



MASTERARBEIT | MASTER'S THESIS

Titel | Title

Early Retirement Behaviour Before and After the 2012 Fornero
Reform in Italy

verfasst von | submitted by

Dario Cavarretta

angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of
Master of Science (MSc)

Wien | Vienna, 2026

Studienkennzahl lt. Studienblatt | Degree
programme code as it appears on the
student record sheet:

UA 066 913

Studienrichtung lt. Studienblatt | Degree
programme as it appears on the student
record sheet:

Masterstudium Applied Economics

Betreut von | Supervisor:

Univ.-Prof. Dipl.-Vw. Monika Gehrig-Merz PhD

Zusammenfassung

Diese Masterarbeit untersucht, wie die italienische Rentenreform von 2012 (Fornero-Reform) das Frühverrentungsverhalten beeinflusst hat. Die Reform erhöhte die Beitragsanforderungen für den vorzeitigen Ruhestand deutlich und hob die gesetzlichen Renteneintrittsalter an, um die finanzielle Nachhaltigkeit des Rentensystems zu verbessern.

Auf Grundlage von Längsschnittdaten aus dem Survey of Health, Ageing and Retirement in Europe (SHARE) rekonstruiere ich Erwerbsbiografien, die Anspruchsberechtigung für Frühverrentung vor und nach der Reform, individuelle und haushaltsbezogene Merkmale sowie den Rentenstatus der Personen. Die Analyse verwendet einen Difference-in-Differences-Ansatz innerhalb eines diskreten Zeit-Hazardmodells der Verrentung, um Arbeitnehmer zu vergleichen, die infolge der Reform ihre Anspruchsberechtigung verloren haben, mit ähnlichen Arbeitnehmern, deren Anspruch unverändert blieb.

Die Ergebnisse zeigen, dass die Reform die gesetzliche Frühverrentung deutlich reduziert hat. Arbeitnehmer, die ihre Anspruchsberechtigung verloren, gingen erheblich seltener frühzeitig in Rente und verblieben tendenziell länger im Erwerbsleben. Gleichzeitig gibt es Hinweise auf eine teilweise Substitution hin zu alternativen Frühverrentungswegen. Zudem deutet die Analyse darauf hin, dass die Reformwirkungen zwischen Individuen variieren, mit stärkeren Reaktionen bei gesünderen und einkommensstärkeren Personen.

Insgesamt legen die Ergebnisse nahe, dass strengere Zugangsvoraussetzungen zur Frühverrentung den Renteneintritt deutlich verzögern können, dass die Gesamtwirkung jedoch teilweise durch alternative Austrittswege aus dem Arbeitsmarkt abgeschwächt werden kann. Die Studie trägt damit zum Verständnis bei, wie Rentenreformen das Arbeitsangebot älterer Arbeitnehmer und die Nachhaltigkeit öffentlicher Rentensysteme beeinflussen.

Abstract

This thesis studies how the 2012 Fornero pension reform affected early retirement behavior in Italy. The reform sharply increased the contribution requirements for early retirement and raised statutory retirement ages to improve the financial sustainability of the pension system.

Using longitudinal data from the Survey of Health, Aging and Retirement in Europe (SHARE), I reconstruct employment histories, eligibility for early retirement before and after the reform, individual and household characteristics, and retirement status. The analysis applies a difference-in-differences approach within a discrete-time retirement hazard framework to compare workers who lost eligibility due to the reform with similar workers whose eligibility did not change.

The results show that the reform strongly reduced statutory early retirement. Workers who lost eligibility were substantially less likely to retire early and tended to remain employed longer. However, there is evidence of partial substitution toward alternative early-retirement pathways. The analysis also suggests heterogeneous reform effects, with stronger responses among healthier and higher-income individuals.

Overall, the findings indicate that tightening pension eligibility rules can significantly delay retirement, although the overall impact may be partly limited by alternative exit channels. These results contribute to understanding how pension reforms influence labour supply at older ages and the sustainability of public pension systems.

AI Attribution Statement

This work was primarily created by the author. Artificial intelligence tools were used only for limited stylistic assistance, including wording suggestions, clarity improvements, and minor language corrections. All AI-assisted content was critically reviewed, edited, and approved by the author. The primary AI tool used was ChatGPT (OpenAI).

List of Tables

1	Difference-in-Differences Estimates of Statutory Early Retirement	30
2	Difference-in-Differences Estimates of Alternative Early Retirement	38
3	Placebo Difference-in-Differences Tests	44
4	Placebo Difference-in-Differences Tests	45
5	Gender Heterogeneity in Statutory Early Retirement DiD Estimates	46
6	Health Heterogeneity in Statutory Early Retirement DiD Estimates	47
7	Income Heterogeneity in Statutory Early Retirement DiD Estimates	48

List of Figures

1	Distribution of contribution years before and after the reform	18
2	Contribution years by gender before and after the reform	19
3	Distribution of observed retirement ages before and after the reform	20
4	Retirement age by gender before and after the reform	21
5	Statutory early retirement eligibility over time	22
6	Early retirement events across SER and AER	23
7	Multinomial Logit results: predicted probabilities by exit path	25
8	Predicted probabilities of retirement pathways by gender.	43
9	Event-study estimates of the effect of the Fornero reform on statutory early retirement.	44
10	Event-study estimates of the effect of the Fornero reform on alternative early retirement.	45

Contents

1	Introduction	6
2	Theoretical Framework and Institutional Background	7
2.1	Theoretical Framework	7
2.2	The Italian Pension System and Early Retirement	8
2.3	The Fornero reform and eligibility changes	10
3	Data and Empirical Setting	11
3.1	Data Sources and Sample Construction	11
3.2	Contribution Histories, Eligibility and Risk Set	14
3.3	Research Design	15

4 Descriptive Evidence on Retirement Behaviour and Eligibility	17
4.1 Contribution Histories and Retirement Ages	17
4.2 Eligibility, Exit Routes, and Observed Transitions	22
4.3 Conditional Exit Probabilities: Multinomial Logit Evidence	24
5 Analysis of the Effect of the Fornero Reform on Early Retirement Out-	
comes	26
5.1 Statutory Early Retirement	27
5.2 Distributional Heterogeneity: Gender, Health and Income	31
5.3 Alternative Early Retirement Pathways	34
6 Conclusions	39
References	41
Appendix	43

1 Introduction

Population ageing represents one of the most significant economic and fiscal challenges facing advanced economies. In many countries, increasing life expectancy and declining fertility rates have caused substantial pressure on public pension systems, raising concerns about the long-term sustainability of social security plans. In this context, governments across Europe have implemented a sequence of pension reforms to extend employment careers, discouraging early retirement, and making public pension systems more sustainable. Understanding how individuals respond to these reforms is crucial for evaluating their effectiveness and for designing policies that balance fiscal sustainability with labour-market welfare.

Italy provides a particularly interesting setting in which to study these issues. Historically, the country's pension system has been characterised by generous early-retirement possibilities, strong links between contribution histories and eligibility thresholds, and sharp gender differences in labour-market participation. Prior to 2012, early retirement represented a widely used pathway out of the labour force, especially for workers with long and stable careers. This institutional configuration led to comparatively low effective retirement ages and high public pension expenditure relative to GDP, with pension spending in Italy amounting to around 16% of GDP, among the highest in Europe (OECD; Andrieu et al., 2020).

The 2012 Fornero reform marked a major structural turning point for the country's retirement system. Introduced during the European sovereign debt crisis, the reform suddenly tightened eligibility conditions for statutory early retirement (Italy's standard and most commonly used early retirement path), increased statutory retirement ages, accelerated the transition toward a contribution-based pension framework, and sharply limited opportunities for early exit based only on contribution years. Unlike most pension reforms in Italy, the Fornero reform was implemented rapidly and with very limited transition, creating a sharp discontinuity in retirement incentives and possibilities for individuals close to the previous retirement age. As a result, the reform represents a valuable quasi-experimental setting to study how older workers adjust their retirement behaviour when a previously accessible exit route is suddenly restricted.

This thesis analyzes how the Fornero reform affected early retirement behaviour in Italy, focusing both on direct effects on statutory early retirement and potential substitution toward alternative labour-market exit pathways. The central research questions are threefold. First, did the tightening of eligibility requirements significantly reduce the incidence of statutory early retirement events? Second, were the effects heterogeneous across individuals, particularly with respect to gender, health status, and income? Third, to what extent did workers substitute toward alternative retirement routes?

To address these questions, the analysis combines detailed institutional information

on pension eligibility rules with longitudinal microdata from the Survey of Health, Ageing and Retirement in Europe (SHARE). Using job-history information, contribution years are reconstructed in order to approximate eligibility conditions under both pre- and post-reform rules. The empirical strategy uses a Difference-in-Differences framework in a discrete-time event-history model. This approach exploits the sudden policy change introduced by the reform to compare retirement hazards before and after 2012 between individuals differentially exposed to the reform. By focusing on individuals who were still working and therefore at risk of retirement, the analysis captures the dynamic timing of retirement while controlling for individual heterogeneity and common macroeconomic shocks.

The results indicate a substantial decline in statutory early retirement following the reform, consistent with the sharp tightening of eligibility requirements. The findings suggest that statutory early retirement constituted a highly used labour-market exit prior to the reform, and that after 2012 such retirement pathway was successfully sharply restricted. At the same time, the analysis suggests evidence of partial substitution toward alternative early-retirement pathways, which could potentially partially offset the overall effect of the Reform on delaying retirement. The heterogeneity analyses show that responses to the reform vary across individuals, especially based on health and income.

The remainder of the thesis is organised as follows. Section 2 outlines the theoretical framework and institutional background of the Italian pension system and the Fornero reform. Section 3 describes the data, variable construction, and empirical research design. Section 4 presents descriptive evidence on retirement behaviour and eligibility patterns before and after the reform. Section 5 develops the causal analysis of the reform's impact on early retirement outcomes and explores heterogeneity and substitution effects to alternative early retirement pathways. The final section concludes with a discussion of policy implications and ideas for future research.

2 Theoretical Framework and Institutional Background

2.1 Theoretical Framework

The theoretical framework reported in this section is particularly useful to this study because it motivates the research hypotheses: (1) the Fornero reform should reduce early retirement overall; (2) effects are likely to be heterogeneous across individuals; (3) effects are likely to be heterogeneous across different exit pathways (such as Statutory Early Retirement exits compared to Alternative Early Retirement exits and Non Pension Retirement Exits).

The analytical foundation of this thesis lies in the life-cycle model of retirement behaviour, rooted in the longstanding life-cycle and retirement literature starting from the

dynamic optimisation frameworks of Modigliani and Brumberg (1954), Feldstein (1974), and the structural retirement models of Gustman and Steinmeier (1986, 2005). Building on this tradition, Daminato and Padula (2024) extend the standard framework by explicitly incorporating detailed eligibility ages, contribution requirements, and NDC-based pension formulas into the life-cycle problem, in order to make institutional constraints central to the retirement decision framework.

The idea is that individuals make intertemporal choices about consumption, saving, and labor supply over their lifetime to maximize utility, balancing the utility of leisure in retirement against the consumption opportunities provided by continuing to work.

In this setting, retirement is not an exogenous event but a rational decision that depends on several key factors. These include preferences (the value placed on leisure and possibly health versus work), economic resources (earnings, wealth, accumulated pension entitlement), and institutional constraints (contribution requirements, eligibility ages, and pension formulas). The pension system directly links retirement timing to lifetime income and contributions: working longer increases accumulated wealth and improves annuity conversion factors, while retiring early reduces future benefits. This creates a dynamic trade-off that individuals solve when choosing the optimal retirement age.

The model also highlights important behavioural mechanisms. A tightening of pension rules, such as higher eligibility ages or a shift to a contribution-based system, raises the opportunity cost of early exit, pushing individuals to delay retirement. At the same time, the strength of this response varies between groups depending on their income, contribution history, health, and household context, and can lead to adjustments not only in when people retire but also in how they exit the labor market (e.g., through disability benefits or gender-based options, like *Opzione Donna* in Italy).

2.2 The Italian Pension System and Early Retirement

Understanding the institutional context is central to the analysis conducted in this thesis. Early retirement behaviour in Italy cannot be analyzed independently of contribution histories, employment patterns, and cohort-specific exposure to policy changes. The strong clustering of retirement transitions around eligibility thresholds, both before and after the reform, highlights the dominant role of pension rules in shaping individual exit decisions. By documenting the institutional foundations of early retirement, this section provides the necessary background for the empirical analysis that follows.

The Italian public pension system has traditionally predominantly operated on a pay-as-you-go basis (with contributions from active workers used directly to pay existing pensions) and has for a long time represented one of the most generous and costly systems among OECD countries (OECD, 2011). Until the early 1990s, pension benefits were defined following a defined-benefit logic, based on final earnings and years of contributions,

with limited adjustment for retirement age. This structure generated strong incentives for early retirement, causing a rapid increase in pension expenditure by the government.

A sequence of structural reforms progressively reshaped the system, especially from the mid-1990s onward. The 1995 Dini reform introduced a notional defined contribution (NDC) scheme for new workers, adjusting pension benefits to lifetime contributions and macroeconomic growth. However, long transition periods meant that for most workers active in the early 2000s, retirement incentives were still mostly governed by pre-reform rules. As a result, early exit from the labour market remained common in the early 2000s, especially among male full-career workers in the private and public sectors (Brugiavini & Peracchi, 2003).

By the early 2000s, Italy had one of the lowest retirement ages in Europe, alongside sharp gender and cohort disparities (OECD, 2011). In order to limit, and possibly reverse this trend, pension reforms in the 2000s and early 2010s increasingly focused on tightening eligibility conditions, harmonising rules across occupational categories, and discouraging early retirement.

In the period preceding the Fornero reform, the Italian system offered multiple pathways into retirement before the statutory pension age was reached. These included Statutory Early Retirement (SER), seniority pensions, disability pensions, and further special schemes linked to labour-market restructuring.

The most often used early-exit route was Statutory Early Retirement, which allowed individuals to retire purely based on contribution histories, regardless of age. Until 2007, eligibility could be reached with 35 years of contributions and 57 years of age, or with 40 years of contributions, regardless of age. This feature was particularly attractive for workers with early and uninterrupted careers, enabling retirement well before the statutory old age (60 for women, 65 for men).

In an attempt to limit early exits, the mid-2000s saw the introduction of so-called “quota” rules. These rules required that the sum of age and contribution years reached a specific threshold (quota 95 in 2008 and 2009 or 96 in 2010 and 2011), imposing a weak age component for individuals retiring with shorter contribution histories. However, the alternative route based on 40 years of contributions, regardless of age, remained in place. As a result, these requirements remained relatively soft and continued to favour early retirement among long-career workers.

Alongside SER, alternative early-retirement (AER) routes also played an important role. These included disability benefits, unemployment-related exits, and firm-level early-retirement agreements, particularly during phases of industrial restructuring. Although access to these pathways was theoretically conditional on health status or labour-market distress, they were often used as early-exit channels for workers with limited re-employment prospects.

Empirical evidence from administrative sources and labour-force surveys shows that,

before 2011, the average effective retirement age in Italy was several years below the statutory old-age threshold. Indeed, retirement behaviour was found to exhibit strong concentration around eligibility thresholds, especially those linked to contribution years. (INPS, 2011; ISTAT, 2011)

2.3 The Fornero reform and eligibility changes

The Fornero reform, approved in December 2011 and enacted on January 1st, 2012, in the midst of the European sovereign debt crisis, represented a structural break in the Italian pension system. Its primary objectives were fiscal consolidation, long-term financial sustainability, and alignment of Italy’s retirement patterns with demographic trends and European standards.

A central element of the reform was the sudden and sharp tightening of early-retirement eligibility. The traditional seniority pension was abolished and replaced by a much stricter contribution-based requirement. Under the new rules, access to Statutory Early Retirement became conditional on the accumulation of 42 years of contributions for women and 43 years for men, independent of age. These thresholds were also indexed to life expectancy, implying a gradual increase over time.

At the same time, the statutory old-age pension age was increased and almost unified across genders, starting at 66 years for women and 67 for men, with automatic adjustments to demographic indicators. The reform accelerated the transition toward the NDC framework, extending contribution-based logic to all workers, including those who satisfied most or all pre-reform criteria.

Unlike previous reforms, the Fornero reform was characterised by its immediacy and almost null transitional provisions. The sudden change caused many individuals who would have qualified for early retirement under pre-existing rules to lose eligibility under the new regime. It also generated a group of so-called *esodati*—workers who had exited employment before the reform under the expectation of imminent retirement but who, at the time of enactment, were not yet pension recipients and found themselves ineligible under the revised rules. This phenomenon was highly controversial and sparked intense political and social debate, ultimately leading to a series of safeguard measures that only partially mitigated their situation (INPS, 2013; Jessoula & Raitano, 2017).

The tightening of eligibility rules under the Fornero reform fundamentally changed incentives for early retirement. By raising contribution thresholds and weakening age-independent retirement possibilities, the reform disproportionately affected individuals with fragmented careers and interrupted employment histories.

Overall, the evolution of the Italian pension system from the early 2000s to the present reveals a gradual shift away from early retirement. The implementation of the Fornero reform stands out as the crucial moment in this process, transforming early retirement

from a widely accessible option into a selective route reserved almost exclusively for long-career workers.

3 Data and Empirical Setting

3.1 Data Sources and Sample Construction

The data used in this thesis is based on the Survey of Health, Ageing and Retirement in Europe (SHARE), Release 9.0.0, which covers 9 waves in the years between 2004 and 2022. SHARE is a large, harmonised, cross-national panel that collects detailed socioeconomic and health information from citizens aged 50+ and their partners in several European countries, including Italy.

The full dataset is made up of a total of 9 waves. Each one provides harmonised information on individuals' demographics, work histories, income and wealth portfolios, labour-market trajectories, pension arrangements, and late-life decisions, rendering it a suitable dataset for analysing early retirement behaviour in relation to the Fornero Reform. Indeed, SHARE has been widely used in the analysis of retirement behaviour, labour-supply responses and institutional reforms, including studies of eligibility rules and pension incentives (Börsch-Supan et al., 2013; Brugiavini & Weber, 2018).

For this study, I rely on three main SHARE datasets, each serving a complementary function in the construction of the final dataset:

1. **easySHARE (rel. 9.0.0)** – a harmonised, simplified panel containing core socio-demographic, labour-market, health, and income information across all waves. This constitutes the backbone of the analysis, providing observations of labour-force status, household income, demographic characteristics, and subjective preferences for retirement across all waves.
2. **Job Episodes Panel (JEP, rel. 9.0.0)** – a longitudinal file containing complete job histories for each respondent. This dataset records start and end dates of all employment episodes, enabling the construction of cumulative contribution years, the central variable in evaluating eligibility for early retirement under the different pre- and post-reform rules.
3. **Gateway Harmonized SHARE (GH SHARE, rel. 9.0.0)** – a harmonised dataset that contains more detailed respondent- and household-level variables across waves using uniform variable names. I use it to pool variables related to retirement timing, wealth aggregates, subjective well-being, and expectations, as well as partner identifiers enabling spouse-level linkages.

All datasets are restricted to respondents who live and work in Italy.

From easySHARE, I keep variables that capture the fundamental determinants of retirement timing according to the life-cycle framework—demographics, health, labour-force status, household structure, and income. Key variables extracted include:

- Age, gender, years of education, marital status, partner co-residence
- Labour-force status indicators, including detailed categories (retired, employed/self-employed, unemployed, disabled, homemaker, other)
- Job-status information (public/private/self-employed; `ep009_mod`)
- Monthly household income
- Household size and composition, including presence and characteristics of spouse or partner

I construct several harmonised indicators:

- Retired indicator (=1 if labour-force status indicates retirement, 0 otherwise)
- Female dummy, status factor, and job-status categorical harmonisations
- Annual household net income and various normalised forms (income per contributor, OECD-equivalised income)

A crucial step in the data construction involves integrating job histories from the SHARE Job Episodes Panel (JEP), which provides retrospective yearly information on individuals' employment histories based on reported job episodes.

To construct a person-year measure of employment activity, job episodes from the SHARE Job Episodes Panel are converted into annual indicators. Specifically, an individual is classified as working in year t if any reported job episode is found in that calendar year. Formally,

$$\text{working}_{i,t} = \begin{cases} 1 & \text{if individual } i \text{ reports employment in year } t, \\ 0 & \text{otherwise.} \end{cases}$$

From this indicator, cumulative contribution years are computed as the total number of years in which an individual is recorded as employed:

$$\text{contrib_years}_{i,t} = \sum_{\tau \leq t} \text{working}_{i,\tau}.$$

The JEP data are merged to easySHARE by aligning interview year with job-episode year, using rolling joins to allow employment histories to carry forward to the closest available interview year.

From GH SHARE, I extract further key variables:

- **Retirement timing:** year and age of retirement for the respondent and the spouse
- **Wealth aggregates:**
 - total household net wealth
 - main residence value
 - other real estate
 - financial wealth
- **Preferences and well-being:** probability of working beyond age 63, CASP-12 quality-of-life index, and life-satisfaction score
- **Spouse linkage:** the variable `sWmergeid` allows attaching spouse characteristics and, where possible, constructing spouse contribution years using the JEP-based method explained above
- **Survey weights:** for each individual in each wave, I extract the cross-sectional respondent weights provided as the appropriate respondent-level weights for cross-sectional analysis (SHARE, 2024)

These variables are joined to the panel using the individual’s ID and wave number identifiers.

An important portion of the analysis concerns socioeconomic determinants of retirement. The following transformations standardize these variables between individuals and waves.

The monthly and annual household incomes are derived directly from the total net household income of easySHARE. I define income using the OECD-modified equivalised income concept, applying the standard scale:

$$\text{eq_scale} = 1 + 0.5 (\text{adults} - 1),$$

and compute equivalised income as:

$$\text{equivalised_income} = \frac{\text{annual HH income}}{\text{eq_scale}}.$$

As a wealth measure, I use total net household wealth, and when this is missing, I replace it with the sum of the main-residence value, financial wealth, and other real-estate holdings (when available). For both income and wealth variables, I also create their lagged versions.

Health is also a classic determinant of retirement decisions (Bound et al., 1999; Disney, Emmerson & Wakefield, 2006). From easySHARE I draw:

- self-assessed general health
- mobility limitations

To mitigate simultaneity, I use lagged health status, following common practices in retirement modelling and hazard studies (e.g., Börsch-Supan & Piekkola, 2001). Missing health values are flagged with indicator variables.

3.2 Contribution Histories, Eligibility and Risk Set

Another central aspect of this thesis is the reconstruction of eligibility under Italy’s Statutory Early Retirement (SER) rules and alternative exit routes, before and after the Fornero reform. Eligibility definitions rely on contribution years, age, and institutional requirements.

For Statutory Early Retirement (SER):

- **Pre-Fornero rules:** either 40 years of contributions, or at least 35 contribution years combined with age thresholds that vary by year and according to different *quota* formulas (e.g. quota 95/96, defined as the sum of age and contribution years).
- **Post-Fornero rules:** tightened requirements of 42 contribution years for women and 43 years for men, regardless of age.

Alternative early-retirement (AER) pathways depend on institutional criteria that are only partially observable in SHARE. However, a common feature across these schemes—both before and after the Fornero reform—is that none permit retirement with fewer than 30 contribution years. I therefore define AER eligibility broadly as applying to individuals who have accumulated at least 30 contribution years but who do not qualify for SER in a given year. Within this group, AER events are classified as observed retirements occurring while the individual satisfies this AER eligibility condition.

These institutional thresholds are coded year by year following documentation from the Italian Social Security Institute (INPS) and academic descriptions (e.g. Fornero, 2013; Jessoula & Raitano, 2017).

Finally, I define early labour-market exits as transitions out of employment among individuals who are not eligible for any form of early retirement. Specifically, individuals are classified as *market-exit eligible* when they have fewer than 30 contribution years and are below the statutory old-age pension age. Within this group, a market exit occurs when the respondent reports being either retired or unemployed. To avoid misclassification, I compute a *later re-entry* indicator and restrict market-exit events to the first observed transition that is not followed by a subsequent return to employment. This outcome represents a separate and mutually exclusive exit route, distinct from SER and AER, and is not directly affected by the Fornero reform.

Together, these definitions generate mutually exclusive exit events, which are necessary for modelling competing labour-market transitions.

The final analytical sample focuses on working individuals aged 55–66, the age range most commonly affected by retirement incentives and eligibility threshold changes. This choice is consistent with the literature on retirement hazards and event-history analysis (e.g. Zweimüller et al., 1996; Lalive & Staubli, 2015; Staubli & Zweimüller, 2013).

In studying the timing of retirement, individuals contribute observations only while they are at risk of experiencing the transition. Once a respondent retires, they exit the risk set. Following the logic of hazard models and duration analysis (Lancaster, 1990), I define:

$$\text{in_risk}_{i,t} = \begin{cases} 1 & \text{if } t \leq \text{retirement year}_i, \\ 0 & \text{otherwise.} \end{cases}$$

This implies that only individuals who eventually retire are included, and that post-retirement observations are excluded. The resulting panel structure is so designed to be suited to analysing the causal impact of the reform on Statutory Early Retirement (SER) and Alternative Early Retirement (AER).

For each exit route (SER, AER, and early market exit), I define an event indicator equal to 1 at the first occurrence of the corresponding transition, and 0 otherwise. This procedure avoids double counting and reflects the largely absorbing nature of retirement states.

The original cleaned person–year panel includes approximately 27,000 observations for Italian men and women aged 50–80 across nine SHARE waves (2004–2021). After constructing the risk set, the number of retained observations is approximately 10,000. Applying eligibility conditions either for SER first and AER later, and restricting the sample to the relevant age interval (55–66) further reduces the estimation sample, but yields a dataset that is more precisely aligned with the institutional retirement rules used in similar DiD and event-study analyses (e.g. Staubli & Zweimüller, 2013).

3.3 Research Design

This thesis adopts a quasi-experimental research design to evaluate the effect of the 2012 Fornero reform on early retirement events in Italy. The empirical strategy takes advantage of the abrupt and institutionally driven change in eligibility conditions introduced by the reform to identify causal effects on retirement outcomes. The core idea is to compare early retirement behaviour before and after the reform across multiple paths (namely Statutory Early Retirement and Alternative Early Retirement) between individuals who were differentially exposed to the policy change due to their pre-reform contribution histories and ages.

The Fornero reform, as already discussed, represents a particularly suitable setting for

policy evaluation. First, it was implemented rapidly and with very limited transitional provisions, creating a sharp discontinuity in retirement eligibility rules. Second, the reform affected individuals asymmetrically: while some workers lost access to statutory early retirement overnight, others remained unaffected because their eligibility status did not change. This institutional feature allows the construction of treatment (those that were eligible for early retirement before the reform but lose their eligibility afterwards) and control groups (always eligible for SER, or never eligible for AER) that are comparable in observable characteristics and labour-market attachment prior to the reform, but exposed to different post-reform incentives.

The analysis is conducted in a discrete-time event-history framework. Retirement is modelled as a transition from employment into mutually exclusive exit states, observed annually. Each individual contributes person-wave level observations while they remain at risk of retirement, and exits the risk set after the first observed retirement event. This approach allows retirement behaviour to be analysed dynamically, capturing the timing of exits relative to policy exposure and institutional thresholds.

Three mutually exclusive exit routes are considered throughout the analysis: statutory early retirement (SER), alternative early retirement (AER), and non-pension labour-market exits. These exit categories are constructed using labour-force status information combined with reconstructed contribution histories and institutional eligibility rules. This classification enables the analysis of both direct reform effects on statutory early retirement and potential substitution toward alternative exit pathways.

Identification relies on Difference-in-Differences (DiD) designs implemented within the risk-set framework. For statutory early retirement, individuals who were eligible under pre-reform rules are divided into a treated group—those who lost eligibility after 2012—and a control group—those whose eligibility status remained unchanged. The reform effect is identified by comparing changes in retirement hazards between these groups before and after the reform. This strategy controls for time-invariant individual heterogeneity through fixed effects and for common macroeconomic and institutional shocks through year fixed effects.

For alternative early retirement pathways, a similar DiD approach is applied using a stylised eligibility proxy based on contribution histories and age restrictions common across AER schemes. Although exact institutional eligibility cannot be fully observed in the survey data, as it depends also on additional unobservable conditions, these restrictions capture the main institutional features of alternative retirement pathways and therefore provide a plausible approximation. Some measurement error is unavoidable but likely limited; importantly, since eligibility is approximated while retirement events are directly observed, any misclassification is expected to lead to more conservative estimates by attenuating the measured reform effect.

Across all specifications, the models control for a rich set of covariates motivated by

the life-cycle retirement framework discussed in Section 2. These include demographic characteristics, household composition, lagged income and wealth measures, and lagged health indicators. Lagged values are used to try to limit simultaneity concerns and to ensure that covariates reflect pre-decision characteristics rather than outcomes of retirement behaviour.

Standard errors are clustered at the individual level to account for serial correlation within respondents, and SHARE survey weights are applied to reflect the sampling design of SHARE. All analyses focus on individuals aged 55–66, the age range most directly affected by early retirement incentives and eligibility thresholds.

Finally, the credibility of the identification strategy is assessed through a series of robustness checks, including pre-reform trend comparisons and placebo reform tests. These checks are designed to verify the parallel-trends assumption underlying the DiD framework and to ensure that estimated effects are not driven by pre-existing differential trends or coincidental timing effects.

Overall, this research design combines institutional detail, longitudinal microdata, and quasi-experimental methods to provide a credible causal assessment of the behavioural impact of the Fornero reform on early retirement decisions and exit pathways.

4 Descriptive Evidence on Retirement Behaviour and Eligibility

This section presents descriptive evidence on retirement behaviour in Italy before and after the implementation of the Fornero reform. The objective is twofold. First, I document how the key elements of retirement eligibility in Italy—contribution histories, retirement ages, and gender-specific differences—differ across pre- and post-Reform periods. Second, I illustrate how institutional eligibility conditions shape observed retirement outcomes.

All descriptive evidence is presented below. The figures and statistics reported in this section are intended to characterise patterns in the data and to motivate the empirical strategy developed in the subsequent sections. The analysis focuses on individuals aged 55–66, that is, those most directly exposed to early-retirement pathways, and relies on survey-weighted statistics to ensure representativeness. In addition, when comparing pre- and post-reform periods, the reported series are directly age-standardised by reweighting age-specific outcomes using a constant reference age distribution computed over the full sample.

4.1 Contribution Histories and Retirement Ages

Contribution histories are a central element of the Italian pension system, as eligibility for early retirement has always been based on accumulated contribution years. While

this remained true after the Fornero reform, the sharp increase in required contribution thresholds substantially restricted access to statutory early retirement. Understanding how contribution patterns differ across periods and demographic groups is therefore essential for interpreting retirement behaviour.

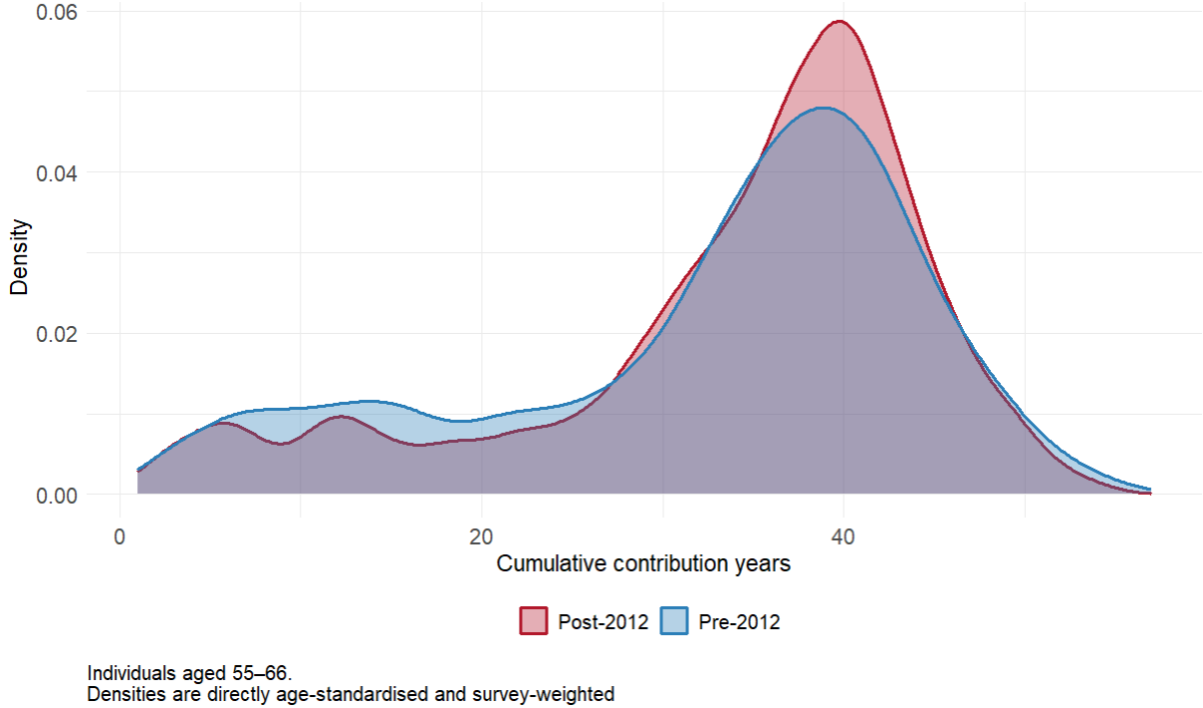


Figure 1: Distribution of contribution years before and after the reform

Figure 1 displays the distribution of cumulative contribution years among individuals aged 55–66 before and after 2012.

Before the reform, the distribution exhibits relatively higher density at lower contribution levels, particularly below 30 years. This reflects a more heterogeneous pattern of contribution accumulation, including a sizable group of workers with interrupted or shorter careers.

In the post-reform period, the distribution shifts rightwards and becomes more concentrated at higher contribution levels. Density increases markedly for cumulative contribution years between 35 and 45, indicating longer and more continuous working careers among individuals observed at these ages. Consistent with this pattern, I find that average weight-adjusted and age-normalized cumulative contribution years rose from 32.6 years in the pre-reform period to 33.9 years after 2012.

While these patterns document substantial changes in contribution accumulation across periods, their implications for early-retirement eligibility and retirement behaviour depend on the institutional mapping between contribution years and eligibility thresholds, which is examined in the following sections.

Gender differences are a central dimension of heterogeneity in the Italian labour market. Persistent gaps in labour force participation, more frequent career interruptions, and

shorter employment histories among women have long translated into markedly different contribution profiles across genders. Examining contribution accumulation separately for men and women is therefore crucial for understanding heterogeneity in retirement-related outcomes.

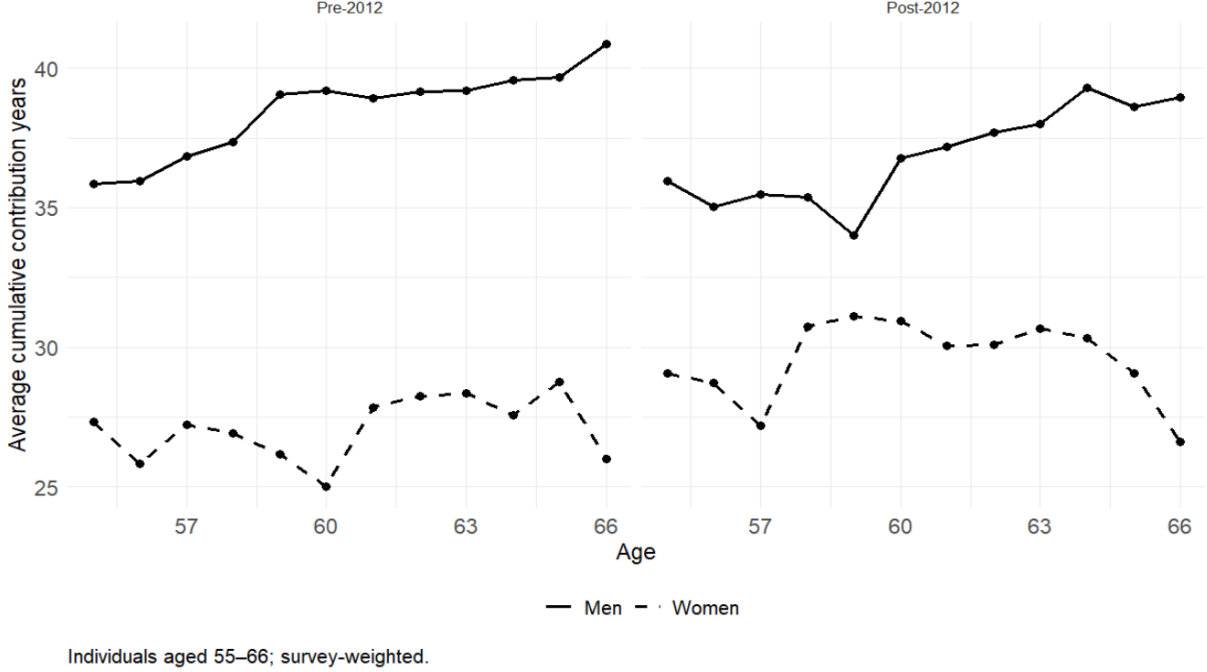


Figure 2: Contribution years by gender before and after the reform

Figure 2 illustrates these differences by reporting cumulative contribution histories by gender, plotting average contribution years by age before and after 2012. In both periods, men display substantially higher levels of accumulated contributions at any given age, and the overall gap between genders remains sizeable throughout the age range considered.

For men, average contribution years are found to largely increase smoothly with age in both periods, consistent with continuous employment careers. In contrast, women's contribution profiles exhibit greater heterogeneity across age groups. Older women often display lower accumulated contribution years than younger cohorts observed at comparable ages, reflecting pronounced cohort differences in female labour market participation and employment continuity.

Comparing periods, the gender gap in contribution accumulation decreases only modestly after the reform, particularly for intermediate age groups. This narrowing appears to be mainly driven by increases in contribution years among women in the post-reform period, while men's average contribution profiles are found to be slightly lower than in the Pre Reform period across all Age Groups. As a result, the overall increase in average contribution accumulation observed after 2012 is largely attributable to improved contribution histories among women rather than to uniform increases across both genders.

While contribution histories capture eligibility potential, actual retirement behaviour

is reflected in observed retirement ages. The following figures report how retirement timing differs before and after the reform and how these changes vary by gender.

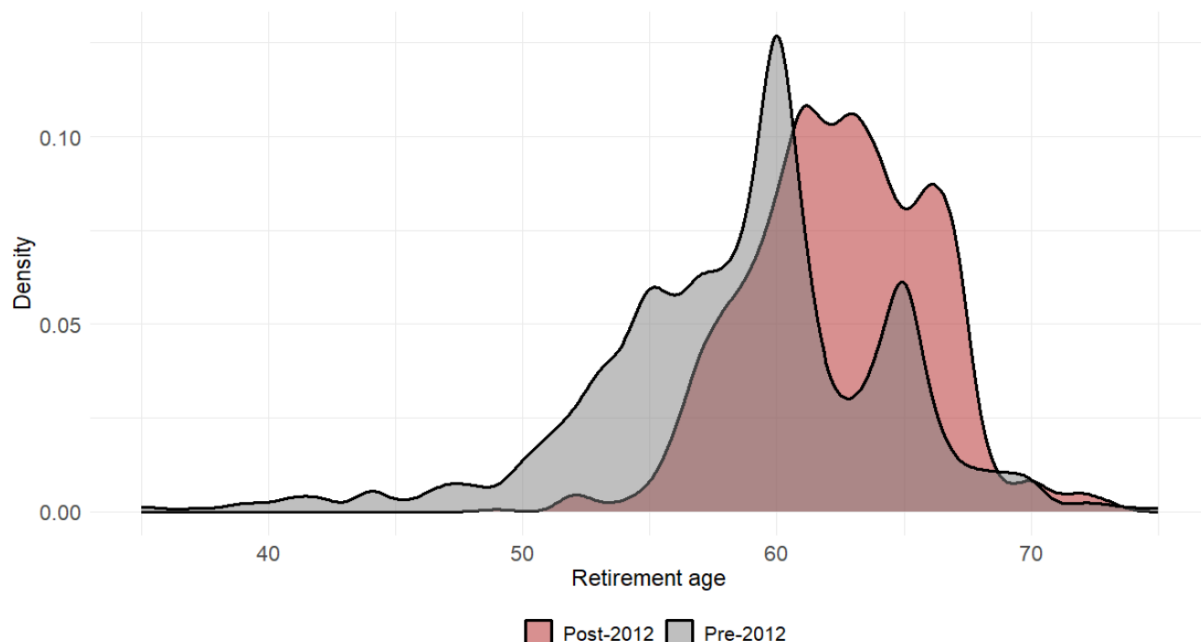


Figure 3: Distribution of observed retirement ages before and after the reform

Figure 3 presents the distribution of observed retirement ages before and after 2012, based on survey-weighted density estimates. The comparison reveals a pronounced rightward shift in the distribution following the reform.

Before 2012, the retirement-age distribution exhibited substantial density at younger ages, with a large concentration of retirements happening around ages 55–60. This pattern is consistent with the widespread use of early-retirement pathways available under the pre-reform institutional framework.

In the post-reform period, the distribution shifts toward higher retirement ages and becomes more concentrated at later ages. Density increases markedly around ages 60–67, while the mass at younger retirement ages declines sharply and is basically null for ages below 50. Comparing the mean of the two contributions, mean retirement age increases from 58.7 pre 2012 to 63.5 post 2012. As a result, retirements occurring in the early sixties and beyond become substantially more common relative to the pre-reform period.

Overall, the density comparison indicates a clear postponement of labour market exit after 2012. Rather than reflecting marginal adjustments around a fixed retirement age, the post-reform distribution suggests a broader reallocation of retirement timing around later ages, consistent with tighter eligibility conditions and higher statutory retirement ages introduced by the reform.

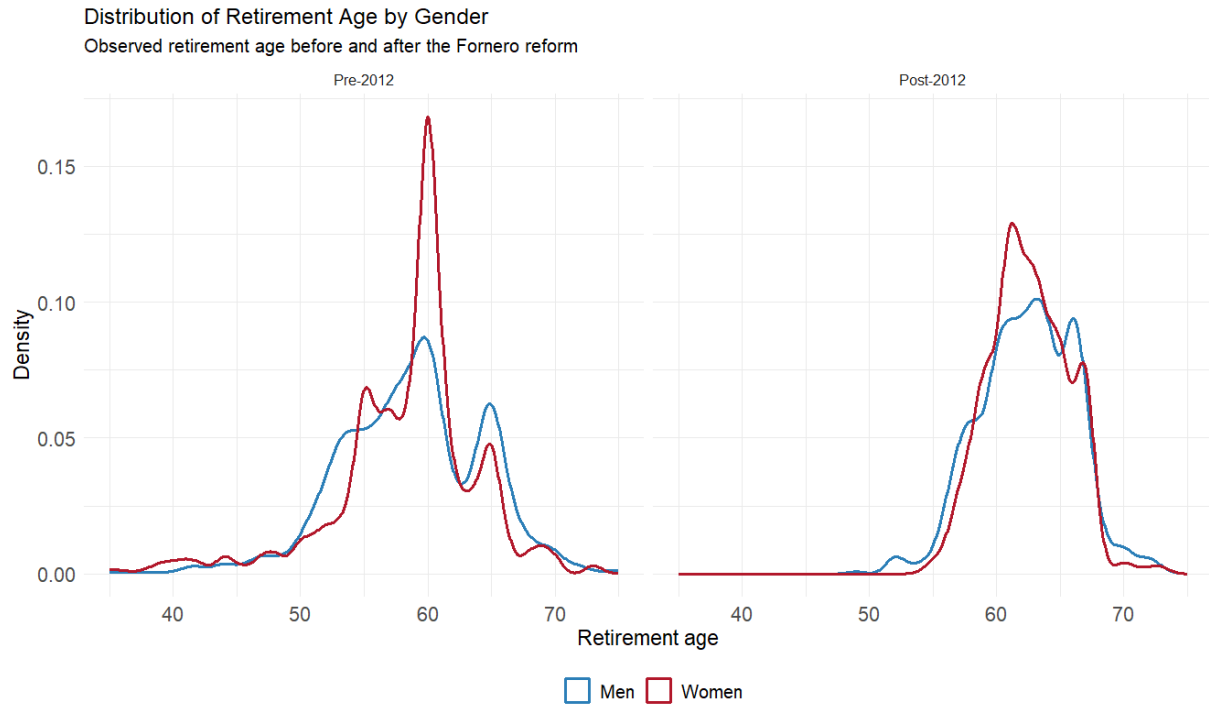


Figure 4: Retirement age by gender before and after the reform

Figure 4 reports the distribution of observed retirement ages by gender before and after 2012. In both periods, the distributions display pronounced concentration at specific ages, consistent with retirement timing being strongly shaped by institutional rules. Taking the means of the distributions, men's mean retirement age increases from 59.6 pre 2012 to 63.1 post reform. The mean increase for women is even bigger: from 58.4 to 62.5.

Graphically, it can be observed that before the reform, women's retirement ages were sharply concentrated around age 60, corresponding to the statutory old-age retirement threshold applicable to women under the pre-reform system. This pattern indicates that many women exited the labour market precisely at the minimum statutory age, consistent with more limited access to early-retirement pathways, which all required the accumulation of sufficiently long contribution histories.

Men's retirement ages in the same period are more dispersed, with substantial mass between ages 55 and 65. This reflects broader access to early-retirement options based on contribution histories, relative to the statutory old-age retirement threshold of 65 applicable to them.

In the post-reform period, retirement-age distributions for men and women shift toward higher ages and become markedly more similar. For women, the sharp concentration at age 60 disappears, and density moves toward ages above 60, reflecting both the increase and the harmonisation of statutory retirement ages and minimum contribution requirements across genders.

For men, retirement ages also become more concentrated at higher ages, with a mass

moving away from pre-reform early-retirement focal points. The resulting distributions for men and women overlap closely, indicating that retirement timing is now governed by a more uniform institutional framework.

4.2 Eligibility, Exit Routes, and Observed Transitions

While retirement ages indicate when individuals actually exit the labour market, they do not capture how different exit routes contribute to observed behaviour. This subsection analyses eligibility conditions and observed exit events, with a focus on statutory early retirement (SER) and alternative early retirement (AER).

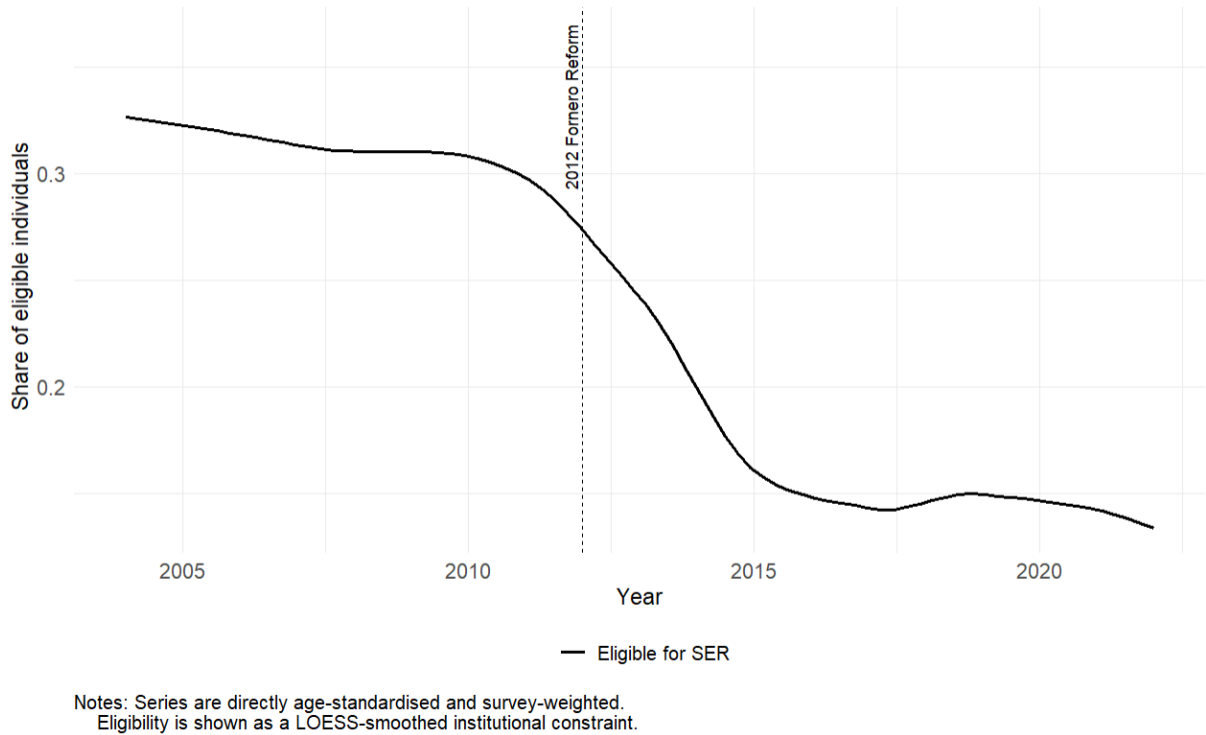


Figure 5: Statutory early retirement eligibility over time

Figure 5 illustrates the evolution of eligibility for statutory early retirement over time. The series reports the share of individuals aged 55–66 who satisfy statutory eligibility conditions in each year, directly age-standardised and survey-weighted. Eligibility is shown as a smoothed series in order to highlight the underlying institutional constraint as well as the structural break induced by the Fornero reform.

Before 2012, eligibility for statutory early retirement was widespread and relatively stable. Roughly one-third of individuals in the relevant age range satisfy eligibility conditions, reflecting the central role of contribution-based early-retirement pathways under the pre-reform system.

Following the Fornero reform, eligibility declines sharply and persistently. The share of eligible individuals drops abruptly in the years immediately after 2012 and stabilises

at around 10 – 15%. This pattern mirrors the tightening of statutory rules, in particular the sharp increase in required contribution years for access to early retirement.

Unlike statutory early retirement, eligibility for alternative early retirement pathways is not directly observable in SHARE. These routes are defined by a combination of labour-market states and institutional arrangements that cannot be mapped one-to-one into formal eligibility criteria, given the available dataset. However, given SER constraints and retirement outcomes, Alternative Early Retirement events can still be accurately observed. As a result, the analysis focuses on observed exit events for alternative pathways rather than on eligibility exposure.

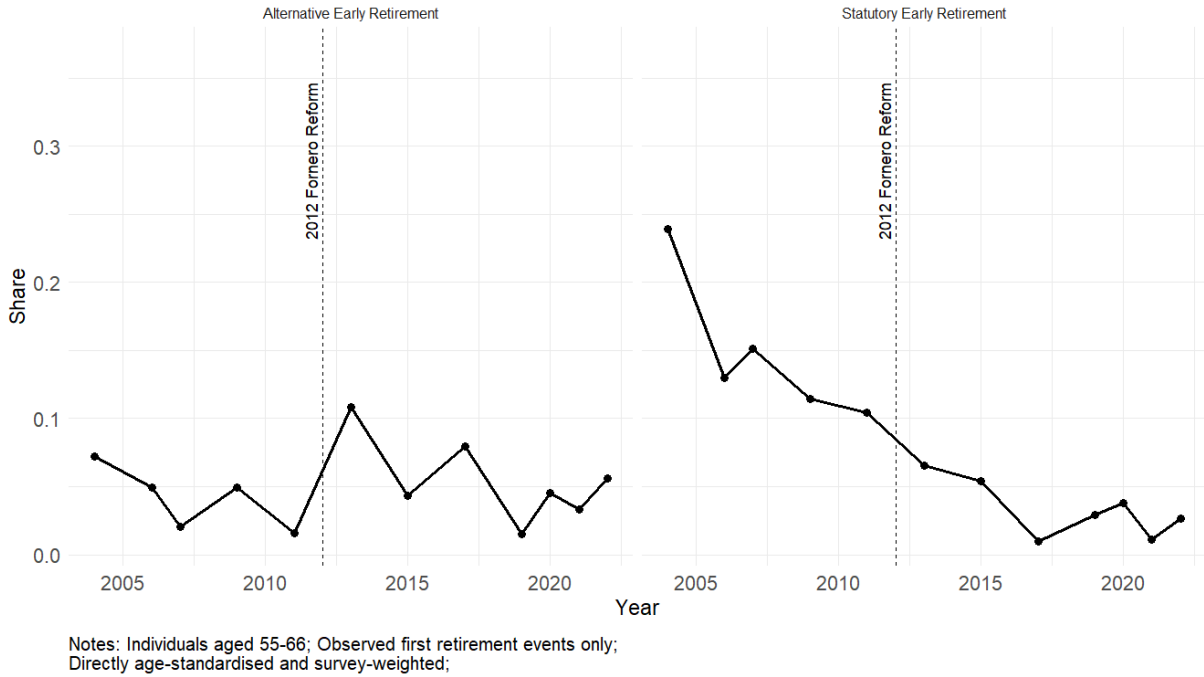


Figure 6: Early retirement events across SER and AER

Figure 6 reports observed first retirement exit events by route, distinguishing between statutory early retirement and alternative early retirement pathways. The series are directly age-standardised (ages 55–66) and survey-weighted, and record only first observed exits from employment in each category.

The right panel shows a pronounced decline in statutory early retirement events over time. Before the reform, statutory early retirement constituted a common exit route, with relatively high event rates throughout the pre-2012 period but already declining. Following the Fornero reform, observed statutory early retirement events collapsed sharply and remained at very low levels thereafter. This decline mirrors the dramatic reduction in eligibility documented in Figure 3.5, indicating that statutory early retirement becomes a rare outcome in the post-reform period.

¹Statutory early retirement was indeed already declining before 2012, most likely due to earlier pension reforms. However, for the DiD analysis, placebo tests indicate no differential pre-reform trends between treated and control groups, supporting the credibility of the DiD design developed in Section 5.1.

The left panel displays alternative early retirement events, which follow a markedly different pattern. While alternative exits were present already before 2012, their prevalence increased in the immediate post-reform years, with a noticeable spike shortly after the reform period. Although these events do not fully offset the disappearance of statutory early retirement, their increased incidence suggests a degree of substitution toward non-statutory exit pathways that might become more attractive when access to early retirement based on contributions is sharply restricted

4.3 Conditional Exit Probabilities: Multinomial Logit Evidence

To complement the descriptive evidence on eligibility conditions and realised retirement events, this section examines how the probability of different labour-market exit routes varies across periods, conditional on individual characteristics. The objective is not to establish causal effects, but rather to summarise how observed exit patterns change once key demographic, socioeconomic, and health-related factors are accounted for.

Retirement behaviour is analysed using a multinomial logit model, in which individuals can transition into one of several mutually exclusive labour-market states. For each individual–year observation, the outcome variable takes one of four categories:

- continued employment,
- statutory early retirement (SER),
- alternative early retirement (AER),
- non-pension labour-market exit (including exits via unemployment or inactivity not associated with pension receipt).

The classification is based on the first observed exit event from employment, ensuring that each transition reflects an initial retirement-related decision rather than repeated observations for the same individual.

The analysis sample consists of individuals aged 55–66, corresponding to the core age range in which early-retirement decisions are concentrated and institutional eligibility constraints are most relevant.

Let $Y_{it} \in \{0, 1, 2, 3\}$ denote the labour-market outcome of individual i in year t , where category 0 (continued employment) is the reference outcome. The multinomial logit model specifies the probability of each exit route as:

$$\Pr(Y_{it} = j \mid X_{it}) = \frac{\exp(X'_{it}\beta_j)}{1 + \sum_{k=1}^3 \exp(X'_{it}\beta_k)}, \quad j \in \{1, 2, 3\}. \quad (1)$$

Here, X_{it} denotes a vector of individual characteristics, and β_j is the outcome-specific parameter vector.

The key regressor of interest is a binary indicator for the post-reform period, $Post_t$, equal to one for observations from 2012 onwards. The model additionally controls for a rich set of covariates motivated by the theoretical framework discussed in Section 2.2 and used consistently throughout the empirical analysis: age-group fixed effects, years of education, marital status, household size, gender, equivalised household income, household wealth (in logarithms), self-reported health status, and indicators of functional limitations.

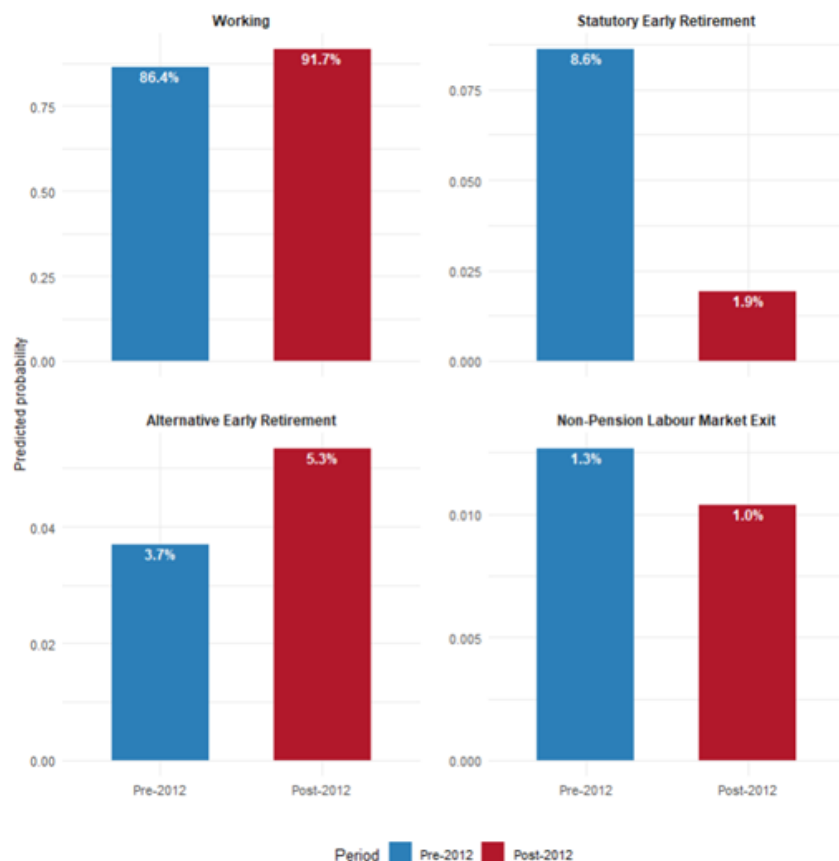


Figure 7: Multinomial Logit results: predicted probabilities by exit path

Figure 7 reports predicted probabilities for each exit route, evaluated separately for the pre- and post-reform periods while holding other covariates at their observed distributions.

First, the probability of remaining employed increases substantially for the observed group after the reform. Conditional on observed characteristics, the model predicts that the share of individuals continuing to work increases by more than 5% in the post-2012 period, reflecting the overall tightening of retirement eligibility conditions and higher statutory retirement ages.

Second, the probability of statutory early retirement (SER) declines sharply. Before the reform, statutory early retirement accounts for 8.6% of exits from employment. In the post-reform period, the predicted probability of this pathway collapses to 1.9%,

consistent with the results documented in Section 4.3.2.

Third, alternative early-retirement pathways become relatively more prevalent after the reform. The multinomial estimates indicate a clear increase in the predicted likelihood of exits through alternative channels, which become even more frequent than statutory early-retirement exits in the post-2012 period. This pattern mirrors the descriptive evidence presented in Section 4.3.2 and suggests that part of the reduction in statutory early retirement may have been offset by increased reliance on non-standard exit routes. Although this evidence does not allow for causal interpretation, it points to a partial reallocation of early retirement behavior toward alternative pathways, potentially attenuating the overall impact of the reform on early retirement.

Finally, non-pension labour market exits remain quantitatively small in both periods and display only limited changes after the reform. This is not surprising, as the reform does not directly affect this exit pathway.

Overall, the multinomial logit estimates reinforce the descriptive findings presented earlier: the Fornero reform is associated with a sharp contraction of statutory early retirement and a partial reallocation of exit behaviour. Importantly, these patterns persist even after conditioning them on a comprehensive set of relevant individual characteristics.

Further multinomial logit estimates of retirement pathways disaggregated by gender indicate that men are substantially more likely than women to enter early retirement. In particular, the predicted probability of statutory early retirement is roughly four times higher for men, while alternative early-retirement exits are approximately twice as likely (both before and after the reform). Conversely, men appear considerably less likely to exit the labour market through non-pension routes. Despite these level differences, the overall changes in retirement pathways following the reform are broadly similar across genders. Full results for this specification are reported in Appendix A as complementary descriptive evidence.

These results provide a useful baseline for the causal analysis developed in the next sections, which seeks to isolate the causal effect of eligibility changes on retirement behavior.

5 Analysis of the Effect of the Fornero Reform on Early Retirement Outcomes

This section moves from descriptive evidence to causal analysis in order to quantify the impact of the Fornero reform on early retirement behaviour in Italy. The previous section documents sharp changes in eligibility patterns, retirement timing, and exit routes around the 2012 reform, but these patterns alone cannot establish whether such shifts were directly caused by the policy intervention. The objective of this chapter is therefore

to isolate the causal effect of the reform on early retirement events.

The analysis is carried out in three steps. First, the chapter estimates the average causal effect of the reform on statutory early retirement hazards, focusing on individuals who were eligible under the pre-reform system and assessing how the removal of eligibility affected retirement timing. Second, it explores heterogeneity in responses across three key individual characteristics (gender, health status, and income) to understand which groups were affected most by the tightening of early retirement rules. Finally, I analyze if the decline in statutory early retirement was partially offset by an increase in alternative early retirement events.

Together, these analysis provide a comprehensive overview of how the Fornero reform reshaped early retirement behavior.

5.1 Statutory Early Retirement

Statutory Early Retirement (SER) represents the main contribution-based early retirement pathway in the Italian pension system. Before the Fornero reform, access to SER depended primarily on accumulated contribution years, with relatively generous thresholds that allowed many workers to retire substantially before the statutory old-age retirement age. As a result, SER constituted a central margin of adjustment in retirement behaviour and accounted for a large share of labour market exits among older workers.

The Fornero reform dramatically altered this framework. By sharply increasing required contribution thresholds and aligning eligibility conditions across cohorts and genders, the reform made statutory early retirement accessible to only a very limited subset of workers. This sudden and substantial tightening provides a natural setting to study how retirement behaviour responds when a previously available and widely used exit route is effectively removed.

This section examines the overall causal impact of the Fornero reform on statutory early retirement decisions among Italian workers who were exposed to the policy change. The reform was announced and implemented within a very short time frame and substantially altered eligibility rules, making a Difference-in-Differences (DiD) design particularly well suited for causal inference.

I adopt a risk-set, discrete-time hazard framework following Staubli and Zweimüller (2013), with adaptations to better reflect the institutional features of the Italian pension system. A discrete-time hazard model estimates the annual probability of first retirement conditional on remaining at work, allowing retirement behaviour to be analysed dynamically while accounting for differential exposure to the reform over time.

The Italian reform closely parallels the Austrian early-retirement reform studied by Staubli and Zweimüller (2013). In both settings, governments faced acute fiscal and demographic pressures and implemented abrupt, largely unanticipated increases in early-

retirement eligibility requirements. In both cases, eligibility was removed almost overnight for a clearly identifiable group of workers who had qualified under the old rules, generating a quasi-natural setting in which otherwise similar individuals suddenly differed only in their post-reform eligibility status.

Following the approach of Staubli and Zweimüller, I also exploit a policy discontinuity in a risk-set that includes only individuals who are still working and therefore at risk of retiring. Each individual contributes observations until the first recorded retirement event, after which the panel is truncated to avoid repeated transitions.

The outcome variable is a discrete-time retirement hazard, equal to one in the first year an individual retires through the statutory early retirement pathway and zero in all preceding years while still at risk. A Post indicator equals one for interview years from 2012 onwards, capturing exposure to the post-reform institutional environment. Statutory early retirement eligibility is reconstructed using detailed contribution histories combined with institutional eligibility thresholds, as described in Section 3.3.2. From the last pre-reform observation (2011 or earlier), I compute eligibility both under the different pre-reform rules and under the stricter thresholds introduced by the Fornero reform.

The analysis is restricted to individuals who were eligible for statutory early retirement under the pre-reform system. This restriction ensures that the sample consists of workers for whom early retirement was a realistic option prior to the reform. Within this group, individuals are divided into:

- a **treatment group**, consisting of workers who were eligible before the reform but lost eligibility after 2012;
- a **control group**, consisting of workers whose eligibility status remained unchanged.

In accordance with the theoretical retirement behaviour model developed by Daminato and Padula (2024), I include flexible age effects, demographic controls (education, marital status, household size), lagged income and wealth controls (with missingness indicators), and lagged health variables. Survey weights are applied, and standard errors are clustered at the individual level.

Once the data are prepared for the difference-in-differences (DiD) analysis, I estimate a sequence of linear probability models (LPMs) with progressively richer sets of fixed effects and controls, following standard practice in evaluations of retirement-age reforms (e.g. Staubli & Zweimüller, 2013; Cribb, Emmerson & Tetlow, 2016). This progression of increasingly flexible specifications is intended to demonstrate robustness to individual heterogeneity and time-varying confounders.

The preferred specification takes the form:

$$y_{it} = \alpha_i + \lambda_t + \phi(\text{age}_t) + \beta (\text{Treated}_i \times \text{Post}_t) + \gamma X_{it} + \varepsilon_{it}, \quad (2)$$

where y_{it} denotes an indicator for an early-retirement event, α_i are individual fixed effects, λ_t are year fixed effects, and $\phi(\text{age}_t)$ represents a set of age dummies.² The vector X_{it} includes time-varying covariates motivated by the theoretical framework, such as household structure, lagged income and wealth, and lagged health indicators.

Because the fixed effects absorb all time-invariant individual characteristics and common year-specific shocks, identification of the reform effect relies on the interaction term $\text{Treated}_i \times \text{Post}_t$. The coefficient β captures the average treatment effect on the treated (ATT), interpreted as the percentage-point change in the annual probability of early retirement for individuals who lost eligibility after the reform, relative to otherwise comparable individuals whose eligibility status remained unchanged.

Table 1 reports Difference-in-Differences estimates of the impact of the Fornero reform on statutory early retirement (SER) hazards among individuals who were eligible under the pre-reform system.

Across all specifications, the estimated effect of the reform is large, negative, and statistically significant, indicating a substantial reduction in the probability of early retirement for workers who lost eligibility after 2012. In the fully saturated specification the estimated coefficient on the interaction term $\text{Post} \times \text{Treated}$ implies a decline of over 18 percentage points in the annual probability of statutory early retirement. Given the relatively high pre-reform incidence of SER in this risk set, this effect represents a very large behavioural response, consistent with the near-elimination of this exit pathway as already documented in the descriptive analysis.

From an economic perspective, the estimated effect suggests that statutory early retirement constituted a central and highly elastic margin of adjustment in Italian retirement behaviour prior to the Fornero reform. The sudden removal of eligibility sharply increased the opportunity cost of early exit, forcing many workers to remain in employment for several additional years. This finding aligns closely with the predictions of the life-cycle retirement model discussed in Section 2, in which retirement timing responds strongly to institutional constraints when early-exit options are based on contribution thresholds rather than actuarially neutral incentives. In this framework, the reform effectively tightened the institutional constraints faced by eligible workers, making early retirement financially and institutionally infeasible for most of them.

The magnitude of the effect is in line to that found in related studies exploiting abrupt early-retirement reforms in other European countries. Staubli and Zweimüller (2013), analysing the Austrian early-retirement reform using a comparable risk-set DiD design, document a reduction in early-retirement hazards of large magnitude for workers who lost eligibility. Likewise, studies of eligibility-driven pension reforms in the United Kingdom and other European contexts (e.g. Cribb, Emmerson and Tetlow, 2016) find

²Age dummies control for the strong relationship between age and retirement behaviour, avoiding age-related lifecycle effects to affect the estimated reform impact.

Table 1: Difference-in-Differences Estimates of Statutory Early Retirement

	(1) Pooled DiD	(2) + Individual FE	(3) + Controls	(4) Full FE
Treated $\times$ Post	-0.114 [†] (0.058)	-0.178*** (0.068)	-0.187*** (0.067)	-0.182*** (0.070)
Married			-0.130 (0.147)	-0.156 (0.144)
Household size			0.064 [†] (0.033)	0.068** (0.034)
Log eq. income			-0.003 (0.004)	-0.002 (0.005)
Log wealth			0.002 (0.014)	-0.001 (0.014)
Spouse in household			0.008 (0.026)	0.010 (0.027)
Any limitation			-0.108 (0.073)	-0.133 [†] (0.073)
Missing spouse info			-0.123 (0.268)	-0.066 (0.249)
Missing log income			0.353 (0.259)	0.305 (0.246)
Missing log wealth			-0.195 (0.193)	-0.219 (0.178)
Age fixed effects	No	No	No	Yes
Individual fixed effects	No	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	790	790	790	790
Adjusted R^2	0.048	0.404	0.417	0.416
Within R^2	0.006	0.014	0.057	0.081

Notes: Linear probability models estimated by OLS. Standard errors clustered at the individual level (mergeid) in parentheses. All regressions are weighted using final survey weights. Age fixed effects in column (4) are single-year dummies. Variables dropped due to collinearity are omitted.

*** $p < 0.01$, ** $p < 0.05$, [†] $p < 0.10$.

large and immediate declines in retirement rates at the affected ages. The Italian case fits into the broader empirical literature showing that eligibility rules, rather than benefit generosity alone, play a dominant role in shaping retirement behaviour.

At the same time, the Italian reform represents an especially stark example of this mechanism, given the abruptness of the policy change and the historically central role of contribution-based early retirement. The estimated 18-percentage-point reduction in the preferred specification (model 4) highlights that statutory early retirement was not just one exit option among many, but the primary channel through which long-career workers exited the labour market before old-age retirement. The results provide evidence that the Fornero reform achieved its immediate objective of sharply curtailing statutory early retirement, with important implications for labour supply at older ages and for the short- to medium-term sustainability of the pension system.

Finally, a series of identification and robustness checks support the validity of the Difference-in-Differences design. Pre-reform trends in statutory early retirement hazards appear similar between treated and control groups, and placebo reforms implemented in pre-2012 years yield no significant effects. These tests are reported in detail in Appendix B.1.

5.2 Distributional Heterogeneity: Gender, Health and Income

The baseline Difference-in-Differences estimates indicate that the Fornero reform led to a large average reduction in the probability of statutory early retirement among workers who lost eligibility. However, this average effect may conceal substantial heterogeneity across individuals. From both a theoretical and a policy perspective, understanding such heterogeneity is important. Life-cycle models predict that retirement behaviour depends on factors such as health, income, and demographic characteristics, which affect individuals' ability and willingness to postpone retirement when eligibility tightens. From a policy perspective, heterogeneous effects are crucial for assessing the distributional consequences of pension reforms and identifying which groups would be the most affected. As such, this section explores whether the impact of the reform varies systematically along three key dimensions: gender, health status and income.

Indeed, gender, health status and income are particularly relevant dimensions along which heterogeneous responses to the reform may arise. From a theoretical perspective, these characteristics affect work capacity, preferences for leisure, and the ability to adjust labour supply when institutional constraints change. From an empirical standpoint, the SHARE data provide high-quality and consistent measures of gender, health and income over time (while variables like wealth, for example, are more fragmented), making them well suited for heterogeneity analysis.

Studying heterogeneity is also important to assess the underlying mechanisms through

which the reform operated. If the Fornero reform functioned purely as a mechanical tightening of eligibility rules, then—once eligibility is removed—all previously eligible workers should be similarly constrained, and the reduction in early retirement should be broadly homogeneous across the population. By contrast, the life-cycle framework reported in Section 2.1 suggests that individuals differ in their ability and willingness to finance early exit from the labor-market. In this case, tightening access to statutory early retirement is expected to generate heterogeneous behavioural responses, depending on health conditions and demographic characteristics.

The heterogeneity analysis builds on the preferred empirical specification (Model 4) developed in Section 5.1. Specifically, I estimate a discrete-time hazard model within a Difference-in-Differences framework, restricting the sample to the risk set of individuals who are eligible for statutory early retirement prior to the reform. The model includes individual fixed effects, year fixed effects, flexible age dummies, and the same set of lagged income, wealth, and health controls used in the baseline analysis. Identification continues to rely on comparing individuals who lost eligibility as a result of the reform (treated group) with individuals whose eligibility status remained unchanged after 2012 (control group).

Because the risk-set sample is, by construction, substantially smaller than the entire workforce aged 55 to 66, all heterogeneity analyzes are conducted using simple two-group splits. This choice ensures sufficient sample size within each subgroup, preserves statistical power, and avoids excessive fragmentation of the data. Accordingly, for each dimension—income, wealth, gender, and health—I divide the sample into two broad groups.

Formally, heterogeneity is introduced by interacting the treatment indicator with a binary group variable:

$$\delta (\text{Treated}_i \times \text{Post}_t \times Z_i), \quad (3)$$

where Z_i equals one for individuals belonging to the group of interest (e.g., low-income workers, women, or individuals in poor health) and zero otherwise; the precise definitions of each subgroup are described below.

The full model is:

$$y_{it} = \alpha_i + \lambda_t + \phi(\text{age}_t) + \beta_0 (\text{Treated}_i \times \text{Post}_t) + \beta_1 (\text{Treated}_i \times \text{Post}_t \times Z_i) + X_{it}^{(-Z)} \gamma + \varepsilon_{it}, \quad (4)$$

where y_{it} denotes the annual statutory early-retirement hazard. The coefficient β_0 captures the effect of the reform for the reference sub-group ($Z_i = 0$), while β_1 measures the differential effect for the comparison group ($Z_i = 1$). The vector X_{it} contains the same set of control variables used in the baseline specification, excluding the variable employed to define heterogeneity in order to avoid collinearity.

Starting with gender heterogeneity, differences are of particular interest because pre-reform early-retirement rules—and the Fornero reform itself—differed by gender. Women experienced substantially larger increases in both early- and old-age retirement ages. Furthermore, women in Italy and in the sample of this thesis generally exhibit more fragmented and shorter contribution histories, as reported in Section 4.1. , making gender a potentially strong source of heterogeneity.

The estimated gender heterogeneity is small and not statistically significant (with p-value above 10 %), suggesting limited evidence of differential reform effects between men and women. This suggests that women in the sample who were pre-eligible for early retirement had contribution profiles similar to those of men in the same risk set, and that the primary variation underlying treatment status is driven by other factors rather than gender-specific retirement rules or differences in contribution histories.

Health status is another important determinant of retirement behaviour. Poor health increases the marginal utility of leisure and reduces the capacity to continue working, making early retirement more attractive. Healthier individuals, in contrast, may choose to continue working even when eligible for early exit. This introduces a potential source of heterogeneity in the response to tightening early-retirement eligibility: individuals in poor health might be more affected because the reform removes a preferred path to exit, or less affected because many lacked the contribution histories required to qualify under the pre-reform system.

From the SHARE dataset, I use s.p.h.u.s as our primary measure of individual health status. This choice is motivated by three factors: it is the only consistently available and comparable health indicator across all waves; self-perceived health is highly predictive of labour-market behaviour (Borsch-Supan et al., 2019); it is easily interpretable. I divide the scale into good health (1-3, from "excellent" to "good") and poor health (4-5, from "fair" to "poor").

The model estimates indicate that individuals in poorer health experience a reform effect that is approximately 13.3 percentage points smaller in absolute value than that of healthier individuals, with the interaction coefficient statistically significant at the 5% level in the preferred specification.. This suggests that the Fornero tightening constrained healthier workers more strongly. Individuals in poor health generally have lower contribution histories in the dataset and were already less likely to meet early-retirement conditions before the reform; thus, the tightening mechanically affects them less. In contrast, healthier workers—who were more often eligible pre-reform—exhibit larger behavioural adjustments once early-retirement pathways are tightened.

Finally, equivalised household income is also a key driver of retirement behaviour. Higher-income workers tend to have longer and more stable contribution histories, better job attachment, and greater financial capacity to finance early exit. They are also more frequently found among those who, before the reform, met the quota-based or seniority-

based early retirement requirements.

For lower-income workers—who often experience discontinuous employment, shorter contribution histories, and weaker financial buffers—the feasibility of early retirement is substantially more limited. Consequently, the removal of early-retirement eligibility should affect high-income workers much more strongly, whereas the effect for lower-income workers might be small simply because many of them would have been ineligible under the old rules as well.

To allow income to vary with aggregate conditions, I classify individuals into low and high-income groups within each wave using the wave-specific median of equivalised household income.

The full DiD specification is estimated with high-income individuals as the reference group and low-income individuals as the comparison group. The resulting estimates indicate that the reform effect for low-income workers is approximately 10 percentage points smaller in absolute value than for high-income workers, with the interaction coefficient statistically significant at the 5% level in the preferred specification. This pattern is consistent with theoretical predictions and suggests that the tightening of eligibility constrained individuals whose career histories made early exit feasible, while generating a much smaller—but still negative—effect among workers for whom early retirement was not financially or institutionally viable even before 2012.

5.3 Alternative Early Retirement Pathways

The analysis of statutory early retirement shows that the Fornero reform produced a large reduction in early-retirement hazards among workers who lost eligibility. However, workers can exit the labour market through other channels that are not directly targeted by statutory seniority rules. These include alternative pension pathways (for instance, disability pensions, unemployment-related early pensions, or special schemes for specific sectors) as well as non-pension exits through unemployment or inactivity.

From a policy point of view, it is important to assess whether the tightening of statutory early retirement resulted in a genuine postponement of labour-market exit or whether it induced a reallocation of exits toward other routes. This section therefore, focuses on two non-statutory margins: alternative early retirement (AER), defined as pension exits not captured by statutory seniority eligibility, and non-pension labour-market exits.

Alternative early retirement captures pension exits that do not occur under the statutory early retirement (SER) rules but still represent early labour-market withdrawal before reaching the statutory old-age threshold. In the Italian context, such exits may arise through disability and invalidity schemes, unemployment-linked early pensions, sectoral exceptions, or other special programs. These channels are not explicitly modelled in the statutory eligibility rules used in Section 1, but they can play an important role in

shaping overall early-retirement behaviour, especially when statutory routes are sharply restricted. It is worth mentioning, that some of these channels have been subsequently restricted or abolished over time after the implementation of the reform (such as *Opzione Donna* and some Disability early retirement pathways).

In general, the Fornero reform did not primarily target these early-exit pathways. Hence, they are a natural candidate margin for substitution: if statutory early retirement becomes much harder to access, individuals previously inclined to retire early might seek alternative ways to exit the labour market. The goal of this subsection is to assess whether tightening statutory early-retirement eligibility was associated with increased use of alternative exit routes and to evaluate the extent to which these patterns may have partially offset the decline in statutory early retirement.

The empirical analysis of AER is based on the same underlying SHARE–Italy dataset as in the SER analysis, enriched with reconstructed contribution histories and lagged controls for income, wealth and health. As before, the sample is restricted to individuals aged 55–66 and to the risk set of observations prior to, or at, the final retirement year. Formally, an observation is kept in the risk set if the interview year is less than or equal to the respondent’s final retirement year (if any).

Within this risk set, the annual outcome of interest is an indicator for an alternative early-retirement event, defined as: (1) the individual is observed as retired in the year t ; (2) the retirement does not correspond to statutory early retirement according to the detailed eligibility rules used in Section 1; and (3) the individual satisfies a minimum contribution requirement of 30 years consistent with all existing standard AER options.

Unlike statutory early retirement, which can be closely matched to institutional rules using detailed contribution and age thresholds, alternative early-exit pathways cannot be reconstructed exactly from SHARE. The data do not contain full administrative information on disability status, sector-specific regimes, or all program-specific eligibility criteria.

To approximate eligibility for alternative early retirement, I therefore use a more pragmatic, stylised rule based on contribution histories, where individuals are classified as potentially eligible for AER in year t if they: (1) are not eligible for SER in that year, (2) have accumulated at least 30 years of contributions, and (3) are still below the statutory old-age retirement age.

This rule identifies a set of workers with substantial, though not maximum, contribution histories for whom some form of early pension is institutionally plausible, even if the exact legal status cannot be observed. In practice, 30 contribution years mark a clear separation between individuals with short or fragmented careers and those with long, relatively stable employment histories.

This modelling strategy follows a well-established approach in the empirical pension literature, which reconstructs early-retirement eligibility in survey data by combining

contribution histories with stylised institutional thresholds when detailed administrative information is unobservable like in this case. Studies using SHARE and similar surveys often rely on simplified eligibility rules to approximate pension access, particularly for non-standard or special early-exit pathways (e.g. Brugiavini and Peracchi, 2003; Brugiavini et al., 2013; Peracchi and Welteke, 2019).

Two important points are worth highlighting. First, within this framework, eligibility is modelled while exit events are observed. The AER “eligibility” indicator is a constructed proxy, whereas retirement exit events are directly observed through realised transitions into retirement. Second, the AER risk set is disjoint from the SER risk set by construction. Only individuals who are not eligible for statutory early retirement can be classified as AER-eligible. As a result, AER captures genuinely alternative retirement routes and does not misclassify statutory exits.

To estimate the impact of the Fornero reform on alternative early retirement (AER), I construct a Difference-in-Differences design analogous to that used for statutory early retirement, but based on the stylised AER eligibility definition.

First, using pre-reform observations only (up to 2011), individuals are classified according to whether they ever satisfied the AER eligibility condition. The treated group (AER) consists of individuals who were ever potentially eligible for alternative early retirement prior to 2012, defined as:

$$\text{Treated}_i^{\text{AER}} = 1 \quad \text{if} \quad \max_{t \leq 2011} \text{eligible}_{it}^{\text{AER}} = 1. \quad (5)$$

The control group (AER) includes individuals who never satisfied the AER eligibility condition and whose pre-reform contribution histories remain well below the eligibility threshold (e.g. $\max \text{contrib}_{i,\text{pre}} < 30$ years).

These treatment indicators are then merged back into the full risk set and combined with a post-reform dummy, Post_t , equal to one for years from 2012 onward. The sample is restricted to individuals who belong to either the treated or the control group.

The preferred specification for alternative early retirement (AER) mirrors the statutory early-retirement (SER) model and is estimated as a linear probability model for the annual AER hazard:

$$\text{AER}_{it} = \alpha_i + \lambda_t + \phi(\text{age}_t) + \beta^{\text{AER}} (\text{Treated}_i^{\text{AER}} \times \text{Post}_t) + X_{it}\gamma + \varepsilon_{it}. \quad (6)$$

Here, AER_{it} is an indicator equal to one if individual i experiences an alternative early-retirement event in year t . The terms α_i and λ_t denote individual and year fixed effects, respectively, while $\phi(\text{age}_t)$ represents a full set of age dummies. The vector X_{it} includes the same set of pre-determined control variables used in the SER analysis—lagged income and wealth, education, marital status, household size, health status, and missing-value

indicators. The interaction $\text{Treated}_i^{\text{AER}} \times \text{Post}_t$ constitutes the Difference-in-Differences term of interest.

Estimation is performed using survey weights, with standard errors clustered at the individual level. The coefficient β^{AER} measures how the AER hazard changes after the reform for individuals with pre-reform alternative eligibility, relative to a comparable control group.

Alternative early-retirement eligibility is not directly observable in SHARE and is therefore approximated using stylised rules based on contribution histories and observed labour-market transitions. As a consequence, the estimates in this section should be interpreted as suggestive rather than as precise causal effects.

The results for alternative early retirement (AER) in the preferred specification (Model 4) reported in Table 2 below indicate a statistically significant increase in the probability of exiting the labour market through non-statutory pension pathways following the Fornero reform. The estimated coefficient on the interaction term $\text{Treated}_{\text{AER}} \times \text{Post}$ is positive and statistically significant at the 1% level, suggesting a differential increase of approximately 4 percentage points in the annual probability of alternative early retirement among individuals classified as potentially eligible for AER prior to the reform. It is worth noticing, that since eligibility is defined using broader proxy criteria than the actual institutional rules, some individuals classified as eligible may not have truly qualified. This likely attenuates the estimated effect, implying that the reported estimate should be interpreted as a conservative lower bound.

Despite likely attenuation due to the broader proxy definition of eligibility, the positive estimated effect remains consistent with partial substitution toward alternative exit routes when access to statutory early retirement is sharply restricted.

From an economic perspective, this finding suggests that the Fornero reform did not operate exclusively by postponing labour-market exit for all affected individuals. Instead, part of the adjustment occurred through a reallocation of retirement behaviour across exit pathways. Workers who were no longer able to retire through statutory seniority rules appear to have increasingly relied on alternative mechanisms—such as disability-related exits, unemployment-linked pensions, *Opzione Donna* or other special schemes—that were not directly targeted by the reform. This interpretation is consistent with the institutional setting, in which several non-statutory early-retirement options remain available, at least temporarily, despite the tightening of contribution-based eligibility for statutory early retirement.

At the same time, the magnitude of the AER response is notably smaller than the estimated reduction in statutory early retirement. This implies that substitution toward alternative pathways only partially offsets the disappearance of statutory early retirement and that the dominant adjustment margin induced by the reform remains delayed retirement rather than full displacement into other exit routes. This pattern is consistent

Table 2: Difference-in-Differences Estimates of Alternative Early Retirement

	(1)	(2)	(3)	(4)
	Pooled DiD	+ Individual FE	+ Controls	Full FE
Treated _{AER} × Post	0.018 [†] (0.009)	0.055** (0.027)	0.053** (0.027)	0.041*** (0.015)
Married			0.011 (0.024)	0.006 (0.007)
Household size			-0.004 (0.006)	0.002 (0.005)
Log eq. income			0.000 (0.001)	-0.000 (0.001)
Log wealth			0.002 (0.003)	0.002 (0.002)
Spouse in household			0.004 (0.003)	0.002 (0.004)
Any limitation			0.014 (0.020)	-0.003 (0.007)
Missing spouse info			-0.033 (0.027)	0.015 (0.034)
Missing lagged income			0.046 (0.034)	-0.017 (0.033)
Missing lagged wealth			0.026 (0.025)	0.010 (0.024)
Age fixed effects	No	No	No	Yes
Individual fixed effects	No	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	790	790	790	3,675
Adjusted R^2	0.002	-0.241	-0.259	0.469
Within R^2	0.004	0.019	0.027	0.020

Notes: Linear probability models for the annual alternative early-retirement hazard. Standard errors clustered at the individual level (mergeid) are reported in parentheses. All regressions are weighted using survey weights. Age fixed effects in column (4) are single-year dummies. Variables dropped due to collinearity are omitted.

*** $p < 0.01$, ** $p < 0.05$, [†] $p < 0.10$.

with the multinomial logit descriptive evidence showing a sharp collapse in statutory early-retirement events after 2012 accompanied by a more modest increase in alternative exits in Section 4.3.

Finally, robustness checks—including pre-trend tests and placebo reforms in pre-2012 years—supports the validity of the Difference-in-Differences design. These results, reported in Appendix B.2, show no evidence of differential pre-reform trends between treated and control groups, reinforcing the interpretation of the estimated coefficient as capturing a causal increase in alternative early retirement induced by the Fornero reform.

6 Conclusions

This research has analyzed how the 2012 Fornero pension reform affected early retirement behaviour in Italy. The reform introduced a sharp tightening of eligibility conditions for early retirement and raised statutory retirement ages, with the goal of improving the financial sustainability of the pension system and encouraging longer working lives. The analysis applied a difference-in-differences hazard framework by using longitudinal SHARE data combined with reconstructed contribution histories to identify the effects of the reform on retirement decisions.

The results indicate that the reform substantially reduced statutory early retirement among workers who lost eligibility. This suggests that eligibility rules play a central role in shaping retirement behaviour and that individuals respond strongly when institutional incentives change. At the same time, the findings suggest some level of substitution toward alternative early-retirement routes that were only partially abolished or tightened after the reform. The results show that while these alternative routes do not fully offset the decline in statutory early retirement, they indicate that tightening one exit channel may not have completely delayed general early retirement behaviour.

The analysis also shows evidence of heterogeneity in the responses of different individuals. In particular, healthier and higher-income workers appear more affected by the reform, whereas individuals with poorer health or weaker labour-market attachment show smaller adjustments. This is likely driven by the fact that the former group faced fewer constraints before the reform and therefore relied more heavily on early-retirement options, making the tightening of eligibility rules more binding for them. These patterns suggest an important result: the reform has uneven distributional effects and should be evaluated not only in terms of fiscal sustainability but also with respect to labour-market inequality and individual well-being.

Several limitations should be acknowledged. Eligibility for alternative early-retirement pathways cannot be observed perfectly in survey data and must be approximated using broader and stylised institutional rules meaning that the estimated effect may likely be

biased downwards . Another limitation to consider is that survey-based contribution histories are generally less precise than administrative records, which I did not have access to. Future research using administrative datasets could provide more accurate estimates, reconstruct alternative early retirement eligibility more precisely and explore long-term labour-market and welfare consequences of pension reforms.

Overall, the evidence presented in this thesis suggest that the Fornero reform succeeded in sharply reducing statutory early retirement and contributed to delaying retirement among affected workers. However, the presence of alternative exit pathways, even when partially restricted, suggests that broader labour-market and institutional factors continue to affect retirement behaviour. Understanding these interactions as well as considering heterogeneity in individuals' responses remains important for designing pension policies that are both financially sustainable and socially balanced.

References

- [1] Börsch-Supan, A., Brandt, M., Hunkler, C., et al. (2013). Data resource profile: The Survey of Health, Ageing and Retirement in Europe (SHARE). *International Journal of Epidemiology*.
- [2] Börsch-Supan, A. H., Rausch, J., & Goll, N. (2020). Social Security Reforms and the Changing Retirement Behavior in Germany. NBER Working Paper No. 27518.
- [3] Börsch-Supan, A., & Piekkola, H. (2001). Labor market transitions and early retirement. *Journal of Public Economics*.
- [4] Bound, J., Schoenbaum, M., Stinebrickner, T., & Waidmann, T. (1999). The dynamic effects of health on the labor force transitions of older workers. *Labour Economics*, 6, 179–202.
- [5] Brugiavini, A., & Peracchi, F. (2003). Social security wealth and retirement decisions in Italy. *Labour*, 17, 79–114.
- [6] Brugiavini, A., & Weber, G. (2018). Long-term care, retirement, and savings: The SHARE perspective. *Oxford Economic Papers*.
- [7] Chan, S., & Stevens, A. H. (2008). What you don’t know can’t help you: Pension knowledge and retirement decision-making. *Review of Economics and Statistics*, 90(2), 253–266.
- [8] Cribb, J., Emmerson, C., & Tetlow, G. (2016). Signals matter? Large retirement responses to limited financial incentives. *Labour Economics*, 42, 203–212.
- [9] Disney, R., Emmerson, C., & Wakefield, M. (2006). Ill health and retirement in Britain. *Journal of Health Economics*, 25, 621–649.
- [10] Feldstein, M. (1974). Social security, induced retirement, and aggregate capital accumulation. *Journal of Political Economy*, 82(5), 905–926.
- [11] Fornero, E. (2013). Pension reform in Italy: The Fornero reform. *CESifo DICE Report*.
- [12] Gustman, A. L., & Steinmeier, T. L. (1986). A structural retirement model. *Econometrica*, 54(3), 555–584.
- [13] Gustman, A. L., & Steinmeier, T. L. (2005). The social security early entitlement age in a structural model of retirement and wealth. *Journal of Public Economics*, 89, 441–463.

- [14] INPS (2011). Annual Report on the Italian Pension System.
- [15] INPS (2013). Report on pension reform implementation.
- [16] ISTAT (2011). Labour market and retirement statistics.
- [17] Jessoula, M., & Raitano, M. (2017). Italy: Pension reforms and inequality. *Italian Economic Journal*.
- [18] Lancaster, T. (1990). *The Econometric Analysis of Transition Data*. Cambridge University Press.
- [19] Lalive, R., & Staubli, S. (2015). How does raising the retirement age affect labor supply? *Economic Journal*.
- [20] Lumsdaine, R. L., Stock, J. H., & Wise, D. A. (1992). Three models of retirement: Computational complexity versus predictive validity. In D. A. Wise (Ed.), *Topics in the Economics of Aging*. University of Chicago Press.
- [21] MaCurdy, T. (1981). An empirical model of labor supply in a life-cycle setting. *Journal of Political Economy*, 89(6), 1059–1085.
- [22] Modigliani, F., & Brumberg, R. (1954). Utility analysis and the consumption function: An interpretation of cross-section data. In K. Kurihara (Ed.), *Post-Keynesian Economics*. Rutgers University Press.
- [23] OECD (2011). *Pensions at a Glance*. OECD Publishing.
- [24] Padula, M., & Daminato, C. (2024). The life-cycle effects of pension reforms: A structural approach. *Journal of the European Economic Association*, 22(1), 355–392.
- [25] Rust, J., & Phelan, C. (1997). How Social Security and Medicare affect retirement behavior in a world of incomplete markets. *Econometrica*, 65(4), 781–831.
- [26] SHARE (2024). Survey of Health, Ageing and Retirement in Europe – Release Guide.
- [27] Staubli, S., & Zweimüller, J. (2013). Does raising the early retirement age increase employment of older workers? *Journal of Public Economics*, 108, 17–32.
- [28] Train, K. (2009). *Discrete Choice Methods with Simulation* (2nd ed.). Cambridge University Press.
- [29] Zweimüller, J., Winter-Ebmer, R., & Falkinger, J. (1996). Retirement of older workers and pension reforms. *European Economic Review*, 40(2), 449–472..

Appendix

A. Full Multinomial Logit Model results disaggregated by Gender

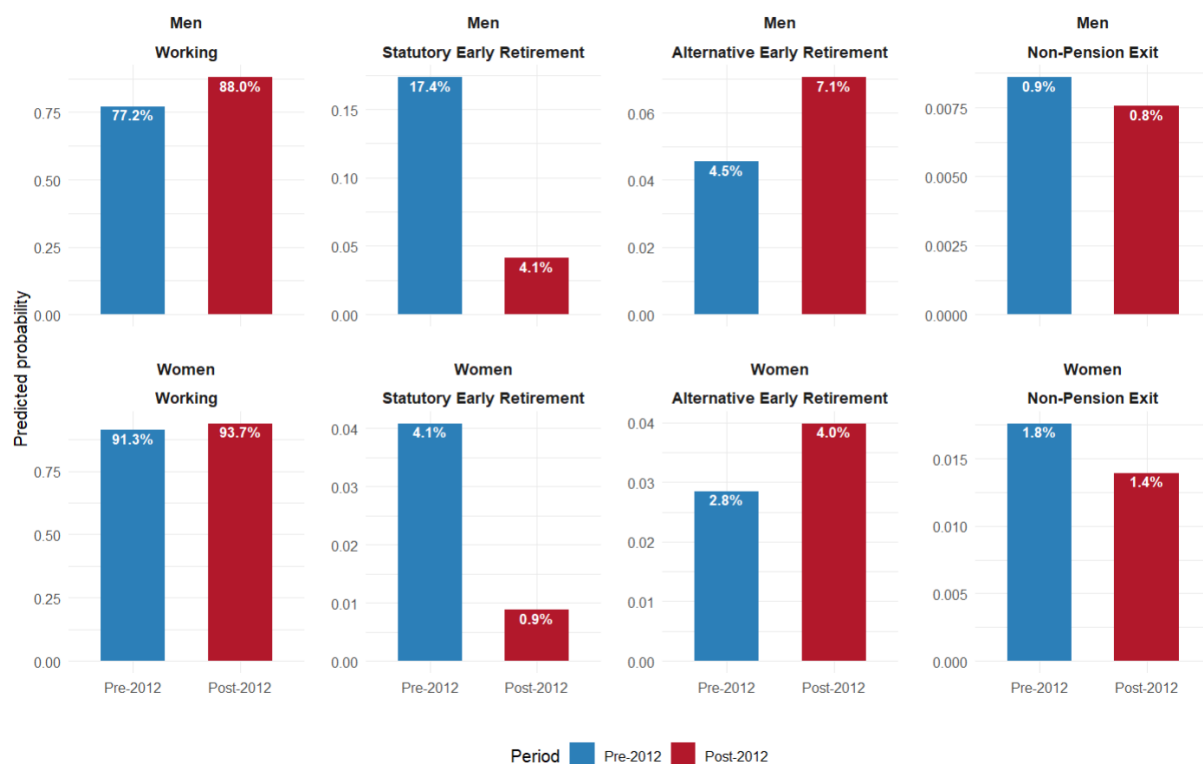


Figure 8: Predicted probabilities of retirement pathways by gender.
Notes: The figure reports predicted probabilities from the multinomial logit model of retirement pathways estimated on individuals aged 55–66, shown separately by gender. These results complement the baseline multinomial specification presented in the main text.

B.1 Robustness Checks for the Statutory Early Retirement DiD Estimates

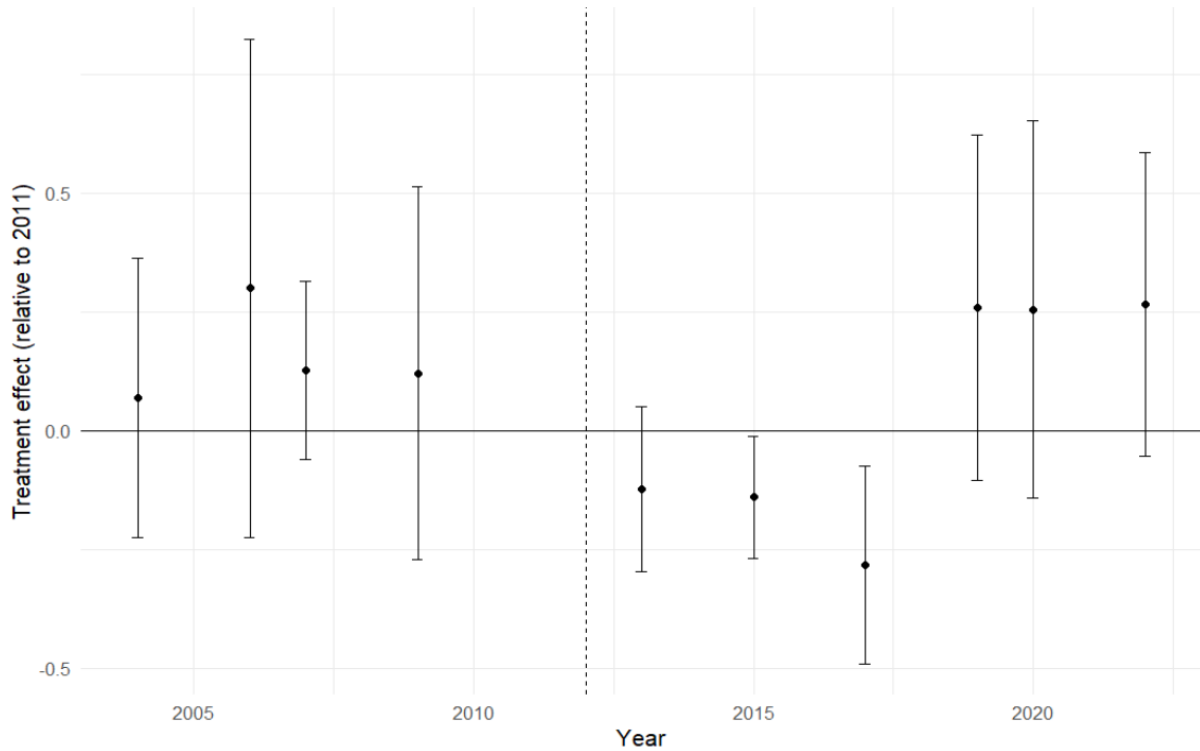


Figure 9: Event-study estimates of the effect of the Fornero reform on statutory early retirement.

Notes: The event-study coefficients are normalized relative to 2011, the last pre-reform observation. The vertical line indicates the implementation of the reform in 2012, even though no survey wave is available for that year.

Table 3: Placebo Difference-in-Differences Tests

Placebo year	Estimate	Std. Error	t-value	p-value
2007	-1.372	18848.316	-0.000	0.9999
2009	0.019	0.138	0.140	0.8889
2011	-0.035	0.643	-0.055	0.9566

Notes: Each specification replicates the preferred DiD model assigning a placebo reform year prior to 2012. Estimates are small and statistically insignificant, supporting the credibility of the identification strategy.

B.2 Robustness Checks for the Alternative Early Retirement DiD Estimates

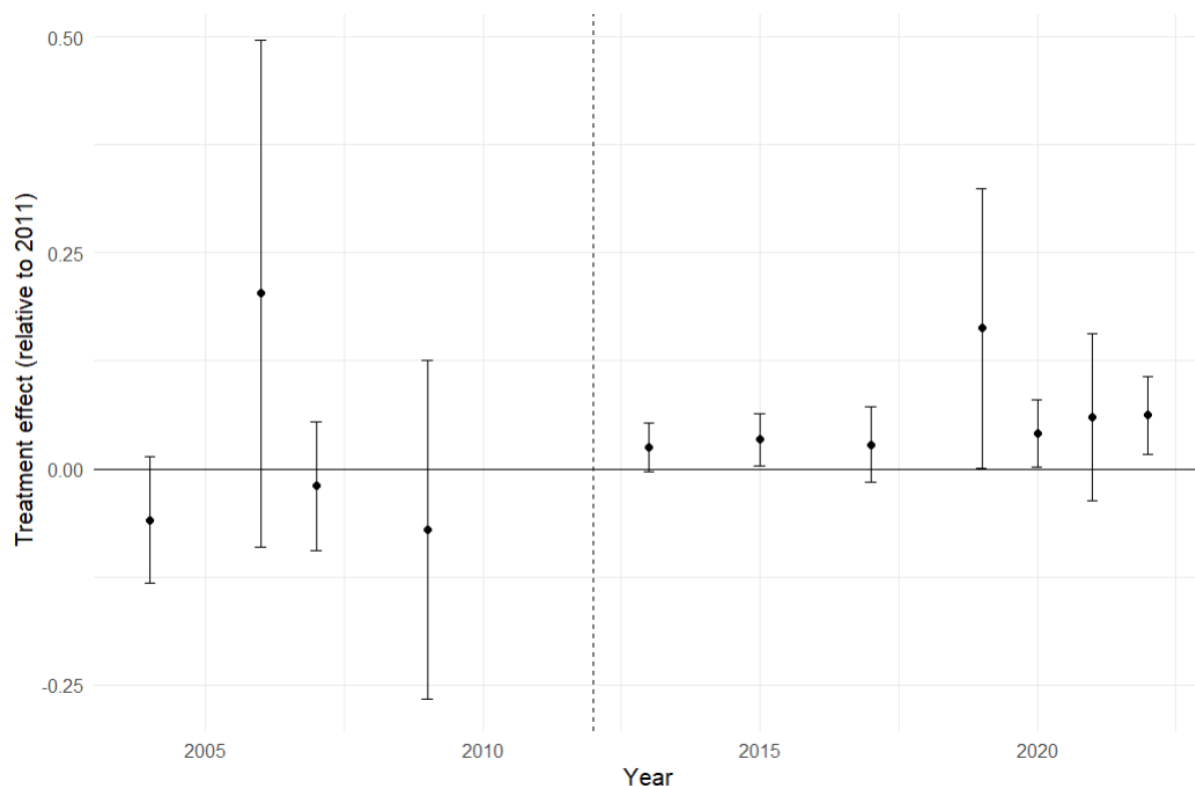


Figure 10: Event-study estimates of the effect of the Fornero reform on alternative early retirement.

Notes: The event-study coefficients are normalized relative to 2011, the last pre-reform observation. The vertical line indicates the implementation of the reform in 2012, even though no survey wave is available for that year.

Table 4: Placebo Difference-in-Differences Tests

Placebo year	Estimate	Std. Error	t-value	p-value
2007	-3.396	7967.355	-0.001	0.9996
2009	-0.0855	0.0522	-1.637	0.1018
2011	0.061819	0.05383	1.148	0.2506

Notes: Each specification replicates the preferred DiD model assigning a placebo reform year prior to 2012. Estimates are small and statistically insignificant, supporting the credibility of the identification strategy.

C.1 Gender Heterogeneity DiD Model Full Results

Table 5: Gender Heterogeneity in Statutory Early Retirement DiD Estimates

Dependent variable:	Early retirement event
Post $\times$ Treated (Men, reference)	-0.1868* (0.0729)
Differential effect: Women vs Men	0.0261 (0.0861)
Married	-0.1792 (0.1370)
Household size	0.0698* (0.0341)
Log wealth	-0.0097 (0.0112)
Log equivalised income	-0.0037 (0.0056)
Self-perceived health	0.0118 (0.0277)
Any limitation	-0.1388. (0.0730)
Missing health info	0.1657 (0.1119)
Missing lagged wealth	-0.2708. (0.1553)
Age fixed effects	Yes
Individual fixed effects	Yes
Year fixed effects	Yes
Observations	790
R^2	0.717
Within R^2	0.076

Notes: Linear probability model estimating statutory early-retirement hazards. The reference group corresponds to men; the reported differential coefficient captures the additional reform effect for women. All regressions include individual and year fixed effects, age dummies, and the same set of controls used in the preferred specification (Model 4 in Section 5.1.). Standard errors clustered at the individual level are reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

C.2 Health Heterogeneity DiD Model Full Results

Table 6: Health Heterogeneity in Statutory Early Retirement DiD Estimates

Dependent variable:	Early retirement event
Post $\times$ Treated (Good health, reference)	-0.3018*** (0.0843)
Differential effect: Poor vs Good health	0.1318* (0.0590)
Married	-0.0599 (0.1301)
Household size	0.0777* (0.0339)
Log wealth	-0.0100 (0.0107)
Log equivalised income	-0.0060 (0.0057)
Missing lagged wealth	-0.1348 (0.1335)
Age fixed effects	Yes
Individual fixed effects	Yes
Year fixed effects	Yes
Observations	790
R^2	0.712
Within R^2	0.061

Notes: Linear probability model estimating statutory early-retirement hazards. The reference group corresponds to individuals in good self-reported health; the reported differential coefficient captures the additional reform effect for individuals in poorer health. All regressions include individual and year fixed effects, age dummies, and the same set of controls used in the preferred specification (Model 4 in Section 5.1.). Standard errors clustered at the individual level are reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

C.3 Income Heterogeneity DiD Model Full Results

Table 7: Income Heterogeneity in Statutory Early Retirement DiD Estimates

Dependent variable:	Early retirement event
Post $\times$ Treated (High income, reference)	-0.2297** (0.0782)
Differential effect: Low vs High income	0.1011* (0.0504)
Married	-0.2280 (0.1414)
Household size	0.0716* (0.0338)
Log wealth	-0.0069 (0.0117)
Self-perceived health	0.0072 (0.0278)
Any limitation	-0.1349. (0.0722)
Missing health info	0.2208* (0.1036)
Missing lagged wealth	-0.2600 (0.1611)
Age fixed effects	Yes
Individual fixed effects	Yes
Year fixed effects	Yes
Observations	790
R^2	0.718
Within R^2	0.080

Notes: Linear probability model estimating statutory early-retirement hazards. The reference group corresponds to high-income individuals; the reported differential effect captures the additional effect for low-income individuals. All regressions include individual and year fixed effects, age dummies, and the full set of controls used in the preferred specification (Model 4 in Section 5.1.). Standard errors clustered at the individual level are reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.