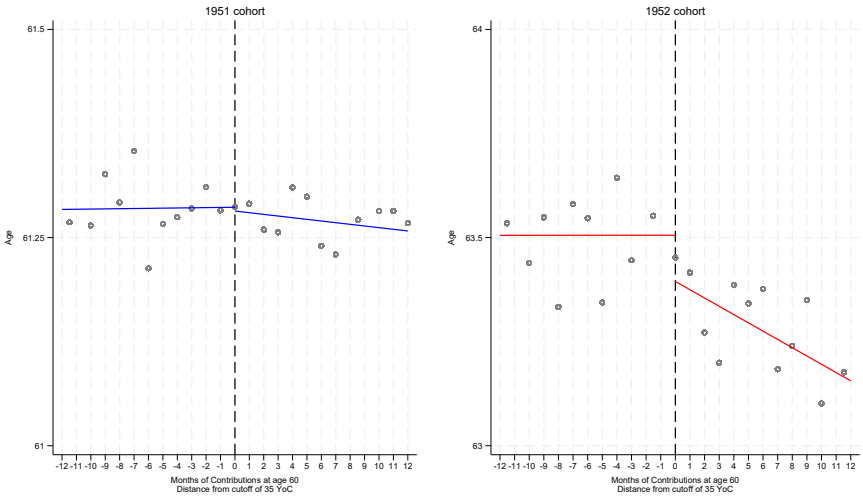
The first dataset includes all retired individuals from 1998 to 2024. It provides information about the type of pension (old age, seniority, survival, invalidity and disability), the month and year in which the pension has started, its monetary value, and the pension fund that provides the annuity.

The second dataset, instead, comprehends the Italian working population born from 1950 onward: it describes the working career of workers from the non-agricultural private sector,

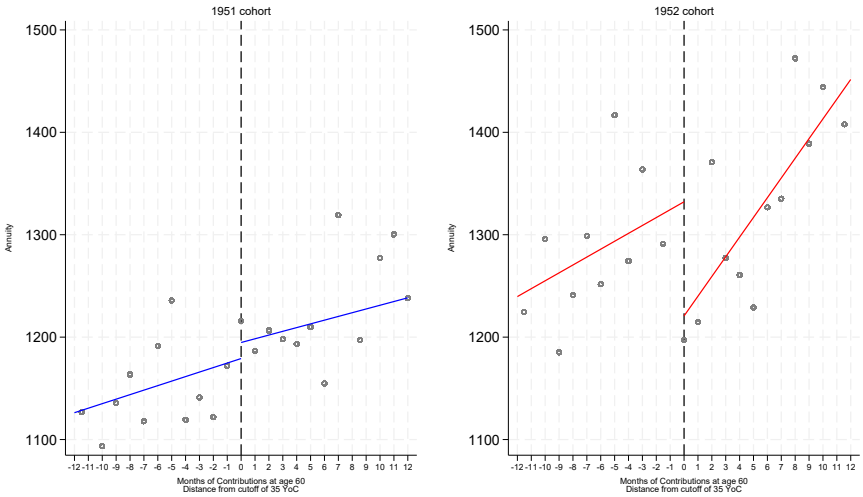
[10] More details on the data will be provided in the next session 4.

Figure 5: Graphical evidence at the 35-year-of-contribution cutoff: age at retirement and annuity

(a) Retirement age



(b) Annuity



Notes: These graphs show the variation in the age of retirement (a) and the annuity (b) by cohort. We centered the analysis at 35 years of contribution, represented at 0 in the pictures. We consider a 12-month bandwidth from each side of the cutoff. **Source**: Own elaborations on INPS data.

starting from the first to the last job spell available. It includes periods of sickness, maternity, parental and family leave. Information about the salary and hours worked are also present. We use this dataset to construct information on the years of contribution accrued by each individual at any age, as well as to recover information on unemployment, sick leave and family leave.

For our analysis, we select women born in 1951 or 1952, who retire with the old age or seniority pension. We include women retiring between 2011 and one year after the statutory retirement age, so till 2013 for the 1951 cohort and till 2017 for the 1952 one. We also observe their complete career history. In fact, we use the information about the working career to recover our running variable, which is the number of months of contributions obtained by each woman at age 60, i.e. December 31st, 2011 for the 1951 cohort, and December 31st, 2012 for the 1952 cohort.[11] The main outcome variables for our analysis are the age at retirement, measured in months, and the monthly annuity the woman receives upon retirement, expressed in 2020 Euro.

From the data, we can recover additional information for the sensitivity checks presented below. We know the marital status of the women[12], whether they received a survival pension and the place of residence at the time of the first pension received. We compute a set of dummy variables equal to one if the woman has family, sick or unemployment leave spells in the last year of work above the median value of the overall sample of women who retired from 2011 to 2017. In addition, we compute a dummy variable equal to one if the last salary was above the median value of the salary of the overall sample of women working.

As described in Section 2.1, a crucial policy change in the Italian pension system was introduced by the 1995 Reform, which gradually changed the pension computation method from a defined-benefit scheme to a defined-contribution scheme. In our sample, we observe women who lie under the defined-benefit, mixed or defined-contribution scheme, depending on the first year of contribution available in the data, and on the accrued contribution at 31st December

[11] As pointed out in Section 3, this is a crucial variable for our analysis, because this is the threshold used by the Monti-Fornero laws to identify treated and untreated cohorts. As women born in 1951 become 60 in 2011, we focus our analysis on women who are not yet retired in 2011, i.e. who haven't used any forms of early retirement schemes before the Monti-Fornero reform was enacted.

[12] Although we know that couples could have joint decisions to retire (Banks et al. 2010, Stancanelli & Soest 2012, Hospido & Zamarro 2014, Ciani 2016, Stancanelli 2017), we cannot identify the partner in the data due to privacy reason.

1995.

Finally, the data allows us to observe the sector of the last employment (for a 13% random sample) and the level of education, which is available from a separate dataset, which gathers compulsory communications of firms regarding changes in job positions and is available from 2010 onward. Given that these variables are not available for the universe of women born in 1951/1952, we use them only in a robustness analysis.

The baseline analysis is conducted on a sample of women within one year from the 35-year-of-contribution cutoff, which comprises 6708 observations, for which we observe all the variables of interest. Table A in Appendix compares the characteristics of the sample used for the analysis with the ones of the entire sample of women born in 1951/1952 and retired between 2011 and 2020, for which we have information in the career dataset. The Table shows that the characteristics are similar in terms of the distribution.

5 Results

Table 3 report the baseline results of the analysis. We refer to age at retirement (defined in months) in Panel A, and to the monthly annuity women receive upon retirement in Panel B. We test the sensitivity of the results by adding one fixed effect at time (regional and marital) and report them in the Table: the main evidence is confirmed.

The coefficient of the variable $TreatedCohort$ refers to coefficient γ_5 in Equation 1 and identifies the effect of belonging to the 1952 cohort and thus being affected by the Monti-Fornero reform, provided that these women have less than 35 years of contributions at age 60, and are not eligible for early retirement with OD. In other words, the coefficients of the variable $TreatedCohort$ give us the *intended* effect of the Monti-Fornero reform. Results show that women born in 1952, who have less than 35 years of contributions, retire 26 months (2 years and 2 months) later than the control group, which is represented by the 1951 cohort with less than 35 years of contributions. Considering that the average retirement age for the control group is 61.8 years, this result implies that the 1952 cohort without an early retirement option retires at

age 64, which suggests a full compliance with the intentions of the reform. The longer working career implies that these women earn 144 Euros more per month, which corresponds to a 11% increase in monthly annuity compared to the average annuity received by women born in 1951 who have less than 35 years of contributions at age 60.

The coefficient of the variable $AboveCutoff$ refers to coefficient γ_1 in Equation 1, and represents the effect of having more than 35 years of contributions for the 1951 cohort; in other words, this coefficient captures any potential take-up of the early retirement scheme OD for the 1951 cohort. The coefficients reported in Table 3 suggest that OD was barely adopted by the cohort not affected by the Monti-Fornero reform: in fact, the coefficient on age at retirement is small and positive, and the one on annuity is not statistically significant. This finding is not surprising: OD can be adopted from age 57 onward, and the SRA before the Monti-Fornero reform was implemented was 60; considering the monetary penalty induced by the take-up of OD, and the very small distance between the two age limits (57 vs. 60), most women may have decided to just wait for the statutory age to retire in order to obtain the full annuity. Another potential explanation for this finding may be due to our sample selection, because we only keep women who are not yet retired in 2011. In other words, if a woman born in 1951 decides to opt for OD and retires in 2010 at age 59, she is no longer in our sample. However, it should be noticed that if she could do that, that means that she had more than 35 years of contributions at age 59, e.g. 35+1 month. At age 60 she would have 36+1 months of contributions, and would be still out of our sample because we use a bandwidth of 1 year. Hence, our small bandwidth ensures that the results are not driven by this type of behaviour. Finally, another explanation is that before the Monti-Fornero reform, individuals had to wait a time window to retire after they became eligible, this time window was about 6 months, which would be reflected in the age of retirement.

The coefficients of interest for our analysis are the ones of the interaction variable $Above * TreatedCohort$, which correspond to coefficients γ_6 in Equation 1, and thus represents our Diff-in-Disc estimates. These coefficients represent the differential effect of having more than 35 years of contributions (instead of less than 35 years of contributions), and thus being eligible for OD,

between the 1952 cohort who was affected by the Monti-Fornero reform and the 1951 cohort. Our results indicate that, with the postponement in full retirement, the difference in retirement age between women eligible and not eligible for OD decreases by 2 months, suggesting that women affected by the reform are more likely to use the early retirement scheme, though the effect is not sizable. However, when we consider the woman's annuity as an outcome, in column (iv), we observe that the differential in annuity between OD eligible and not eligible women decreases by 66 euros with the increase in statutory retirement age. Considering that the early retirement scheme implied a penalization in the annuity induced by the methodology adopted to compute the pension amount (Defined-Contribution instead of Defined-Benefit), we interpret this negative effect as further evidence of the take-up of OD, which thus implies a substantial drop, even if we only consider the monthly annuity received immediately upon retirement.[13] This penalty is equivalent to a 5% loss in the annuity for life.

Table 3: Baseline results on the age of retirement and the annuity

	(i)	(ii)	(iii)	(iv)
Panel A. Retirement Age (months)				
Above	0.1757	0.2337	0.1997	0.2468
	(0.3224)	(0.3154)	(0.3205)	(0.3166)
TreatedCohort	26.7644***	26.7391***	26.7661***	26.7368***
	(0.3939)	(0.4145)	(0.3913)	(0.4138)
Above×TreatedCohort	-2.2131***	-2.1728***	-2.2134***	-2.1663***
	(0.5190)	(0.5314)	(0.5217)	(0.5332)
Panel B. Annuity (2020 Euros)				
Above	0.2931	2.5516	-6.4008	-1.8187
	(22.7216)	(18.4562)	(23.1060)	(18.5953)
TreatedCohort	144.7474***	147.3507***	141.9041***	144.8512***
	(14.9601)	(14.6407)	(15.0377)	(14.3837)
Above×TreatedCohort	-60.5231*	-69.5766**	-56.1814*	-66.3480**
	(29.3801)	(28.2538)	(29.0978)	(27.8664)
Region FE		✓		✓
Married/Survival pension			✓	✓
N	6708	6708	6708	6708

Notes: The table reports the results of a parametric estimation of Equation 1 (baseline specification), with the age of retirement as dependent variables in column (i) and the annuity amount in columns (ii). The variable *Above* indicates whether the woman has more than 35 years of contributions at age 60. Standard errors are clustered at the months of contribution level. The bandwidth is 12 months. P-values: * p<0.10, ** p<0.05, *** p<0.01
Source: Own elaborations on INPS data.

[13] In section 6, we will assess whether such penalty is confirmed in the woman's lifetime earnings.

5.1 Sensitivity analysis

We test the robustness of our results under three main dimensions: (i) we control for potential variables that may systematically jump at the 35-year-of-contribution cutoff (as reported in Figure A-1 in Appendix); (ii) we change the bandwidth selection; (iii) we provide estimates at different cutoffs.

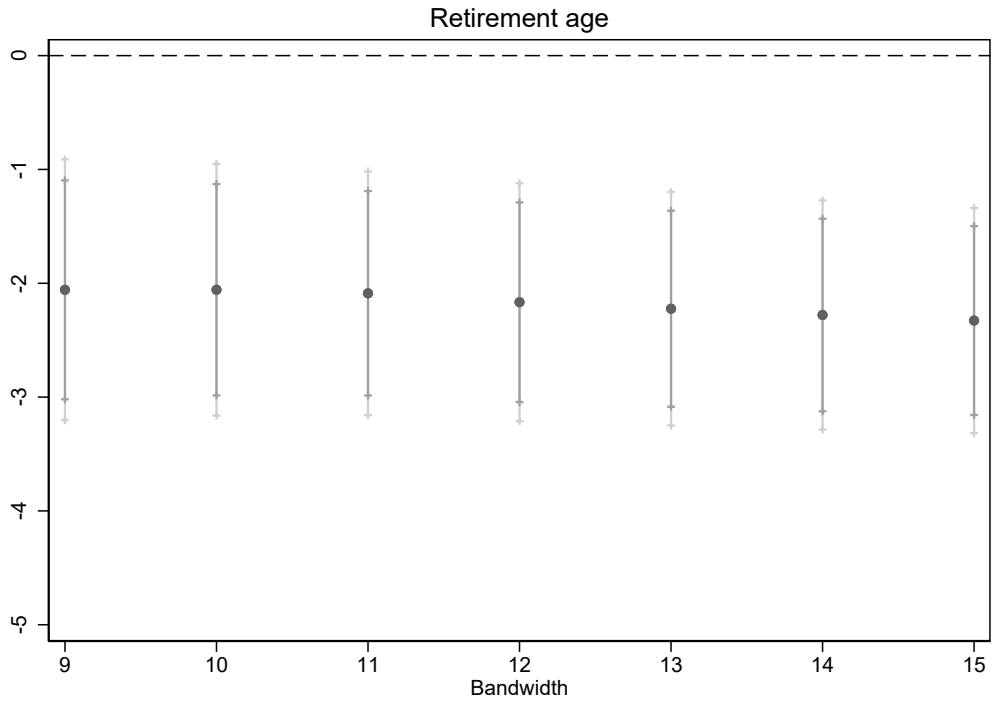
Table 4 reports the baseline results when we control for additional characteristics of the women in the sample. In column (i) we control for whether the woman has a low labor market attachment, which is measured as unemployment, sick or family leave above the median Then, column (ii) controls for having the last wage above the median wage, column (iii) if they were under the mixed computation scheme, column (iv) controls for being a part-time worker in the last job. Finally in column (v) we control for the sector of the workers, although available for a subsample, as well as having higher education in column (vi). Panel A shows the results for the age of retirement for the coefficient of interest: the results for the Diff-in-Disc are significant and confirm the effect of 2 to 7 months of anticipation for the treated cohort with more than 35 years of contribution. This evidence is in line with the baseline found in Table 3 and confirms the robustness of our strategy. Panel B of the Table reports evidence for the annuity, and also in this case the results are robust to the inclusion of individuals' characteristics.

Second, we test the sensitivity of the results to the choice of bandwidth. To do that, we run the baseline model with different bandwidth specifications. We select bandwidth from 9 to 15 months and report the estimated coefficients of interests for the Diff-in-Disc estimates in Figures 6a and 6b. We observe that the results are stable across the different specifications, the estimated effect on annuity do not lose significance as long as we enlarge the bandwidth; the effects on annuity are always negative, and, when using a bandwidth of 15 months, the coefficient is still significant at the 5% and 10% level.

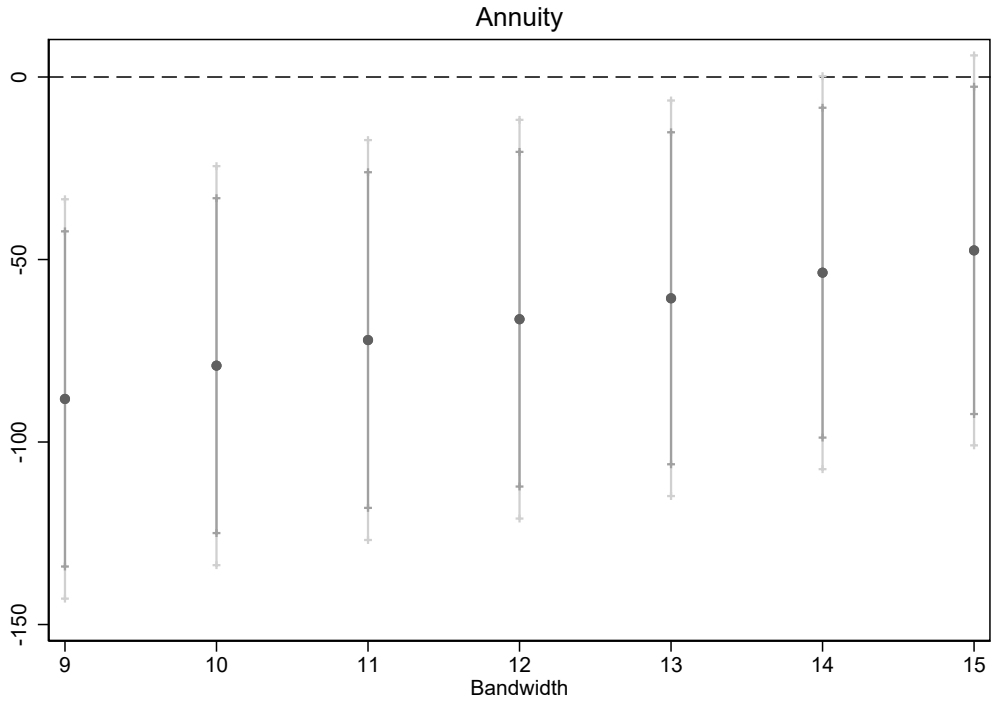
Third, we perform a set of placebo tests to assess the possibility that our results arise from random chance rather than the causal effect of the Monti-Fornero reform. Figures 7a and 7b show the results of the models on the age of retirement and annuity, respectively, for the cutoffs of 30, 32 and 37 years of contributions. At these thresholds, we expect to find no effect of

Figure 6: Results on the age of retirement and the annuity with different bandwidth

(a)



(b)



Notes The figures report the results of a parametric estimation of Equation 1 (baseline specification), with the age of retirement as dependent variables in Figures (a) and the annuity amount in Figures (b). We report the coefficient of interest for Diff-in-Disc ($Above * TreatedCohort$) estimates at 5% and 10% level of significance. We select bandwidth from 9 to 15 months on each side of the cutoff, as reported on the horizontal axis. Standard errors are clustered at the months of contribution. **Source**: Own elaborations on INPS data.

Table 4: Results on the Age and Annuity by controlling for additional characteristics

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Panel A. Retirement Age						
Above×TreatedCohort	-2.1235***	-2.1662***	-2.1645***	-2.1776***	-7.8600***	-3.2009***
	(0.5557)	(0.5302)	(0.5332)	(0.5312)	(2.2997)	(0.8064)
Panel B. Annuity						
Above×TreatedCohort	-62.4443**	-73.4161**	-65.9585**	-67.2537**	-185.8279*	-75.0580*
	(27.7374)	(28.9793)	(27.9904)	(27.7259)	(94.9791)	(41.6116)
Low lbr mkt attachment	✓					
Last wage above median		✓				
Mixed contr.scheme			✓			
Last job PT				✓		
Sector of last empl.					✓	
College educ						✓
N	6708	6708	6708	6708	1537	2906

Notes. The table reports the results of a parametric estimation of Equation 1 (baseline specification), for age at retirement (Panel A) and annuity (Panel B). We control for marital status, survival pension, region and add additional controls one by one, as reported in the bottom of the table. In particular we control for having a low labor market attachment, having the last wage above the median, being under the mixed contribution scheme, being a part-time worker in the last job, sector fixed-effect and having a college education. Standard errors are clustered at the months of contribution. p-values: * p<0.10, ** p<0.05, *** p<0.01
Source: Own elaborations on INPS data.

the reform on the outcomes considered, given that these thresholds are not related to the early retirement option. Indeed, the figures show no significant effect both on the retirement age and on annuity, at the different cutoffs. This result is reassuring and confirms that the effect found at the 35 year-of-contributions threshold captures the effect of the interaction between the OD scheme and the Monti-Fornero reform.

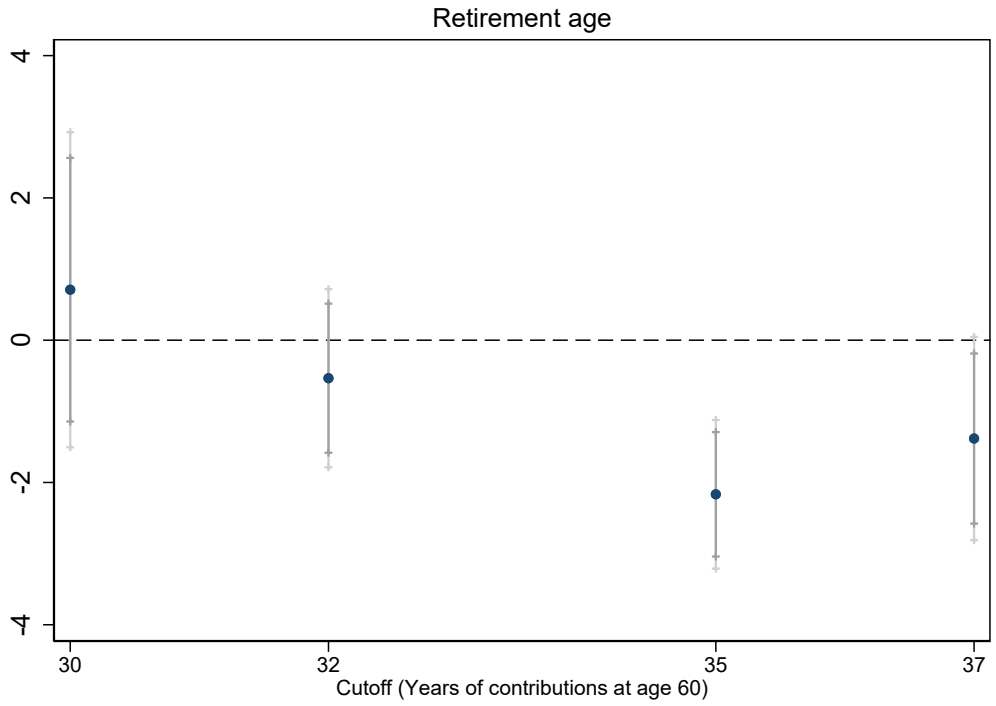
5.2 Heterogeneous effects

In this section, we investigate the presence of any potential heterogeneity in the results.

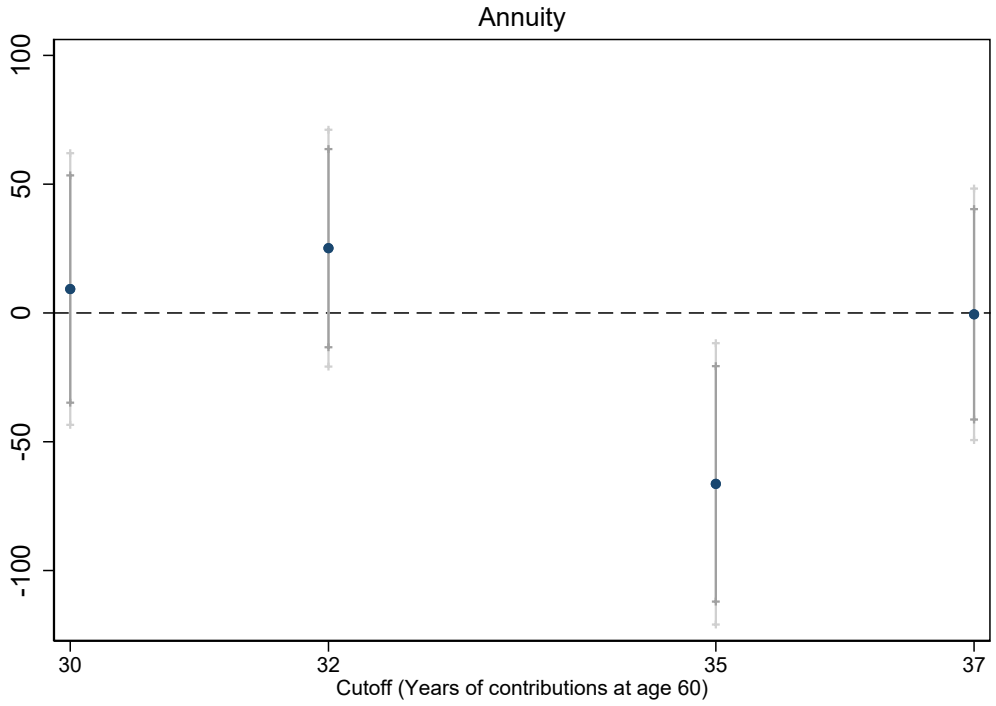
We split the sample according to several important characteristics and run separate analysis by subgroup. In particular we focuse on labor market attachment, working part-time vs full-time and the type of contribution scheme (defined benefit vs mixed). The results are reported in Table 5. In Panel A, when looking at the effect on age of retirement, women with low labor market attachment, working full time and with the defined-benefit scheme are the one retiring earlier compared to the other groups. This evidence is suggesting that attachment to labor market plays a role but also that those working full-time and under the most generous scheme

Figure 7: Results on the age of retirement and the annuity with different cutoffs

(a)



(b)



Notes The figures report the results of a parametric estimation of Equation 1 (baseline specification), with the age of retirement as dependent variable in Figure (a) and the annuity amount in Figure (b). We report the coefficient of interest for the Diff-in-Disc (Above×TreatedCohort) estimates. We select cutoffs 30-32-35-37 years of contribution, as reported on the horizontal axis. Results are reported at 10% and 5% significance level. Standard errors are clustered at the months of contribution level. **Source**: Own elaborations on INPS data.

decide to retire earlier. This evidence is also confirmed by the results on the annuity in panel B. Women with low attachment to labor market experience the highest penalty of abour 140 euro . However, the result is also significant for full-time workers (-80 euro) and under the defined benefit (-68 euro).

Table 5: Results on the Age and Annuity by group characteristics

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	Lbr mkt attachment		Working time		Contribution scheme	
	Low	High	Part time	Full time	Defined-benefit	Mixed
Panel A. Retirement Age						
Above×TreatedCohort	-3.8748***	-0.4946	-1.9469	-2.3193***	-3.8216***	-1.1461
	(1.0606)	(0.7513)	(1.6501)	(0.7107)	(0.8959)	(0.8845)
Panel B. Annuity						
Above×TreatedCohort	-139.4822***	-1.5680	-36.8912	-79.8125**	-67.9116*	-54.9768
	(35.6745)	(33.6960)	(52.1425)	(33.3139)	(38.5675)	(44.5785)
N	2952	3756	1482	5226	2787	3921

Notes. The table reports the results of a parametric estimation of Equation 1 (baseline specification), for age at retirement (Panel A) and annuity (Panel B). We report the coefficient of interest of the Diff-in-Disc estimates. We control for region, marital status and survival pension. Standard errors are clustered at the months of contribution. p-values: * p<0.10, ** p<0.05, *** p<0.01
Source: Own elaborations on INPS data.

6 Labor supply semi-elasticity and Social Security Wealth

In this section, we focus on the semi-elasticity of the labor supply of women treated by the reform. We refer to semi-elasticity instead of elasticity because we do not know the respective monetary amount of the additional years of contribution that the reform had foreseen.

The main concept is that the reform aimed at keeping women born in 1952 at least an additional four years in the labor market, by simply increasing the retirement age for the old age pension of four years. However, as we show in section 5, women just above the 35 year cutoff respond to the reform and retire (slightly) early. So, we proceed by computing the semi-elasticity of the labor supply to understand how (in)elastic the response was to the reform.

To do that, we follow Bozio (2008) and compute the semi-elasticity as follow:

$$Semi\text{-}elasticity = \frac{\Delta Age}{\Delta Years of Contribution} \tag{2}$$

Where $\Delta Age = \widehat{Age_{52}}$ - $\widehat{Age_{51}}$, it is the difference between the estimated age for the cohort 1952 and 1951 of Equation 1, below and above the cutoff respectively. $\Delta Years of Contribution$ equals four, which is the minimum number of additional years required by the reform to access the old age pension

If women align their labor supply to the reform requirements, we should see a *semi-elasticity*=1. If women supply less (more) than what the reform aimed, then the *semi-elasticity*< (>)1.

Table 6 reports the results. We show the estimated age by cohort below and above the cutoff, the difference and the relative semi-elasticity. We compute the analysis for the different groups based on several characteristics.

Starting from the top of the Table, women below the cutoff display a higher semi-elasticity compared to women above the cutoff in the bottom of the Table. This result is consistent with the evidence that women above the cutoff retire early and exit the labor market earlier. There are heterogeneous effects based on the different characteristics such as education and labor market attachment.

Looking at education characteristics, some differences appear. Women with low education, (below college education), are those exiting earlier the labor market compared to those with higher education. Indeed, the semi-elasticity for women with low education below the cutoff is 0.66 vs 0.71 for high educated women below the cutoff. A similar pattern appears also above the cutoff, with a semi-elasticity of 0.62 for low educated vs 0.71 for highly educated. This evidence suggests that education and information awareness might also play a role in the retirement choice.

We proceed by looking at leave characteristics such as sick leave. Starting with sick leave pattern, for women below the cutoff with higher sick leave span (above the median) the semi-elasticity is 0.52 vs 0.56 for women below the cutoff with lower sick leave span. A similar pattern is also found above the cutoff, with women with higher sick leave pattern having a semi-elasticity of 0.34 vs 0.51 for women with low sick leave span. This evidence supports that women with high leave spells exit earlier the labor market potentially due to their worse health conditions.

Above the cutoff, women with full time jobs (0.51); followed by women under the defined benefit scheme (0.48) are those exiting earlier the labor market. These women, along with those living in the centre-south and with high sick leave (0.48 and 0.34 respectively), are those retiring earlier among those above the cutoff.

Overall, this result is important because it shows that those with low education or more leave spells tend to retire early and consequently end up with smaller pensions. Those women are also more exposed to poverty or financial hardship in the long run.

Table 6: Semi-elasticity of the labor supply

	(i)	(ii)	(iii)	(iv)
Below 35	1952	1951	difference	semi-elasticity
All Sample	63.46	61.23	2.22	0.55
High Educ	63.71	60.87	2.85	0.71
Low educ	64.01	61.36	2.65	0.66
Low attach	63.55	61.16	2.39	0.60
High attach	63.34	61.24	2.10	0.53
Part time	63.61	61.36	2.25	0.56
Full time	63.42	61.19	2.23	0.56
Sick Leave above median	64.15	62.08	2.08	0.52
Sick leave below median	63.44	61.22	2.23	0.56
Mixed	63.38	61.22	2.16	0.54
DB	63.62	61.29	2.33	0.58
Salary above median	63.37	61.33	2.05	0.51
Salary below median	63.53	61.13	2.40	0.60
Above 35	1952	1951	difference	semi-elasticity
All Sample	63.28	61.23	2.04	0.51
High Educ	63.71	60.87	2.85	0.71
Low educ	63.75	61.28	2.46	0.62
Low attach	63.22	61.16	2.06	0.52
High attach	63.34	61.24	2.10	0.53
Part time	63.61	61.36	2.25	0.56
Full time	63.23	61.19	2.03	0.51
Sick Leave above median	64.15	62.79	1.36	0.34
Sick leave below median	63.26	61.22	2.04	0.51
Mixed	63.38	61.22	2.16	0.54
DB	63.30	61.37	1.93	0.48
Salary above median	63.20	61.33	1.88	0.47
Salary below median	63.33	61.13	2.20	0.55

NOTE: The ages in column (i) and (ii) are computed using the estimated age from the results of Equation 1 for each group considered. The elasticity is computed dividing the difference of col. (III) by 4, which is the difference between the new and old retirement age by the Monti-Fornero Reform.

As a second step, we focus on the reform effect on the social security wealth (SSW). The social security wealth is the expected discounted value of future benefits. We follow the literature (Feldstein 1974, Gruber & Wise 1998, 2004, 2008, Belloni et al. 2020) and define the SSW following Lalive et al. (2023):

$$SSW_i = \sum_{j=R}^{\Omega} P_{i,j}\pi(j|a)\beta^{(a-j)} \tag{3}$$

Where i is the individual, R her age of retirement, Ω is the maximum age alive (set at 110 years), a is the age after retirement, $\pi(.)$ are the survival probabilities and β is the discount factor. $P_{i,j}$ is the public annuity at the annual level. The survival probabilities are computed following the Human Mortality Database (2023). The β is set at 0.98. Understanding the effect of the reform on the SSW is particularly interesting because, as other scholars have pointed out, SSW is essential to understand retirement behaviours (Stock & Wise 1990), or the erosion of private savings (Gale 1998, Attanasio & Brugiavini 2003, Kapteyn et al. 2005, Alessie et al. 2013, Belloni & Alessie 2013). We run the analysis of Equation 1 on the SSW as outcome. Results are shown in Table 7. The same approach is used with 1 year bandwidth and errors clustered at the running variable level.

Looking at the Table, in the result of the Diff-in-Disc analysis, the coefficient of Above×TreatedCohort is negative and significant at 5% level. The magnitude of the effect is a reduction of Euro 28,270, which suggests that women born in 1952 above the cutoff have a SSW of Euro 226,730 compared to women born in 1952 below the cutoff, with a SSW of Euro 255,000. The reduction is about 11.7% compared to those born in 1952.

Our results align with the one found for the annuity and confirm the penalty for women who opt for the early retirement option.

Table 7: Results on the Social Security Wealth

Dep. Var: SSW Wealth	(i)	(ii)	(iii)	(iv)
Above	14191.461**	14709.994**	12716.198*	13753.935**
	(6836.159)	(6068.8737)	(6755.4856)	(6006.6830)
TreatedCohort	41205.3045***	41968.749***	40519.5434***	41359.5314***
	(6081.478)	(6160.132)	(6201.0110)	(6263.338)
Above×TreatedCohort	-27131.105**	-29078.4146***	-26068.5675**	-28269.254**
	(10131.878)	(10147.244)	(10334.429)	(10295.1856)
Region FE		✓		✓
Married/Survival pension			✓	✓
N	6708	6708	6708	6708

Notes. The table reports the results of a parametric estimation of Equation 1 (baseline specification), with the social security wealth (SSW) as dependent variable. We control for region, marital status and survival pension. Standard errors are clustered at the months of contribution. p-values: * p<0.10, ** p<0.05, *** p<0.01
Source: Own elaborations on INPS data.

7 Conclusion

The increasing retirement age for pensions has been crucial in many Western countries in the last decades. However, understanding how older workers responded to those reforms is crucial to better designing social security systems.

This paper investigates the response of close-to-retire women affected by a sharp increase in the statutory retirement age. The design of the reform pushed the treated women to work for at least four more years. Otherwise, the only possibility to exit the labor market was with penalised annuities for a lifetime.

Our empirical strategy focused on women with the same years of contribution, namely around the 35 year cutoff, but with different demographic ages. Indeed, the reform exempted women born in 1951, who were already 60 years old, and hit instead women born in 1952, the first treated cohort. Provided with this setting, we apply a Difference-in-Discontinuities, which compares treated and control groups based on differences in the years of contribution. We find that treated women were more likely to retire earlier before the statutory retirement age, though the effect is not sizable. When we look at the the annuity amount, we find a significant negative effect for women treated by the reform, eligible for the early retirement option, and the penalty is about 5% per year for lifetime. This evidence is only a lower bound of the penalty because we focused on women who were about to retire and were pushed to stay an additional four years.

After the reform, the average woman was forced to stay an additional seven years (since the age of retirement for the old age pension shifted from 60 to 67). Thus, future research could focus on the average annuity penalty for women with a longer retirement gap and decide to retire earlier with OD. Furthermore, we uncover heterogeneous effects based on women's characteristics. We show that those who are more likely to retire earlier are women with low labor market attachment and low education. So, women who were already among the most disadvantageous groups are those retiring earlier, despite smaller annuities.

Our most striking result is the early retirement for the first cohort treated of the decision to retire. This evidence is particularly important for several reasons. First, the reform was meant to push women to stay longer in the labor market, with the intent of reducing the budget spending for the pension system. However, our results show that women attempted, when possible, to leave the labor market earlier. Second, the choice of retire early came with a monetary cost for these women, who would retire without penalty under the pre-reform rules. Finally, claiming early with a great monetary cost suggests that women respond to the reform without following financial incentive motives. This suggests that women do not act as the classical option value model would predict, but instead, they are moved by other types of preferences and or behavioural responses. This aligns with recent evidence by Behaghel & Blau (2012), Seibold (2021), Lalive et al. (2023).

Our results have important policy implications. Women live longer than men and are more likely to spend part of their retirement in widowhood. However, sudden and unexpected pension reform might act against them and their decision to remain in the labor market longer. In particular, if the only early retirement option includes a monetary penalty, women close to retirement might be inclined to leave the labor market earlier, even at a penalty, not to stay additional years in the labor market. Women in vulnerable groups, such as those with low education and low labor market attachment, seem to be more sensitive to this type of decision. This choice might pose concerns and expose them to difficult financial situations later in life. Policymakers should consider this evidence when implementing welfare reforms.

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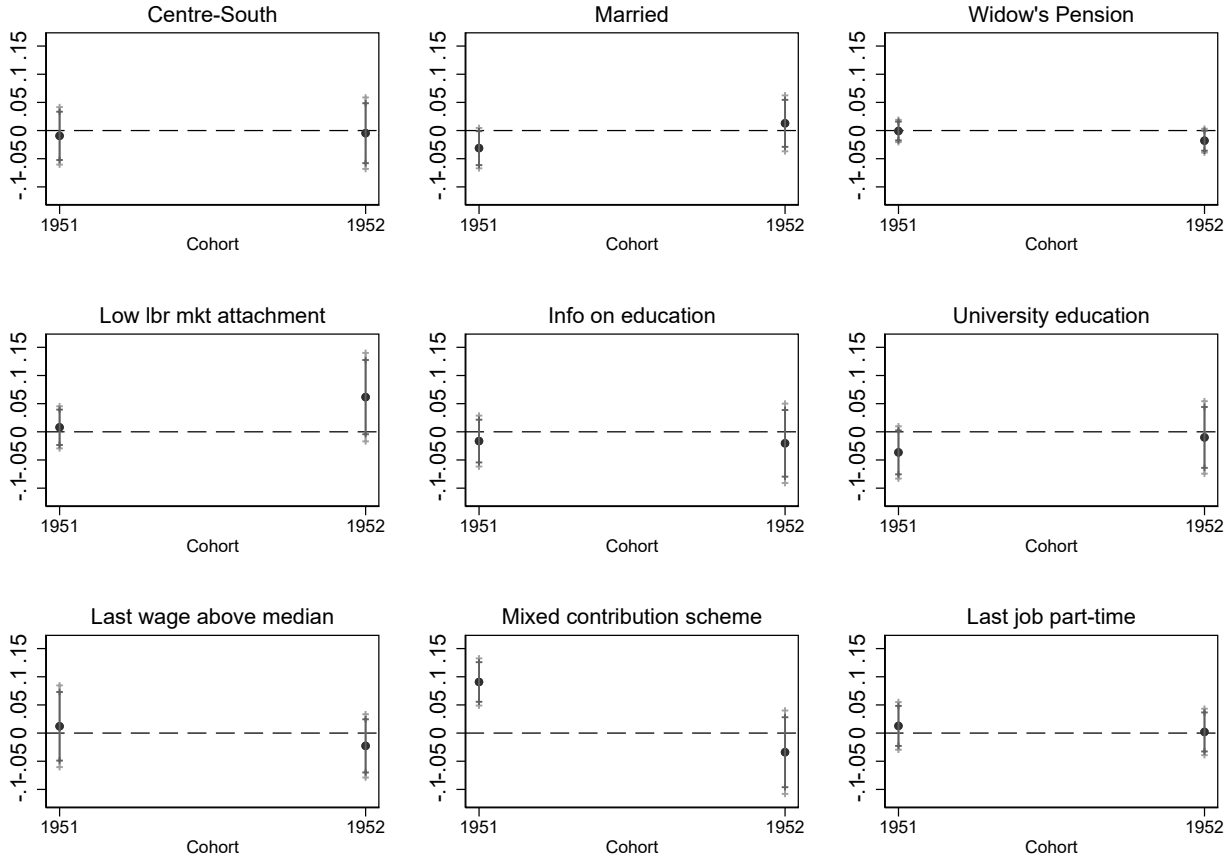
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A Appendix A

Figure A-1: Continuity of the covariates at the 35-year-of-contribution cutoff by cohort



Notes: The Figures report the test for the continuity of the individuals' characteristics in the baseline analysis. We plot the RD coefficient (35 years of contribution cutoff), with its confidence intervals. We run the analysis separately by cohort. Each sub-figure report the dependent variable in the Title.
Source: Own elaborations on INPS data.

Table A-1: Descriptive statistics for the variable of interests

Variable	Sample	Entire Sample	Statistics	Sample	Entire Sample
	Mean	Mean	T stat	N	N
Age at retirement	62.20	62.07	-6.05	6708	20155
Annuity	1240.105	1288.142	5.45	6708	20155
Centre	0.236	0.233	-0.6	6708	20155
South	0.16	0.161	0.3	6708	20155
North	0.604	0.606	0.3	6708	20155
Ever married	0.891	0.898	1.65	6708	20155
Low attachment	0.44	0.433	-1.05	6708	20155
Last salary above median	0.442	0.443	0.2	6708	20155
Mixed scheme	0.585	0.394	-27.65	6708	20155
Part time	0.221	0.206	-2.7	6708	20155

Notes: This table reports the mean by sample for women born in 1951 and 1952 who retired from 2011 to 2017. Sample 35 refers to women included in the estimated sample with 34 to 36 years of contribution. Entire Sample refers to all the women available in the career dataset who retired from 2011 to 2017, with any years of contributions. **Source**: Own elaborations on INPS data.