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Portfolio Effects of the Fornero Reform

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Abstract

This study examines the financial implications of reforms raising the Minimum Retirement Age (MRA) by leveraging the 2011 Italian Fornero Reform as a quasi-natural experiment. While previous research has extensively investigated the employment responses of such policies, particularly for close-to-retirement workers, their potential impact on financial decisions remains largely unexplored. To address the gap in the literature, this work investigates the effects of a sudden and heterogeneous extension of the working horizon for middle-aged workers, with a specific focus on expected human wealth, saving behaviors and portfolio allocations. The analyses provide evidence of *forward-looking* middle-aged Italian workers and validate the theoretical predictions mapping human wealth to savings and risky asset allocations. Furthermore, this research project highlights the role of government incentives in shaping the effects of pension reforms aimed at promoting long-term financial sustainability and equality of treatment within and across generations. Finally, these findings contribute to the ongoing debate on the pension wealth effects of the Fornero Reform and shed light on workers' understanding of the mechanisms of the pension system.

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1 Introduction

Due to aging populations and shrinking fertility rates, many OECD countries have implemented unpopular pension reforms to recover long-term financial sustainability and improve the intergenerational and intragenerational solidarity of the system. One measure has been to raise the statutory Minimum Retirement Age (MRA). Existing literature has mainly examined the significant employment responses associated with these pension reforms, while the impact on individual expectations regarding future income sources and financial decisions remains relatively unresolved. Moreover, economists have typically studied the effects of raising the statutory retirement age on workers close to retirement, specifically those who would have met eligibility requirements under pre-reform rules but who are not eligible anymore under the new ones. However, this approach neglects reactions of relatively younger individuals who are not immediately impacted but may still internalize such reforms due to the extensive public debate surrounding them. Indeed, even if not eligible to retire under any scenario, also middle-aged individuals experience an extension in their working horizon and may anticipate changes in their expected labor and pension wealth. However, assessing the response of far-from-retirement individuals is challenging: it requires a shock that is economically important, enough to be well absorbed by individual expectations, and heterogeneous even among younger cohorts ([8] Carta and De Philippis, 2021). So far, no research has been devoted to understanding the effects of reforms that raise the MRA on the expected human wealth and portfolio decisions of middle-aged workers. This lack of knowledge prevents us from gaining valuable insights into the potential impact of these reforms on the level of liquid wealth available to future generations of retirees. In an effort to bridge this gap, the present study leverages a quasi-natural experiment that took place in Italy at the end of 2011, the Fornero Reform.

Raising the statutory minimum retirement age can affect the level of savings and the composition of portfolios through changes in the present discounted value of future labor earnings and pension benefits, here defined as expected human wealth. The effect of raising the MRA on savings is an empirical question that depends on reform-specific employment and pension wealth channels. In particular, by requiring individuals to wait longer before becoming eligible for public pension benefits, these reforms can prompt workers to either rely solely on their existing wealth or, more commonly, to continue working for extra years. In the latter scenario, the increased human wealth resulting from additional periods of labor earnings, which typically exceed public pension benefits, and a shorter period of non-employment to be financed may generate positive income effects leading to higher consumption out of a current and unaffected disposable income ([15] Etgeton, Fischer and Ye, 2023)). To gain a comprehensive understanding of the impact on saving behaviors, this study goes beyond the conventional focus on saving rates. In a life-cycle framework with pension shocks,

households exploit savings to smooth consumption over time by choosing what proportion of lifetime wealth to consume today and what proportion to set aside for the future. As they aim to maintain a level of financial assets that aligns with their present and future total wealth, households should be primarily concerned about the proportion of their savings relative to lifetime wealth rather than current income. Consequently, this work will explore the effect of unexpected increases in total lifetime wealth on individual *saving ratios*, a measure proposed by [33] Ordonez and Piguillem (2022) that quantifies the optimal stock of savings out of expected lifetime wealth predicted by standard dynamic models. Furthermore, as human wealth is typically compared to a bond endowment given its uncertainty, illiquidity and weak correlation with stock market returns, the potential positive impact of reforms raising the MRA on expected human wealth may also influence the "consumable" wealth available during retirement by triggering changes in the household asset mix. In accordance with diversification motives, [29] Merton's CRRA life-cycle model (1975)[1] predicts an optimal portfolio share in stocks increasing in the ratio of human wealth to financial wealth.

Government incentives can also play a role in shaping changes in expected human wealth resulting from reforms that raise the MRA. If post-reform rules provide greater pension benefits as a reward for each additional working year, people may reasonably anticipate higher human wealth due to increased periods of labor earnings and improved pension benefits at the time of retirement. However, when the working horizon extension is not accompanied by more generous replacement rates (defined as the ratio of the first pension benefit to the last salary), postponing access to constant pension benefits can reduce expectations of future pension wealth. Studies investigating the effects of reforms reducing expected pension benefits on consumption behaviors have consistently shown an increase in private savings, aligning with what [17] Feldstein (1974) calls substitution effect: pension wealth crowds out discretionary wealth. Indeed, previous evidence for Italy has found how the reduction in replacement rates following the 1992 Amato reform caused an increase in saving rates ([1] Attanasio and Brugiavini, 2003) and in the household wealth–income ratio ([5] Bottazzi, Jappelli and Padula, 2006). Moreover, [6] Bottazzi et al. (2011) have shown that the decline in the expected pension wealth resulting from the Italian reforms of the 1990s led to an increase in the allocation of private wealth towards safer and real assets. Hence, if the increase in future labor earnings is offset by a negative pension wealth channel, the impact of reforms that raise the MRA on the different components of private wealth for far-from-retirement individuals is a priori ambiguous, further justifying my empirical analyses.

[1] Merton's CRRA life-cycle model with deterministic human capital (1975) predicts a hump-shaped life-time portfolio risky share: young people invest heavily in stocks and then rebalance with age as the ratio between human capital and financial wealth declines, with a concave profile until retirement. [12] Cocco et al. (2005), rationalizing many anomalies predicted by Merton's CRRA model with deterministic human capital (1975), showed how portfolio rules depends on age and wealth and lifetime portfolio risky share rules are hump-shaped also when not insurable income and pension risk are included.

The unexpected 2011 Italian pension reform provides an ideal setting to empirically test the theoretical predictions discussed so far. The Fornero Reform was implemented to improve the sustainability of the Italian pension system and homogenize pension rules among different workers. Written in only 19 days at the peak of the sovereign debt crisis, the reform induced different labor and pension wealth shocks across genders and pension regimes. The sudden and heterogeneous changes in pension eligibility criteria offer a valuable opportunity to examine the response of workers' portfolios to MRA increases. Furthermore, the broad public debates generated by the reform, leading to a widespread understanding of its effects among the population, increase the validity and relevance of assessing the unexplored impacts on financial decisions for middle-aged workers. The main change introduced by the reform was an increase in the minimum retirement age ranging from 1 to 7 years. In addition to this noticeable employment shock, the goal of granting equality of treatment within and across generations created an heterogeneous system to reward people for additional working years. While individuals under an *actuarially fair* pension scheme[2] benefited from higher statutory replacement rates, namely from an increase in the annuity rates governing the pension computation in a Notional Defined-Contribution system ([4] Borella and Coda Moscarola, 2015), people enrolled in the more generous Defined-Benefit pension scheme saw unchanged pension benefits deferred over time.

This study leverages data from the Bank of Italy's Survey on Household Income and Wealth (SHIW), which offers not only detailed information on the composition of household wealth, but also individual *expectations* of retirement age and replacement rates that allow to capture changes in the expected working horizon and pension wealth due to the reform. The analyses involve a sample of nearly 6,000 workers from repeated cross-sections spanning the period from 2006 to 2016. Results are further validated by incorporating a rotating panel component covering the years 2008 to 2014. By employing a Difference-in-Differences (DID) model, the results exploit the variation in the MRA within cells built based on the key determinants of pension eligibility in Italy (age, contribution years, gender and employment status). To address the potential nonlinear impact of the increase in the MRA and the limited responsiveness of middle-aged workers to small shocks, this study employs a treatment assignment strategy that targets individuals most affected by the reform following the approach proposed by [8] Carta and De Philippis (2021). The primary focus of the study is on male workers as they provide a more straightforward comparison between the treatment and control groups, while also considering a selected sample of treated women with discontinuous working histories.

The main findings reveal that the reform differently affected expected human wealth depending on the

[2] An actuarially fair benefit calculation method links all the life-time paid contributions to future pension benefits. In Italy, the actuarially fair Notional Defined-Contribution (NDC) regime involves "fully" all people who started working after 1995 and "partially" all workers with less than 18 contribution years in 1995. Before that date, all Italian workers were subject to the Defined-Benefit (DB) scheme, where pension benefits strongly depend on the last five labor earnings independently of the number of accrued contribution years.

pre-reform generosity of the pension regime individuals belonged to. Male workers with an important MRA shock experienced a puzzling reduction in their expectations of future pension benefits, which is consistent with results from previous literature studying the pension wealth effect of the Fornero Reform. This study shows that the decrease in expected replacement rates was driven by individuals experiencing a negative pension wealth channel rather than by a lack of awareness about the functioning of the pension system ([32] Oggero, 2019). Indeed, workers under actuarially fair pension regimes experiencing important Fornero shocks increased their expected replacement rates, in line both with the increase of individual pension benefits through higher contributions and lower expected longevity at the time of retirement ([18] Fornero, Oggero, and Puglisi, 2019) and with the post-reform incentives to work longer provided through higher annuity rates. Concerning the impact on savings behavior and portfolio allocations, after the reform the average saving rate increased by 1.5 percentage points for each additional working year, representing approximately 6% of the average saving rate for the control group in the pre-reform period. This study shows how the observed increase in savings was driven by most exposed individuals experiencing a negative pension wealth channel, in accordance with the substitution effect proposed by Feldstein. Conversely, workers under actuarially fair pension regimes with an important increase in their MRA increased their expected human wealth and reduced their optimal proportion of savings out of lifetime wealth. Finally, portfolios of most exposed workers responded to the changes in expected human wealth induced by the reform. Actuarially fair workers under the Notional-Defined-Contribution and Pro-rata pension schemes increased their allocation to risky assets, particularly stocks. This shift in portfolio composition can be attributed to the post-reform increase in their ratio of human wealth relative to financial wealth. These findings support the idea that saving and portfolio adjustments are predominantly driven by individuals who comprehend how pension reforms are altering their financial incentives ([5] Bottazzi et al, 2006). To validate the causal relationships observed, several robustness checks are conducted. These analyses include the use of panel data to ensure the reliability of the results found with repeated cross-sections, as well as the examination of household-level dynamics.

The thesis is structured as follows. Section 2 elucidates a comprehensive conceptual framework that helps to understand the possible effects of pension reforms raising the MRA on human wealth and financial decisions. Section 3 provides a concise overview of the Italian pension system and highlights the key features of the 2011 Fornero reform. Section 4 introduces SHIW data and outlines the process of constructing the Fornero shock and the selection of the treatment variable. Additionally, this section describes summary statistics and the empirical strategy employed to study repeated cross-sections. Lastly, it concludes with an examination of the identifying assumption of the study to assess the validity of causal interpretations. Section 5 presents the key findings for middle-aged male workers from repeated cross-sections: it starts by

examining the influence of a strong increase in MRA on expected replacement rates, thereby shedding light on an important mechanisms driving the observed change in human wealth following the Fornero Reform. Subsequently, the analyses explore financial decision outcomes and the role of different pension regimes in explaining the heterogeneity in the results. In Section 6, the study examines panel data to validate the robustness of the main findings. Moreover, this section presents analyses that explore the effects of the reform for married couples in which both partners are affected by the MRA shock. In fact, previous results explore the heterogeneity of the effects of the Fornero Reform across genders by leveraging the individual shocks for household heads responsible for financial decisions, as financial variables are available in the Survey of Household Income and Wealth (SHIW) only at the household-level. Although these robustness analyses rely on a smaller number of observations, they account for potential spillover effects from the shocks of the household heads' partners. Conclusions follow in the last section.

2 Conceptual Framework

2.1 The Impact of Pension Reform Raising the Minimum Retirement Age on Savings

This research project contribute to the literature addressing the implications of pension reforms that raise the statutory Minimum Retirement Age (MRA) on savings and portfolio allocations. Firstly, the empirical evidence of strong employment responses[3] ([27] Mastrobuoni, 2009; [7] Carta, D'Amuri and von Wachter, 2021; [26] Manoli and Weber, 2016; [19] Gruber, Milligan and Wise, 2009), including among middle-aged individuals ([8] Carta and De Philippis, 2021) suggests that the potential impact of these reforms on financial decisions may differ from the standard evidence highlighted by the literature analysing pension reforms. The empirical finding of a strong *substitutability* between public pension wealth and private savings arises from pension reforms that alter the pension benefit formula or replacement rates. Focusing on the Italian context, several empirical studies[4] supported an increase in private savings subsequent to the reduction in

[3]Policy reforms designed to increase the statutory retirement age encounter several concerns. Firstly, there is contention regarding the potential impact of such reforms on the employment rates of older individuals, as these policies could lead to an increase in unemployment benefits ([36] Staubli and Zweimüller, 2013) and/or disability benefits ([14] Duggan, Singleton and Song, 2007). However, [26] Manoli and Weber (2016) provide evidence that affected individuals retain their jobs for longer periods. Their findings reveal no increased substitution towards alternative benefit programs, such as unemployment insurance, sick leave, or entry into disability pensions in response to these reforms. Second, fairness objections are raised, arguing that retirement at the minimum retirement age is disproportionately binding for workers with physically demanding occupations or low-income positions. Finally, some argue that the increased employment of older individuals may reduce youth employment opportunities. [19] Gruber, Milligan and Wise (2009) find no evidence to support the notion that increasing the employment of older individuals leads to a reduction in job prospects for younger generations. Moreover, [7] Carta, D'Amuri and Von Wachter examine the unexpected increase in the share of older workers resulting from the Italian Fornero reform. They find a positive impact on both young and middle-aged employment and increases in total value added.

[4][1] Attanasio et al. (2003) modeled the response of savings exploiting how the 1992 Amato Reform affected more younger and educated public employees with respect to older and uneducated workers in the private sector. Bottazzi et al. (2006) showed how this decline in replacement rates led to an increase in the stock of private wealth [3] and in the share of safe and

replacement rates resulting from the pension reforms of the 1990s. However, as highlighted by [17] Feldstein (1974), the overall impact of changes in public pension wealth on private savings depends on the magnitude of the employment effect resulting from the specific policy examined. Research on the potential interaction of labor and pension wealth effects due to reforms raising the MRA is currently missing.

My thesis is closely related to the work of [15] Etgeton, Fischer and Ye (2023), which investigates how increases in the early retirement age affect saving decisions. Their analysis acknowledges the dual nature of individuals' reactions to an increase in the retirement age. On one hand, if individuals plan not to extend their working horizon, they may increase their private savings to offset the loss in pension income resulting from a delayed retirement. On the other hand, if individuals face a significant increase in their MRA, they are likely to cope with the important loss in public pension wealth by extending their labor supply. As a consequence, they might reasonably anticipate an increase in lifetime wealth driven by (i) additional labor income, (ii) enhanced pension benefits through more contributions and a higher replacement rate, and (iii) a shorter period of non-employment to finance. According to the authors, presuming the increased lifetime wealth accrues sufficiently to counterbalance the deferred pension benefits due to later claiming, the consumption smoothing hypothesis would predict a decrease in their per-period savings prior to retirement[5]. [8] Carta and De Philippis (2021) dispute the likelihood of a scenario in which Italian workers rely exclusively on their savings and provide empirical evidence of how the 2011 Italian reform boosted the labor supply of middle-aged women[6] subject to a strong increase in their MRA. Consequently, at least for most exposed middle-aged women, it would be reasonable to anticipate a downward trend in savings rates after the 2011 reform. However, also government incentives could influence saving decisions. If post-reform rules provide greater annuity rates as rewards for each additional working year, individuals may reasonably anticipate higher human wealth due to both increased labor earnings and improved pension benefits at the time of retirement. However, if individuals face a postponement of constant pension benefits as a result of these reforms, they may internalize a reduction in their expected pension wealth. In such cases, the empirical predictions from the literature studying negative pension wealth channels can provide helpful insights into saving dynamics. Furtermore, this work assess how middle-aged households adjust their consumption choices when facing an exogenous permanent change in expected lifetime wealth, relating to studies that examine

real assets [6] for households most affected by the reforms who fully adjusted their beliefs on the new rules.

[5]Etgeton et al. (2023) provide empirical evidence of dissaving behavior among German women in response to an increase in the early retirement age. The authors found that the loss in pension wealth due to the policy change was absorbed through an adjustment in labor supply.

[6]It should be noted that these women were characterized by the most discontinuous work histories prior to the reform. In contrast, there was no significant labor supply response observed among men who were already well-attached to the labor market. They also find a more pronounced labor supply response among women under a Defined-Benefit scheme, suggesting that individual responses to the 2012 reform could be influenced by changes in expected pension wealth.

saving responses to unexpected permanent income changes ([23] Jappelli et al. (2010)). Finally, this area of research has relevant policy implications: if workers increase their consumption after reforms raising MRA, this raises concerns about potential mismatch between expected and realized retirement ages. For instance, overconfidence in their ability to extend their working lives may lead to inadequate savings, highlighting the importance of raising awareness about the potential consequences of these reforms on individuals' long-term financial security.

When it comes to defining saving rates[7], I adhere to the standard definition of savings as a fraction of disposable income ($s_t^d = \frac{y_t - c_t}{y_t}$), i.e.) for the purpose of comparison with existing literature. In addition, as an alternative specification that focuses on the potential effects of reforms raising the MRA on the labor market, savings are also evaluated relative to current labor income (namely excluding property income and transfers). However, households optimize their savings by choosing what proportion of total wealth (which is more than current net worth) to consume today and what proportion to set aside for the future in order to smooth consumption over time. Consequently, as they aim to maintain a level of financial assets that depends on their present and future total wealth, households may not be primarily concerned about the proportion they save out of current income. Instead, to ensure an optimal growth rate for their lifetime wealth, they should choose their savings by integrating the observed growth in financial and human wealth with saving motives. [33] Ordoñez and Piguillem (2022) propose a measure of savings that captures a core prediction of theoretical models: people's propensity to save out of total wealth. They define it as *saving ratio*. As detailed in Appendix A, the fundamental saving motives behind this measure are represented by individual discount rates, precautionary motives and intertemporal smoothing motives. For instance, if individuals anticipate increases in future income or a shorter retirement period, their previous optimal level of savings becomes unnecessary to smooth consumption over time. Hence, they may reduce their savings out of total wealth. Despite not being consistently evaluated in the literature (primarily due to the absence of a uniform methodology for assessing financial and human wealth), the saving ratio shares close ties with the conventional saving rate. The relationship between the two is explicated using a standard dynamic consumption model where people can save in a risk-free asset b and in a risky asset a subject to *i.i.d.* idiosyncratic shocks. In particular, the authors showed that saving rates are not a reliable indicator for the evolution of savings ratios in case of important changes in the present value of future human capital. Indeed, from the definition of the saving ratio as:

$$s_t = \frac{s_t^d + \chi_t}{1 + \chi_t},$$

[7]Some economists advocate for a more restrictive approach, suggesting that only a fraction of expenditure on consumer durables should be included. They further argue for income adjustments to account for inflation or for savings to be considered net of capital stock depreciation ([25] Rossi and Visco, 1994)

where s_t^d is the standard saving rate, while χ_t represents net worth and human wealth normalized by current income, it becomes clear that the dynamic properties of s_t carry over to implications for s_t^d only if financial wealth $p_t a_t + b_t$ and human wealth h_t remain stable. Please refer to Appendix B for a detailed description of the measure employed to assess expected human wealth.

2.2 The Portfolio Effects of Pension Reforms Increasing Human Wealth

In a CRRA model with no labor income, volatile stock returns and time-separable preferences, changes in social security wealth should not affect portfolio rules ([28] Merton, 1969; [30] Mossin, 1968; [34] Samuelson, 1969;)[8]. To address the empirical discrepancies of this framework and acknowledge that the evolution of total lifetime wealth is likely to affect optimal portfolio choice, it is necessary to relax the assumption of the absence of human capital, defined as the present value of future labor income discounted at the risk-free rate. Specifically, under the assumptions of deterministic labor income, CRRA preferences and complete markets, [29] Merton (1975) shows that the optimal allocation to risky assets is positively related to the ratio of human wealth to financial wealth $H(a,\tau)/W_{i,a}$. The risky share for an investor i of age a is the proportion of lifetime wealth invested in risky financial assets, namely:

$$\frac{\alpha_{i,a} W_{i,a}}{H_{a,\tau} + W_{i,a}} = \frac{(\mu - r_f)}{\gamma_i \sigma_i^2},$$

where total wealth $W_{i,a}$ is the combination of human wealth and accumulated assets, $(\mu - r_f)$ represents the risk premium, σ_i the volatility of risky returns and γ_i denotes the individual constant relative risk aversion. The optimal risky share as a fraction of financial wealth can be calculated as follows:

$$\alpha_{i,a} = \frac{(\mu - r_f)}{\gamma_i \sigma_i^2} \cdot \left(1 + \frac{H(a,\tau)}{W(a)}\right),$$

The ratio $H(a,\tau)/W_{i,a}$ reflects how the relative importance of human wealth compared to financial wealth changes with age and affects the optimal allocation of risky assets. Specifically, this model predicts a hump-shaped life cycle portfolio risky share: young people invest heavily in stocks and then rebalance with age as the ratio between human capital and financial wealth declines, with a concave profile until retirement. The rationale for this pattern is that the significant presence of riskless and tradable human capital acts similarly to a large endowment in risk-free bonds, thereby creating strong incentives for stock market investments. This feature has been observed consistently in calibrated optimal portfolio choice models over the life cycle

[8] The Merton-Mossin-Samuelson seminal dynamic framework predicts individual participation at all ages and an age-wealth-independent share in risky assets, contradicting both the *participation puzzle* observed in the data at all ages and conventional financial advice that encourages young individuals to invest in stocks and gradually reduce their exposure to risk as they approach retirement.

which rationalize many anomalies[9] predicted by the Merton's CRRA model with deterministic human capital (1975): in particular, [12] Cocco et al.(2005) show how life-time portfolio risky share rules are hump-shaped even when not insurable income and pension risk are included.

One of the objectives of this study is to empirically investigate the degree to which the observed data aligns with the predictions of the Merton's model concerning the relationship between human wealth and the optimal portfolio risky share. This examination is relevant in light of the potential wealth redistribution resulting from reforms raising the MRA, which can influence the amount of consumable wealth available to individuals during retirement. Indeed, different wealth components are not perfect substitutes for one another. Financial assets are readily available for consumption, while real assets are more illiquid and can be converted into cash at a cost. Relaxing the assumption of complete markets[10], theoretical predictions suggest that portfolio allocations respond to the wealth effects of pension reforms depending on the composition[11] of private wealth. Moreover, reforms targeted at addressing the imbalance in pension systems and mitigating the risks associated with social security wealth may lead to a decrease in background risk (pension risk is inherently unavoidable), which may correlate with an increase in households' allocation to risky assets ([20] Guiso, Jappelli and Terlizzese, 1996). Finally, the standard life-cycle model for portfolio choices assumes perfect information, which may not accurately reflect real-world scenarios. Information frictions related to the pension system can rationalize poor saving responses to reforms affecting lifetime wealth. Furthermore, individuals' varying levels of pessimism regarding their retirement prospects can lead to reactions not aligned with a positive human wealth channel. Indeed, my study is also closely related to the existing research[12] that explores the heterogeneous accuracy of subjective expectations regarding retirement age and social security benefits across the population. In summary, while theory predicts portfolio allocations responsive to pension reforms affecting human wealth, the exact direction of the effects remains ambiguous, justifying the relevance of empirical investigations in this area.

[9] Merton's influential model faces limitations in its prediction of participation in financial markets at all ages and risky shares at young age inconsistent with data. Researchers have suggested the inclusion of multiple factors that discourage young financial risk: borrowing costs, endogenous habit formation preferences, a positive correlation between labor income and stock returns, counter-cyclical volatility for idiosyncratic income risks or variation in perceived background risk to generate time-varying risk aversion ([21] Guiso and Sodini, 2013). Moreover, Merton's model fails to account for the possibility of exiting the stock market. To address this limitation, researchers have proposed to introduce small per-period participation costs, relatively high risk aversion, a small age-invariant probability of a disaster and mistrust ([16] Fagereng, Gottlieb and Guiso, 2017)

[10] In a hypothetical complete market economy, all assets would yield equivalent risk-adjusted returns, making the composition of investors' portfolios irrelevant. However, real-world factors such as borrowing constraints, bequest motives, short-sightedness, liquidity constraints, uninsurable risks, illiquid future benefits and transaction costs come into play.

[11] For example, if a pension reform leads to an increase in housing wealth, the adjustment in the allocation of risky assets will depend on whether the crowding-out effect or the hedge effect dominates ([2] Bottazzi, Jappelli and Padula, 2011). While housing wealth serves as a hedge against rent uncertainty ([35] Sinai and Souleles, 2005), the risk associated with housing price fluctuations may deter individuals from investing in stocks, especially those with low financial net worth ([11] Cocco, 2005)

[12] [5] Bottazzi et al. (2006) have highlighted the role played by financial education and beliefs in shaping individual portfolio allocations following the Italian pension reforms of the 1990s. Their study reveals that people better informed about the reform tend to exhibit saving behaviors in line with the outcomes predicted by theoretical frameworks.

3 Institutional Background

3.1 The Italian Pension System

Prior to the reforms of the 1990s, the Italian social security system featured generous earnings-based benefits, high replacement rates and favorable schemes for early retirement. In 1992 public pension spending reached nearly 16 percent of the Italian GDP, the highest among OECD countries. Since the Amato (1992) and Dini (1995) reforms aimed at improving the financial sustainability of the pay-as-you-go first pillar system, Italian workers have been divided into three different pension schemes. Those who had contributed for more than 18 years at the end of 1995 retained the generous provisions of the pre-1992 regime: they were subject to an earning-based method, the so-called Defined-Benefit scheme, where pension benefits were determined based on the average salaries of the final stages of people's careers, regardless of accrued contributions. People who started working after 1995 were covered by a Notional Defined-Contribution system, where pension benefits were calculated as the sum of all contributions revalued at the rate of GDP growth and annualized based on life expectancy at retirement. This calculation method implies that deferring retirement improves the adequacy of pension benefits by increasing the annuity rate. Finally, workers who had contributed for less than 18 years at the end of 1995 were subject to the mixed Pro-Rata system, which involved a weighted average of DB and NDC benefits.

The right to claim full retirement is based on age (age-based pensions), contributions or a combination of the two (seniority-based pensions). Pension wealth is maximized when claiming pension benefits as soon as eligibility is reached. Indeed, several existing evidence shows that around 70 percent of Italians retire as soon as eligible for their full retirement ([2] Battistin et al, 2009; [7] Carta et al, 2021; [9] Ciani, 2016) and it is worth noting that Italy has historically had a high average tax burden on labor income once individuals reach eligibility to retire ([13] Di Nicola et al, 2017). *Opzione donna* is the only scheme that allows one to claim pension benefits before meeting the eligibility criteria and is available only to women, but is not very popular as it implies an average pension cut of almost 35 percent ([22] INPS, 2016).

Governments have also tried to promote the development of the second pillar, which refers to supplementary pension schemes. Since 2007, the severance pay flows of private employees has been automatically redirected to these schemes unless individuals explicitly choose not to participate. However, the enrollment rates in private pension schemes remain relatively low, reaching only 25.5 percent of the total working population in 2012 ([4] Borella and Coda Moscarola, 2015).

3.2 The Fornero Reform

Italy has spent the largest share of national income on pensions among OECD countries since 2000: 14.1 percent of GDP ([31] OECD, 2011). The Fornero reform was presented at the end of 2011, only 20 days after the appointment of a new technocratic government. The main goal was to avoid a financial default in the context of the European sovereign debt crisis and reach financial stability by reducing pension expenditure by around 20 percentage points of GDP over the period 2012-2050. In force since January 1 2012, the reform could not have been anticipated:: also stock markets responded sharply after its release. New rules (i) increased pension eligibility requirements for the old age and seniority pension schemes and homogenized requisites between genders and working schemes, (ii) increased average replacement rates, especially for the youngest purely NDC cohorts, (iii) abolished the quota system, an early retirement option that allowed to retire up to five years before reaching the old age requirement, (iv) extended the pro-rata mechanism to DB workers for contributions paid starting from 2012. The increase in the MRA varied significantly based on gender, cohort and previously accrued years of contributions. Younger generations faced a larger increase in their average retirement age, with the exception of the 1955 cohort[13] for women, for whom not only the early retirement option was suppressed but also the old-age requirement was gradually increased in order to match male requirements by 2018. New rules for self-employed workers[14] followed the same patterns. The reform left unaltered the early retirement scheme for women. Despite its take-up slightly increased after the reform, it remained less than 20 percent in 2015.

The shock affected more women with fewer contribution years. Before the reform they could have retired at 60 under the old age scheme, while after the reform they had to wait till 67. Less exposed women were those who accrued more contributions before the reform: they could have retired with 40 contributions years and had to reach 42 afterwards. With regards to men, those with an intermediate number of contribution years experienced a larger shock, as these would have retired under the quota system abolished by the reform. Conversely, men with the most and least continuous working lives were less affected: the former could have retired with 40 years of contributions pre-reform and had to reach 43 afterward, while the latter could have retired under the old age scheme at 65 and had to wait till 67, as women, after the reform.

Finally, it is important to highlight that people under the Defined-Benefit method moved to the Notional Defined-Contribution scheme for all working years starting from 2011, resulting in a mixed scheme where the weight of each regime in the pension formula depends on the number of years spent under each scheme.

[13] This cohort of women faced the greatest increase in MRA and benefited from an increase of 13.2 percentage points in their replacement rates ([4] Borella and Coda Moscarola, 2015).

[14] However, for them the increase in replacement rates was particularly relevant, as in Italy they face higher risks of not accruing adequate pension benefits: under the NDC system, they contribute with a lower payroll tax rate (20 percent) compared to employees (33 percent).

As DB workers tend to be older and closer to their MRA, their generous pension benefits remained almost unchanged after the reform, unlike other workers subject to more actuarially fair pension regimes (NDC and Pro-Rata) who experienced an increase in their public pension benefits.

4 Empirical Analysis

4.1 Data and Sample

I leverage data from the Survey of Household Income and Wealth (SHIW), a representative biennial survey of the Italian population carried out by the Bank of Italy. The most recent surveys involve a sample of around 8,000 households and present a rotating panel component which represents almost half of the original sample. The panel size is halved for each new wave included. Hence, although panel data offer several advantages for the implementation of a differences-in-differences (DID) methodology, the constraints posed by the sample size[15] and the potential for standard sample selection issues justify their use as a valuable complementary source for conducting robustness checks. Limited panel observations also explain the smaller number of survey waves used in the panel analyses compared to the repeated cross-sectional analyses: as the new pension rules have been in force since 2012, panel data cover the survey waves from 2008 to 2014, while repeated cross-sections span from 2006 to 2016. To ensure the representativeness of the sample, survey weights are employed for descriptive statistics.

SHIW data offer several advantages[16] for my empirical strategy. First, they provide information on the determinants of the Italian MRA and expectations regarding individuals' retirement age and replacement rate[17]. This allows to compute both the statutory and expected retirement delays, as well as changes in the expected pension wealth, so to capture how workers internalized the reform. Second, SHIW data provide a full picture of the composition of household wealth and detailed information on expenditure and income, enabling me to study changes in savings and portfolio allocations. Third, these data are available for a long time span, allowing me to study the dynamic effects of the reform and support the identifying assumption of parallel trends for DID analyses.

My empirical strategy aims to assess the impact of raising the MRA on financial decisions for individuals

[15] In particular, the limited sample size prevents analyses by civil status or the possibility to perform separate regressions for different pension schemes due to the scarcity of observations for NDC and Pro-rata workers in the control group. Additionally, the limited number of respondents who reported their expected replacement rate (253 individuals) precludes the identification of the factors that influenced their financial decisions.

[16] It should be noted that the Survey of Household Income and Wealth is prone to non-response or low participation of wealthy families, measurement errors and misreporting, particularly with respect to financial assets. The survey also suffers from inconsistencies related to the starting year of working life due to recall problems and question ambiguity. Furthermore, only a minority of respondents declare to hold risky assets, which happens to be an important variable of interest in this study.

[17] The questions on the survey are the following: When do you expect to retire? Think about when you will retire, and consider only the public pension (that is, exclude private pensions, if you have one). At the time of retirement, what fraction of labor income will your public pension be?

not eligible to retire before the reform. Aligned with the framework outlined by [8] Carta and De Philippis (2022), the analyses focus on men aged between 45 and 64 and women aged between 45 and 59, both having less than 40 years of contributions in 2010. This filtering criterion excludes individuals who were already eligible to retire under the old-age and seniority schemes before the 2011 reform. Moreover, all retired people are dropped and workers with $MRA_{pre} < age$ (where MRA_{pre} refers to their Minimum Retirement Age under the pre-reform rules) are assigned a Fornero shock equal to 0. In fact, individuals who opted to remain in the workforce despite being eligible to retire before the reform did not experience a labor shock after 2011. Finally, to neglect people too far from retirement, the analyses exclude people aged less than 45 and with less than 10 years of accrued paid contributions. Results are robust to small changes in the sample.

4.2 The Treatment Variable: Constructing the Fornero Shock

To ascertain the extent to which each individual is affected by the policy, I built cells (denoted as q) based on the interaction of the key factors determining the Italian MRA (age, gender, years of contributions and employment status) and constructed a cell-specific and time-invariant metric of exposure to the reform following [8] Carta and De Philippis (2022). Tq is the number of additional years each cell q has to work before becoming eligible to retire after the Fornero reform and is defined as the discrepancy between the statutory MRA under post-reform and pre-reform rules ($MRAq, post - MRAq, pre$). Once interacted with a post-reform dummy, the continuous treatment Tq allows to estimate the average treatment effect of a linear increase in MRA after 2011 on several variables.

Figure 1 illustrates the distribution of the increase in the statutory MRA for male and female household heads in charge of financial decisions resulting from repeated cross-sections. The reform, aimed to equalize pension rules across genders by 2018, caused on average a greater extension in the working horizon for women than for men. It is essential for the shock to be substantial in magnitude to be credibly internalized by middle-aged individuals not close to retirement. As in this sample the average MRA increase is 3.8 years for men and 5.3 years for women, the treatment group is defined as men (women) who experienced a shock in their MRA of at least 4 (6) years. This treatment definition ensures a comparable number of observations between treated and control groups and maintains consistency with the research conducted by [8] Carta and De Philippis (2021). It is noteworthy that a subgroup of people were subject to a *grandfathering clause*, which allows retirement under pre-reform rules for workers eligible to the social security system in the year a pension reform passes. In my analyses, workers who qualify for retirement in 2011 have a $Tq = 0$ and are included in the control group.

To identify Tq with the actual increase in the MRA post-reform, it is necessary to assume that workers

accumulate contributions continuously from the survey year. While this assumption may be less realistic for individuals with more fragmented work histories, such as women, it only underestimates their actual increase in MRA. In addition, to establish that the Fornero shock truly affected the working horizon of middle-aged individuals, this study assumes that workers retire as soon as they reach their MRA (widely supported by previous empirical studies for Italy as discussed in Section 3.1), understand the reform and modify their expected retirement age in accordance with the new rules. Figure 13 from Appendix C validates these last assumptions by showing a more substantial increase in the reported expected retirement age for men and women experiencing a larger statutory increase in their MRA.

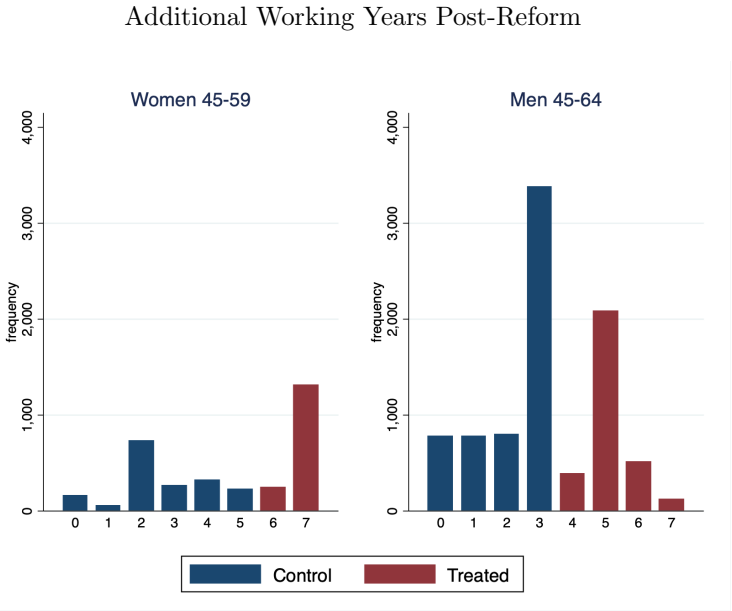


Figure 1: Source: SHIW 2006-2016
NOTE - Distribution of the increase in MRA post-reform by gender. The sample includes household heads who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). Women are aged between 45-59 and men between 45-64 in 2010. Both have less than 40 and more than 10 years of accrued paid contributions. Women (men) are defined as treated if they experience an increase in their MRA of at least 6 (4) years after the reform.

4.3 Descriptive Statistics: Repeated Cross-Sections

The sample from repeated cross-sections comprises nearly 44,000 household heads surveyed between 2006 and 2016. Among them, 30,612 individuals are directly affected by the Fornero reform, with 20,767 men and 9,845 women in charge of household financial decisions. Among individuals who were not eligible to retire before the reform, a subset of 4,575 men and 2,291 women experienced a MRA increase, with the majority of men belonging to the generous DB system and the majority of women belonging to the Pro-

Rata system. 727 men and 151 women were grandfathered, nearly all being DB workers. To examine the heterogeneous impact of the Fornero reform by gender, individual shocks can be constructed in SHIW data mainly for household heads. However, the analyses[18] based on household-level shocks conducted in Section 6 take into account potential spillover effects of the partner's MRA shock on household financial outcomes. These checks validate the main results at the individual level and suggest that the shock experienced by the household head, who is often the primary earner, has a greater impact on household wealth allocation.

Before delving into the different specifications, it is useful to first grasp the underlying rationale behind the shock's heterogeneity across genders. Tables 1 and 2 in Appendix D report descriptive statistics for women and men more and less exposed to the changes in pension rules. The Fornero shock was more important for women with fewer contribution years[19] who planned to retire under the old age scheme. This system required women with at least 20 years of contributions to be 60 before the reform and 67 afterwards. Consistently, Table 1 shows that women most exposed to the reform had an average of 7 years less in contributions compared to the control group. As a result, the female treated group[20] represents a selected sample consisting of people with more discontinuous working histories, which also explains the higher proportion of unemployed women among the treated group. Table 2 reveals a dissimilar situation for men, as more[21] and less exposed male workers appear to be similar across most of the evaluated dimensions. This is one of the reasons why they are the primary focus of the main results presented in this study. In fact, due to the similarities between the pre and post-reform rules governing the old age and seniority schemes for men, the control group involves both workers with more and less discontinuous work histories. Finally, Tables 1 and 2 underline the absence of substantial differences between treated and control groups with regard to most of the financial variables examined in Section 5, particularly for male workers. In fact, women more exposed have a statistically significant higher share of deposits and lower share of real assets and stocks.

Overall, for women contribution years played a greater role than for men in determining the cross-sectional variation of the shock. To validate the impact of the Fornero shock on each gender, the sources of variation of an exogenous increase in MRA exploited in my specifications will be different contribution years within cohorts for women and different cohorts with comparable years of contributions for men. In fact, age does

[18] Moreover, the main findings remain robust when focusing on single-shock households, which comprise household heads who are single, separated, divorced, or married to a retired partner.

[19] As detailed in Section 3.2, individuals who began to work at an early age and had a continuous work history would have retired prior to the reform under the seniority scheme, which mandated 40 years of accumulated contributions. Workers with more discontinuous work histories or who began to work later would have retired under the "quota" system relying on both age and contributions, while people with far more discontinuous work histories or who began working much later would have retired under the old age scheme.

[20] The higher expected replacement rate among the control group can be rationalized with a larger proportion of Defined-benefit workers, who benefited from a more generous pension scheme. Consistent with a Defined-Benefit system that covered workers with more than 18 years of contributions in 1996, this control group includes older women, with lower levels of education and a higher proportion of married women with retired partners.

[21] The treated group has a higher proportion of people with a university degree, from the South and a higher proportion of workers with a Defined Benefit (DB) pension scheme, which helps explain the higher average replacement rate compared to the control group.

not represent a confounding factor for women, while contribution years for men. To further mitigate related concerns, Appendix E examine the extent to which the increase in MRA is influenced by these variables by comparing the distributions of residuals derived from the regressions of the continuous treatment on age or contribution years. The figures reported confirm that age predominantly explains the MRA shock for men (treated men are typically older), while contribution years have a stronger explanatory role for women. In fact, the degree of skewness towards 0 in the distributions of the residuals signals the extent to which these independent variables explain the increase in MRA.

In line with the role of government incentives for expected pension wealth outlined in Section 2, Figure 13 from Appendix C suggests how pension regimes may be an important drivers of expected replacement rates for workers not eligible to retire by 2010 presented in. Across both genders, on average individuals under actuarially fair pension regimes (the NDC and Pro-Rata schemes, as detailed in Section 3.1) subject to an increase in statutory replacement rates after the reform exhibited a gradual increase in expected replacement rates during the years following the reform. In contrast, female workers under the generous Defined-Benefit scheme saw a strong decrease in expected replacement rates after 2011, while DB male workers experienced a strong reduction in 2012 with a partial recovery in the following years. It should be noted that no group experienced a reduction in statutory replacement rates after the reform. However, the negative pension wealth effect suggested by Figure 13 may be rationalized by the postponement of constant pension benefits among individuals under the Defined-benefit (DB), in contrast with the more generous annuity rates offered to workers subject to actuarially fair pension regimes. Moreover, the average reduction in expected replacement rates observed among all male workers in the aftermath of the reform might suggest that the reform was interiorized as a bad signal regarding the stability of the Italian pension system. This perception may have raised concerns about the potential for future administrations to implement additional measures aimed at ensuring the long-term financial sustainability of the system, such as reforms reducing replacement rates similar to the ones witnessed in the 1990s. The larger reduction in expected pensions for workers who were benefiting more from pre-reform rules could be attributed not only to the first-order effect of unchanged pension benefits deferred over time, but also to their apprehension about being the most vulnerable group to potential future cuts.

4.4 Specifications

This research project aims at studying how an exogenous extension in the working horizon affects human wealth, savings and the "consumable" wealth of the next generations of retirees. To examine the relationship between retirement delays and financial decision-making, a difference-in-differences model is employed. This

leverages the variation in the MRA within cells (described in Section 4.2) among middle-aged workers. The specification with repeated cross-sections for an individual i in year t and within cell q is:

$$Y_{iqt} = \sum_{t=2006}^{2016} \beta_t (Treat_q \cdot time_t) + \sum_{t=2006}^{2016} \gamma_t (X_{i2006} \cdot \alpha_t) + \alpha_t + \alpha_q + \epsilon_{iqt}, \tag{1}$$

where β_t is the coefficient of interest estimating the average differences in the dependent variable Y_{iqt} between cells that experienced a larger or a smaller increase in MRA. In the baseline specification, a dummy variable taking value 1 for $T_q >= 4$ is employed as treatment variable $Treat_q$ for men, while an indicator for $T_q >= 6$ is used for women (refer to Section 4.2 for more details on the treatment assignment strategy). Moreover, to account for varying intensities of the MRA shocks, we employ $T_q = MRA_{q,post} - MRA_{q,pre}$ as a continuous treatment variable. This approach serves as a robustness check, given that it assumes a linear effect of each additional year of MRA, which may not necessarily hold, and given far-from-retirement workers are more likely to respond to important shocks. The treatment variable interacts with a time variable which can take the form of a post-reform dummy ($Post2011_t$) or a full set of year fixed effects (α_t). The former estimates the average treatment effect in the post-reform period, while the latter assesses how the treatment effect evolves over time. To control for nonlinear trends that may interact with characteristics that were not balanced before the reform across treated and control groups (see Section 4.3), individual-level controls[22] measured in 2006 are interacted with year dummies (α_t). Finally, year fixed effects (α_t) are used to absorb time-variant factors that affect the sample uniformly, while cell fixed effects (α_q) are employed to account for all pre-reform differences associated with gender, years of experience, age and sector of employment. Standard errors are clustered at the cell level. Finally, we have seen how the Fornero shock is influenced by age, contribution years and gender. To account for the distinct sources of variation in male and female shocks, age is included in X_{it2006} to leverage contribution years as a source of variation for women and contribution years are controlled to to exploit the shock heterogeneity across male cohorts. To analyze the panel, these specifications are employed with a time interval spanning from 2008 to 2014.

To examine the heterogeneity of the effects of the 2011 pension reform across different pension regimes, a triple-difference specification is estimated:

$$\begin{aligned} Y_{iqt} = \delta_1 Treat_q \cdot DB_i + \sum_{t=2006}^{2016} \delta_t^{MRA} (Treat_q \cdot time_t) + \sum_{t=2006}^{2016} \delta_t^{DB} (DB_i \cdot time_t) \\ + \sum_{t=2006}^{2016} \beta_t (Treat_q \cdot DB_i \cdot time_t) + \sum_{t=2006}^{2016} \gamma_t (X_{i2006} \cdot \alpha_t) + \kappa_i DB_i + \alpha_t + \alpha_q + \epsilon_{iqt}, \end{aligned} \tag{2}$$

[22] The vector of controls X_{it2006} includes civil status, region of residence, employment status, education level, number of family members, wealth quartiles, share of illiquid wealth and expected replacement rates.

where the dummy variable DB_i is equal to 1 for workers under the Defined-Benefit pension regime and 0 for workers under the Pro-Rata and Notional Defined-Contribution schemes. The coefficients of interest are denoted by β_t: they reflect whether a significant increase in the minimum retirement age has a differential effect on the dependent variable Y_{iqt} for workers under the Defined-Benefit scheme, who experience a reduction in pension wealth, with respect to individuals under the Pro-Rata and NDC schemes, who receive incentives for working longer.

4.5 Identifying Assumption

To interpret the difference-in-difference estimates as a causal effect, the untestable parallel trend assumption needs to hold: in the absence of the treatment, the evolution of the dependent variable Y_{iqt} would have been the same for treated and control workers. Although the counterfactual cannot be observed, credibility can be added to this assumption by showing the absence of statistically significant pre-trends among individuals with different retirement delays. To demonstrate parallel pre-trends, equation (1) will be estimated with $time_t$ equal to a complete set of year dummies (α_t). To validate the observed DID effects as the average treatment effects of the Fornero reform for most exposed workers (ATT), the interaction coefficients β_t should not be statistically different from zero in the pre-reform period. In other words, the treatment variable should not predict any changes in the variables of interest before the reform.

5 Results

The primary objectives of this research are to examine the influence of pension reforms raising the MRA on expected human wealth (section 5.1), standard savings rates examined in existing literature and saving ratios predicted by theoretical models (section 5.2), as well as net wealth, with a particular focus on financial assets (section 5.3). The following results allow to test specific empirical predictions. Firstly, we will examine whether workers who experience a significant increase in expected human wealth adjust their consumption patterns by reducing their savings out of an unchanged current income or the proportion of their lifetime wealth they save. Secondly, we will explore whether workers facing a negative pension wealth channel respond by increasing their savings as a form of compensation. Finally, we will test if the share of stocks out of net worth increases in the ratio of human wealth to financial wealth. The main results presented focus on middle-aged male household heads in charge of financial decisions for the reasons detailed in Section 4.3.

5.1 Expected Human Wealth

The analyses begin by estimating equation (1) to study the effects of increasing the MRA on expected replacement rates among middle-aged male workers who were not qualified to retire prior to 2011 and who were most affected by the reform. On average, men with a MRA increase of at least 4 years anticipated less generous pension benefits after the Fornero reform. This finding is consistent with existing literature: [32] Oggero (2022) suggests that individuals may not understand the functioning of a Defined Contribution (DC) pension system, particularly the principle that delaying retirement leads to higher pension benefits. However, Figure 2 illustrates the role played by different pension regimes in shaping changes in the expected generosity of the Italian pension system. The triple difference-in-difference estimates obtained from Equation (2) indicate that an important MRA increase reduced expected pension wealth for men covered by the generous Defined-Benefit pension scheme, in line with less years of constant pension benefits. However, the reform did increase expected pension benefits for men under actuarially fair pension regimes. Based on the average labor earnings reported in SHIW data, a 5-unit increase in expected replacement rates corresponds to an approximate 100 euro increase in expected monthly pension benefits. This finding suggests that workers have a solid understanding of the mechanics behind their pension formula and have internalized not only their deferred retirement, but also the different rewards for each additional working year.

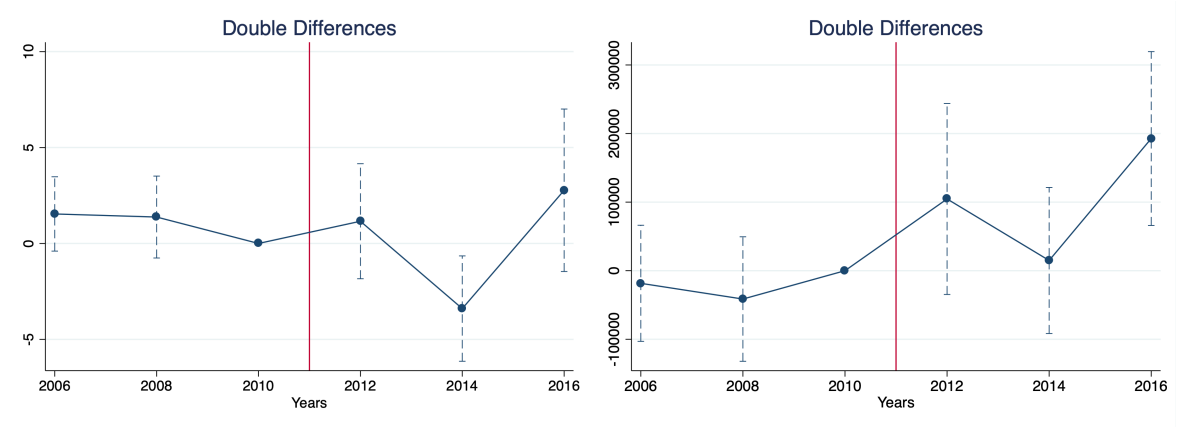
Table 7 presents the empirical findings for the present discounted value of future labor earnings and pension benefits using the continuous treatment specification. The results for men indicate that each additional year of working life is associated with an increase in expected human wealth equal to 22,664, which is equivalent to a 4 percentage points growth relative to the average value of the control group in the pre-reform period. To investigate whether the influence on expected human wealth of the increase in MRA grows linearly or is mainly concentrated among workers who have experienced the most significant shocks, the study refers to Table 3. Along with the dynamic difference-in-difference estimates presented in Figure 2, this Table illustrates how men most exposed to the reform witnessed a 17% increase in expected human wealth compared to their baseline level. Across all specifications (triple differences in Figure 2 and double differences spitting the sample by pension regime in Table 3), this increase is concentrated among individuals covered by the Notional Defined-Contribution (NDC) and Pro-Rata pension schemes, in accordance with the positive labor and pension wealth channels associated with actuarially fair regimes. Conversely, individuals enrolled in the generous Defined-Benefit scheme did not experience a significant[23] change in expected human wealth, suggesting that the absence of additional incentives to work longer may offset the potential positive income channel resulting from more years of labor earnings. Next sections will delve into the role of the

[23]When estimating standard difference-in-difference coefficients separately for the subsamples of actuarially fair workers and Defined-Benefit workers, the results indicate a significant decrease in expected human wealth for the DB workers.

positive human wealth channels and negative pension wealth channels in influencing financial decision-making processes.

Expected Replacement Rate and Expected Human Wealth - Men

Effects of Increased MRA among middle-aged workers



Differential effects of Increased MRA by Pension Regime

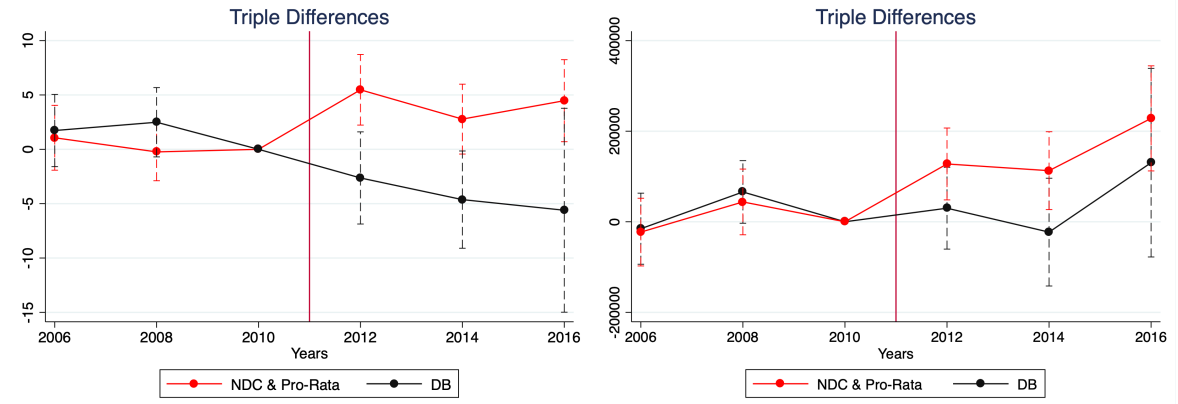


Figure 2: Source: SHIW 2006-2016
NOTE - The upper panels report the estimated difference-in-differences coefficients of the extended working horizon ($Treat_q \cdot \alpha_t$) for most exposed middle aged male workers who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The lower panels report the estimated difference-in-differences coefficients of a MRA increase for most exposed individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect for most exposed workers under the more generous Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). The left panels present the effects of the Fornero reform on the expected generosity of pension benefits. Replacement rates are defined as the ratio of the expected first pension benefit to the last salary. The right panels illustrate the effects on expected labor earnings and pension benefits. Expected human wealth is defined in section B. Men aged between 45-64, with less than 40 and more than 10 years of accrued paid contributions are defined as treated if they experienced an increase in their MRA of at least 4 years after the reform. The specification controls for year and cell fixed effects. The control variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

5.2 Saving Rates and Saving Ratios

Now we elucidate the impact of the 2011 Fornero reform on savings[24] for middle-aged male workers in charge of financial decisions. Table 7 illustrate how each additional year of deferred retirement eligibility increased the saving rate by 1.5 percentage points, accounting for 6.5% of the pre-reform average saving rate of the control group. When focusing on savings related to current labor earnings only, column 2 shows that the average increase in savings out of labor income is all driven by DB workers experiencing an increase of 3.52 percentage points, which translates into 10% of their baseline level. This results is consistent with their negative pension wealth channel and validates the empirical predictions advanced so far. Table 3 offers insights into saving responses when we relax the assumption of a linear impact of a MRA increase on financial decisions. It shows how the above results are concentrated among most exposed male workers, as men who encountered a shock greater than 4 years raised their savings out of current disposable and labor income by 5.7 and 8.9 percentage points respectively. A disaggregation of the latter ratio in columns 3 and 4 reveals that the reform significantly influenced savings and left current labor income unaffected. Figure 3 illustrates the impact of the reform on saving rates and saving ratios for most exposed men and the differential impact by pension regime. The significant increase in saving rates post-reform is driven by workers experiencing a negative pension wealth channel. On the other hand, while men under actuarially fair pension schemes did not exhibit significant decline in saving rates after the reform (contrary to women), they did witness a 5 percentage points decrease in their savings out of total wealth. This reduction corresponds to approximately 6% of their baseline level and drive the average decrease in saving ratios following 2011 among most exposed men. In other words, when faced with an increase in lifetime wealth, workers may perceive it as unnecessary to save as predicted by their pre-reform optimal saving rule in accordance with the intertemporal smoothing motives outlined in Section 2.1. The reduction in the proportion of savings out of lifetime income compensate the increased lifetime wealth, resulting in no significant impact on the overall level of savings after the reform. Although this last result may seem contradictory to the finding of constant saving rates, it should be noted that (i) the Survey of Household Income and Wealth suffers from a severe underestimation of consumption data potentially leading to an overestimation of savings rates([10] Cifaldi and Neri, 2013)[25], (ii) after unexpected shocks to lifetime wealth, standard dynamic models predict savings to change as a proportion of lifetime wealth, (iii) saving rates may not be a reliable indicator for the evolution of savings ratios when there are important changes in the present value of future human capital

[24] In terms of trends over the sample period for savings relative to current disposable income and lifetime wealth, there is a noticeable average decline in savings rates in the year 2012, while saving ratios appear more stable, as presented in Figure 13.

[25] The authors found that the underestimation of consumption is more severe than the one for income. In fact, the former measure involves broad categories of expenditure which makes a correct quantification more complex. The distortion in saving rates is particularly noticeable for households belonging to the low-income classes, as income measurement errors are proportionally larger for high incomes, while consumption data are a less sensitive topic.

([33] Ordoñez and Piguillem, 2022).

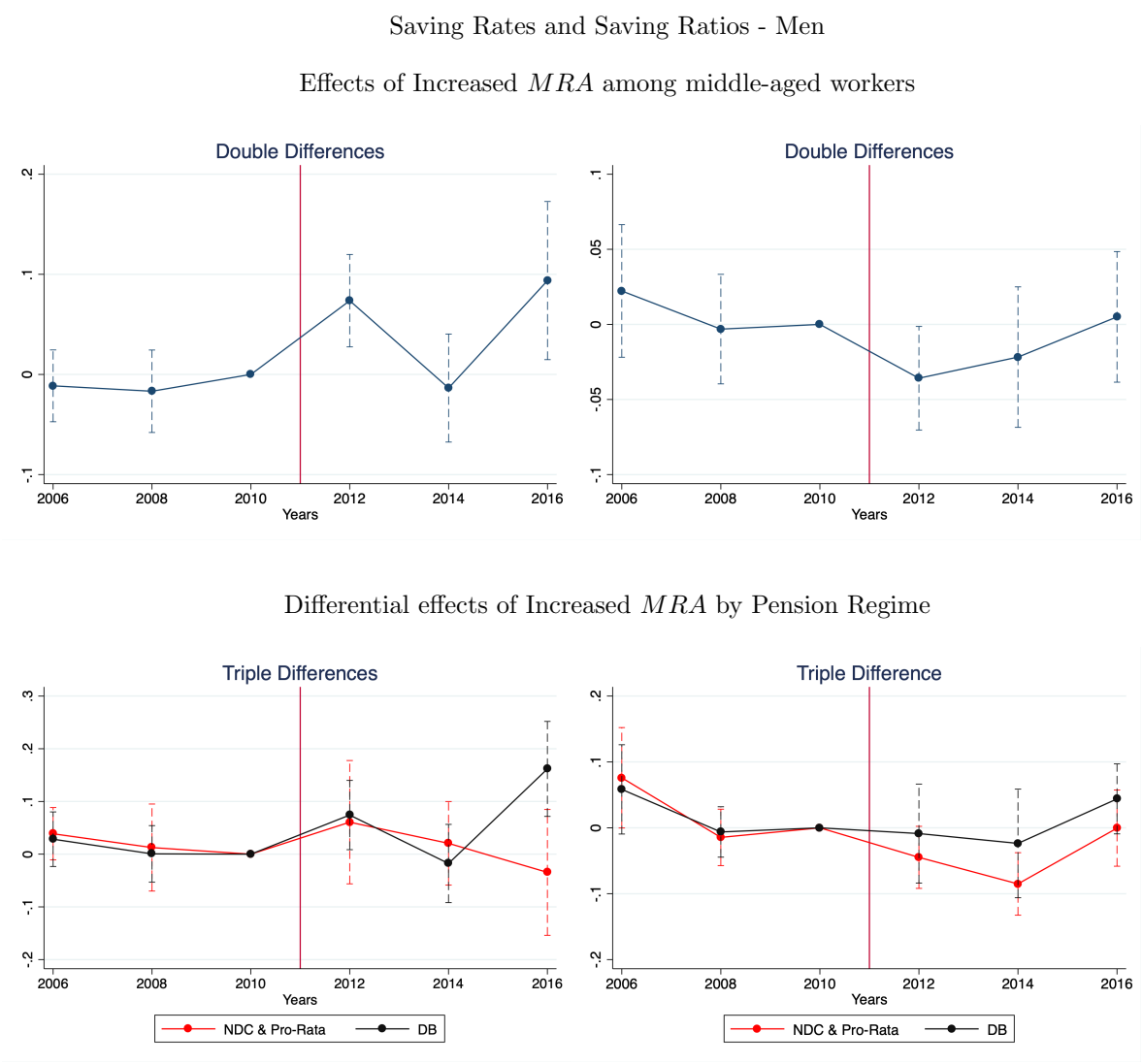


Figure 3: Source: SHIW 2006-2016
NOTE - The upper panels report the estimated difference-in-differences coefficients of the extended working horizon ($Treat_q \cdot \alpha_t$) for most exposed middle aged male workers who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The lower panels report the estimated difference-in-differences coefficients of a MRA increase for most exposed individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect for most exposed workers under the more generous Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). The left panels report the effect on the standard saving rate, namely savings out current disposable income, while the right panels present the impact on the optimal saving rule predicted by standard dynamics models (the saving ratio proposed by [33] Ordoñez and Piguillem, 2022). Men aged between 45-64, with less than 40 and more than 10 years of accrued paid contributions are defined as treated if they experienced an increase in their MRA of at least 4 years after the reform. The specification controls for year and cell fixed effects. The control variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

5.3 Portfolio Effects

This section wants to test the predictions of the Merton's (1975) model discussed in Section 2.2, which suggests that individuals experiencing an increase in their ratio of human wealth to financial wealth should invest more in stocks in accordance with diversification motives. Prior to the reform, both treated and control groups exhibited an average ratio of human wealth to financial wealth approximately equal to 31. After 2011, this average ratio increased to 37 for men experiencing an increase in their MRA of at least 4 years. In line with theory, Table 4 reports an average increase of 1.53 percentage points in the share of stocks out wealth for most exposed men, 50% with respect to the baseline level. Moreover, Figure 4 presents triple difference-in-difference estimates by pension regime showing that the average increase in the proportion of stocks out of net worth is solely driven by most affected workers under actuarially fair pension regimes. Consistently with Merton's predictions, their ratio of human wealth out of financial wealth increased to 38[26] after the reform, rationalizing increases in their share of risky assets and stocks by 5.59 and 4.45 percentage points. Conversely, treated Defined-Benefit workers experienced no significant change in their financial portfolios according to the double differences estimated for this subgroup, as reported in Table 4. However, triple difference-in-difference estimates presented in Figure 4 show a significant reduction in bonds, which may be attributed to a post-reform decline in human wealth out of financial wealth from 31 to 29[27]. Moreover, Figure 4 present the effects of the 2011 reform on a decomposition of household net wealth: real assets, financial liabilities and financial assets, which are further decomposed into safe (as deposits) and risky (as share and bonds) financial assets. The left panels provide triple DID estimates alone, while the right panels present estimates normalized with respect to the average level of the control group in the years before the reform for each variable studied by pension regime. After the reform NDC/Pro-Rata workers doubled their share of stocks compared to their baseline level, while the reduction in the share of bonds for DB workers accounts for more than 50% of their baseline. The dynamics of the effects of the Fornero reform on the share of risky assets for actuarially fair versus generous pension regimes are reported in the Figure 15 from Appendix H. Finally, it is worth noting that the direction and significance of the results presented remain consistent when normalizing the different components of private wealth by current disposable or labor income.

[26] Before the reform, treated workers under NDC and Pro-rata regimes exhibited average human wealth and financial wealth equal to 733719.72 and 25806.22, respectively.

[27] The average pre-reform expected human wealth and financial wealth for treated DB workers was 602,634.47 and 19,232.31, respectively.

Wealth Decomposition and Financial Assets - Men
Differential effects of Increased MRA by Pension Regime

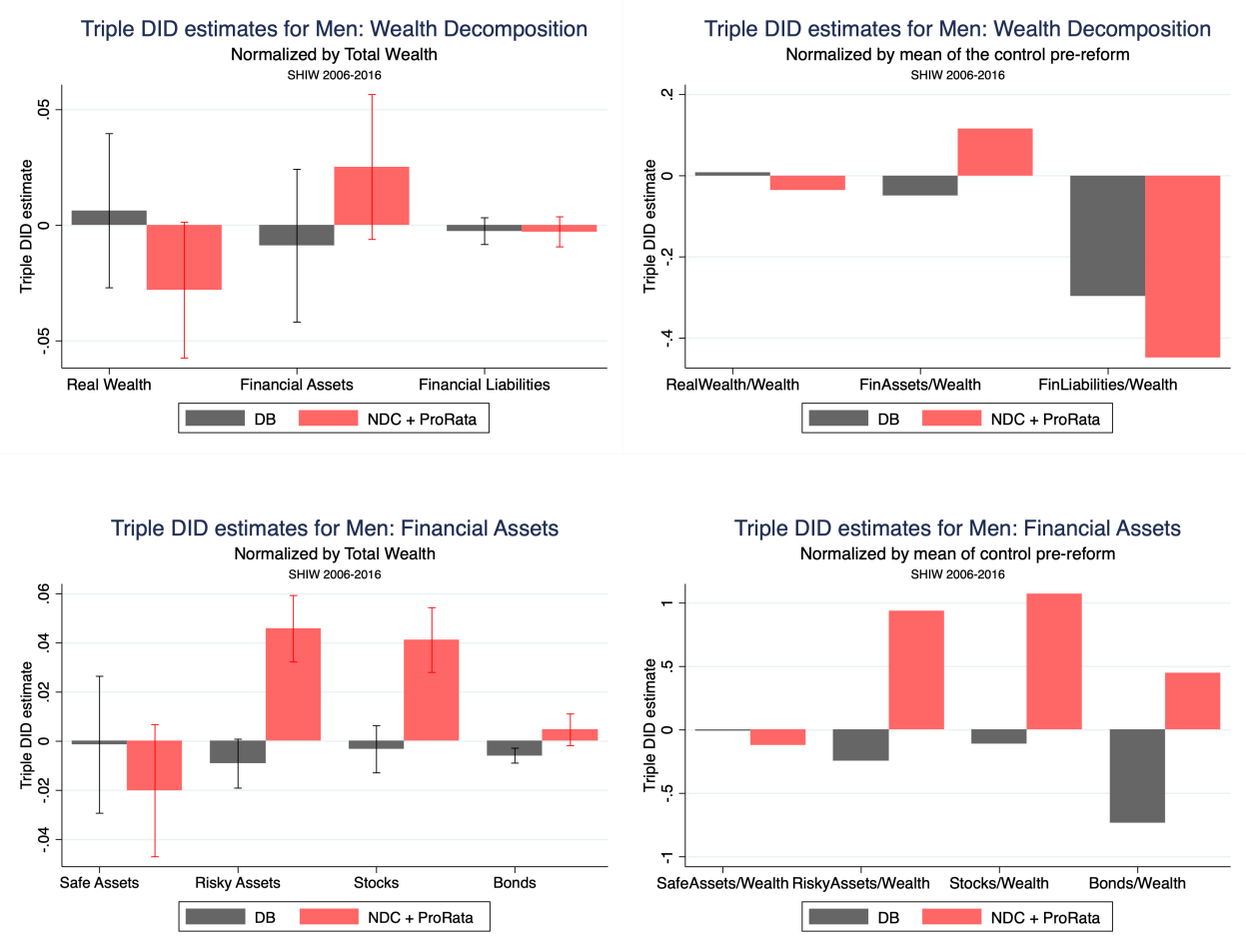


Figure 4: Source: SHIW 2006-2016
NOTE - The left panels reports the difference-in-differences coefficients of the extended working horizon for individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect of increasing the MRA for workers under the Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The right panels reports the same triple DID estimates related to the average value of the variable of interest for the control group in the pre-reform period. The upper panels present the effects of the 2011 reform on the decomposition of individual net wealth: real assets, financial assets and financial liabilities. The lower panels present the effects of the 2011 reform on the decomposition of individual financial assets: the first two groups of bars represent the effects on the share of safe and risky financial assets, while the last two groups of bars decompose risky financial assets in stocks and bonds. The sample includes individuals who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). Men aged between 45-64, with less than 40 and more than 10 years of accrued paid contributions are defined as treated if they experienced an increase in their MRA of at least 4 years after the reform. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

5.4 Women

On average, most exposed middle-aged female workers reduced their replacement rates after the Fornero reform, in line with the existing literature supporting people's lack of awareness regarding the functioning of pension systems. However, Figure 5 validates the role of different pension regimes in shaping this outcome even for women: the reduction in expected pension benefits is driven by women subject to a negative pension wealth channel. In contrast to men, women who experienced positive labor and pension wealth channels did not show significant increases in expected pension benefits. Table 8 presents results for the present discounted value of future labor earnings and pension benefits with continuous treatment specifications. The findings reveal that each additional year of working life corresponds to a rise in expected human wealth equal to 6,609, which represents 1.5 percentage points relative to the average of the control group in the years preceding the reform. This effect is particularly pronounced among women who experienced a MRA increase of more than 6 years: Table 5 illustrates how most affected women recorded an increase in expected human wealth corresponding to 17% of their baseline level. Across all specifications, the increase in expected human wealth is concentrated among NDC and Pro-Rata women, while workers subject to the more generous pension scheme experienced no significant change, as supported by Figure 5.

To understand the impact of the 2011 pension reform on the saving choices of middle-aged female workers in charge of financial decisions, Table 8 reports how a unit increase in MRA led to a 1.37 percentage points reduction in the saving rate, 6.9% of the baseline level. Moreover, in line with the decline in savings rates, women recorded a 2.37 percentage points decrease in savings when compared to their labor income, approximately 6.6% of their baseline. The effects described above seem to be concentrated among most exposed female workers: Table 5 shows that women who faced an extended working horizon of at least 6 years decreased their savings out of disposable and labor income by 7.9 and 11 percentage points respectively. Figure 5 illustrates the differential impact of the reform by pension regime[28] on saving rates and saving ratios for most exposed women. Consistently with the continuous treatment specifications and the theoretical predictions from Section 2, women under the NDC and Pro-Rata schemes with an increase in MRA of at

[28] Additional dimensions of heterogeneity, such as wealth and marriage, were explored in this study. The results reveal how expected replacement rates increased for most exposed women below the first income quartile when compared to the most exposed ones above the third income quartile. One possible explanation is that economically advantaged women may anticipate the possibility of future reforms cutting benefits, especially for higher pensions, to enhance the system's sustainability. Moreover, [8] Carta and De Philippis (2021) document how liquidity-constrained women, characterized by lower wealth and education, increased their labor supply more after the reform. Hence, the stronger increase in human wealth resulting from both positive labor and pension wealth channels may explain the larger rise in consumption rates observed among women with weaker economic conditions. Furthermore, results from Carta-De Philippis and [15] Etgeton et al. (2023) suggest that married couples could experience an enhanced lifetime wealth due to inter-partner spillover effects, which may lead to a more substantial increase in consumption. However, this study finds that the contraction in female saving rates is concentrated among actuarially fair single and divorced women most exposed to the reform, consistently with their larger increase in expected pension benefits relative to married women. This positive pension wealth channel may be attributed to the fact that the Fornero reform had a full impact on unmarried women, whereas married women may experience some mitigation of the reform's effects through their partners' earnings. Also for unmarried women, the anticipation of more generous pension benefits appears to catalyze a larger decline in savings, despite the absence of extended partner earnings due to leisure complementarities.

least 6 years drove the average decline in savings. Specifically, this group saw a reduction in saving rates and savings out of labor income of 11 and 14 percentage points respectively, due to a reduction in savings equal to almost 20% of the baseline level. Furthermore, similar to the findings for highly exposed actuarially fair male workers, women who experienced a positive human wealth channel reduced their saving ratios. To rationalize their significant rise in consumption, contrary to men, it's worth noting that most exposed middle-aged women encountered not only a more severe shock following the Fornero reform, but also an increase in labor market participation and an improvement in employment conditions which men did not experience[29] ([8] Carta and De Philippis, 2021). Indeed, as outlined in Section 4, these women had the most discontinuous pre-reform work histories, i.e. they were characterized by lower participation rates and higher labor supply elasticity compared to most exposed middle-aged male workers, who were typically more consistently involved in the Italian labor market. It is also important to acknowledge that the estimated increase in expected human wealth may be underestimated due to the evidence of spillover effects among partners of women most affected by the Fornero reform (Carta and De Philippis, 2021)[30]. On the other hand, women enrolled in the Defined-Benefit scheme did not show an increase in their saving rates as observed among their male counterparts. However, they did exhibit an increase in their saving ratios, which suggests that these women may perceive the need to allocate a larger proportion of their lifetime wealth towards savings in order to achieve consumption smoothing over time after the decline in expected pension wealth.

The portfolio effects of the reform on female household heads align with the patterns observed for men. Before the reform, women exhibit an average ratio of human wealth to financial wealth equal to 34 if more exposed to the reform and 36 if less exposed. After 2011, this average ratio increased to 40[31] for treated female workers. When focusing specifically on most exposed female workers under the NDC/Pro-rata (Defined-Benefit) schemes, this average ratio was 32 (43) before the reform and increased (decreased) to 38 (37)[32] afterwards. In terms of portfolio choices, NDC/Pro-rata women subject to a MRA increase of at least 6 years not only experienced a significant 5.57 percentage points rise in the proportion of risky assets relative to their net worth, primarily driven by a 4.89 percentage points increase in their share of stocks as their male counterparts, but also more than doubled their financial liabilities and reduced their holdings of real illiquid assets. Conversely, women enrolled in the DB pension scheme showed a significant reduction in financial liabilities, amounting to more than 50% of their baseline level. The dynamic effects of the share

[29] Carta and De Philippis detected no labor market response to the Fornero reform among most exposed middle-aged men. However, women who experienced at least a seven-year extension in their working horizon were more likely to secure high-wage and full-time employment, as well as to benefit from permanent contracts.

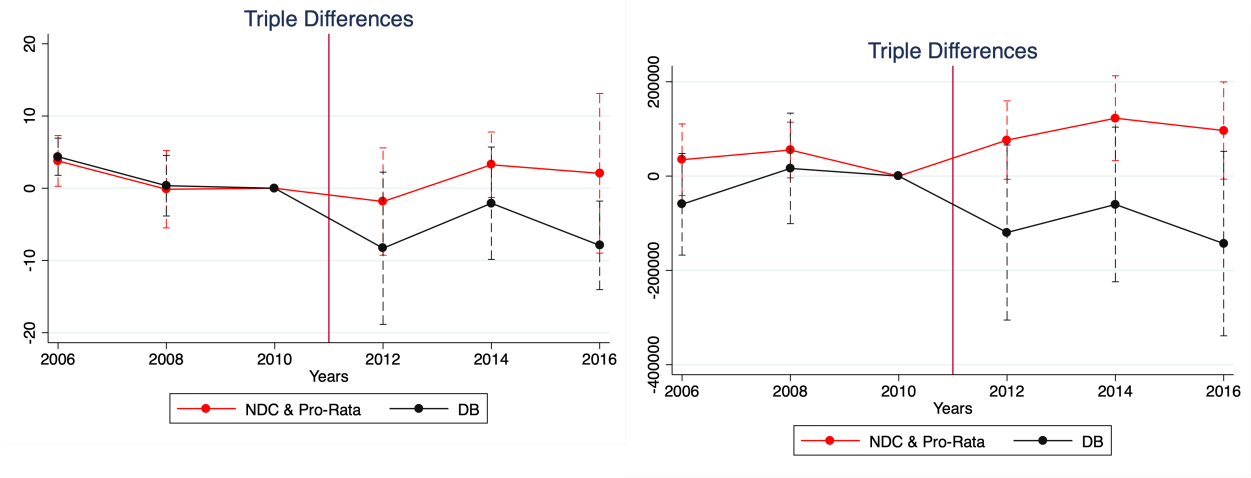
[30] Their findings suggest that men who had the option to retire prolonged their working horizon due to leisure complementarities within the household.

[31] Before the reform treated women exhibited an average human wealth and financial wealth equal to 457,563.93 and 13,475.35.

[32] NDC/Pro-rata female workers had average human wealth and financial wealth equal to 478,531.66 and 15,085.02 before the reform, while for DB women these measures corresponded to 390,208.67 and 8,871.55.

Differential effects of Increased MRA by Pension Regime - Women

Expected Replacement Rate and Expected Human Wealth



Saving Rates and Saving Ratios

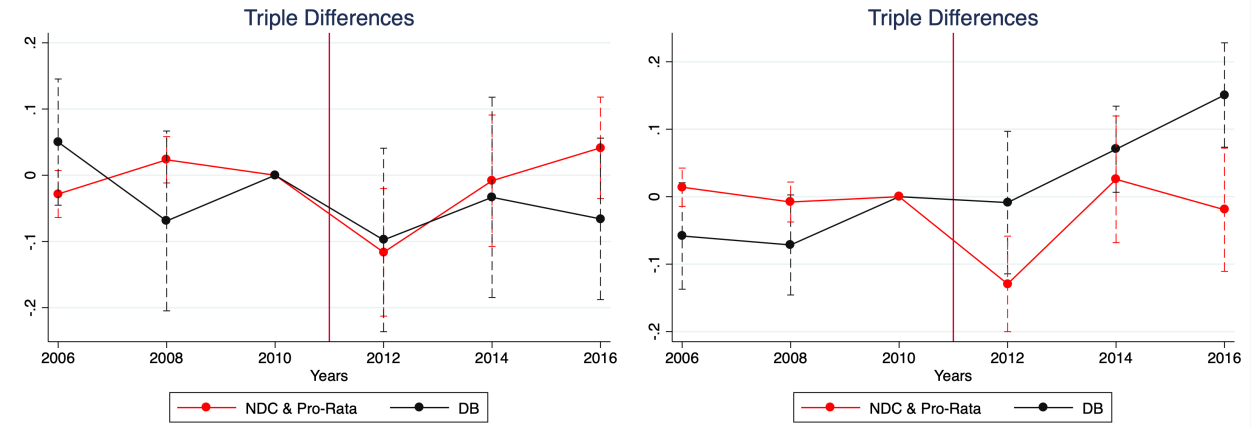


Figure 5: Source: SHIW 2006-2016
NOTE - The panels reports the estimated difference-in-differences coefficients of the extended working horizon for most exposed individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect of increasing the MRA for most exposed workers under the more generous Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The first panel reports the effects of the Fornero reform on the expected generosity of future pension benefits. Replacement rates represent the expected ratio of the first pension benefit to the last salary. The second panel presents the effect on expected labor earnings and pension benefits. Expected human wealth is defined in section B. The lower panels presents the effects on the standard saving rate and the saving ratios proposed by [33] Ordoñez and Piguillem (2022). The sample includes individuals who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). Women aged between 45-59, with less than 40 and more than 10 years of accrued paid contributions are defined as treated if they experienced an increase in their MRA of at least 6 years after the reform. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

of risky assets out of net wealth are illustrated for different pension regimes in Figure 15 from Appendix H. Lastly, it is worth emphasizing the consistency of these findings when normalizing the various components of private wealth by either current disposable income or labor income.

Wealth Decomposition and Financial Assets - Women
Differential effects of Increased MRA by Pension Regime

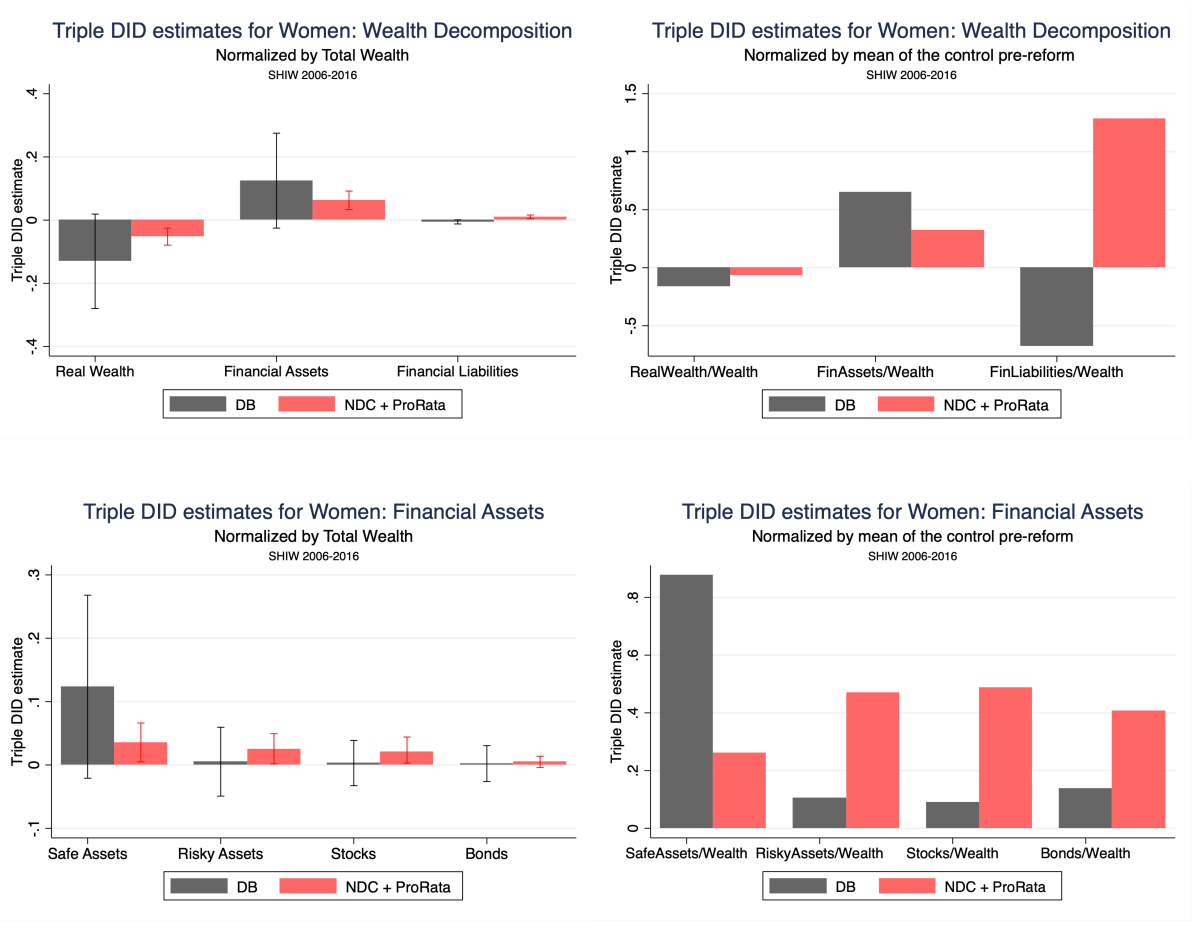


Figure 6: Source: SHIW 2006-2016
NOTE - The left panels reports the difference-in-differences coefficients of the extended working horizon for individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect of increasing the MRA for workers under the Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). The right panels reports the same triple DID estimates related to the average value of the variable of interest for the control group in the pre-reform period. The upper panels present the effects of the 2011 reform on the decomposition of individual net wealth (real assets, financial assets and financial liabilities), while the lower panels on the decomposition of individual financial assets, decomposed as safe (deposits) and risky (stocks and bonds) in the first two groups of bars. The sample includes individuals who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). Women aged between 45-59, with less than 40 and more than 10 years of accrued paid contributions are defined as treated if they experienced an increase in their MRA of at least 6 years after the reform. The specifications control for year and cell fixed effects. The control variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

6 Robustness Checks

This section presents the main robustness checks conducted in the study. It is organized as follows. The first part examines the rotating panel component of the Survey of Household Income and Wealth (SHIW) data to validate the use of repeated cross-sections. The second part leverages the larger sample size available in the repeated cross-sections to explore potential effects of the partner shock on financial outcomes. Specifically, it investigates whether the key findings remain consistent when focusing on households where both partners are subject to the Fornero reform and belong to either an actuarially fair pension scheme or a generous Defined-Benefit scheme.

6.1 Panel Analysis

The analysis is based on a sample of 996 households observed from 2008 to 2014, out of which 367 are affected by the Fornero reform. Among them, 242 households are led by men and 125 by women. Restricting the attention to the sample of middle-aged individuals not eligible to retire by 2010, 254 individuals are subject to a MRA shock ranging from 1 to 7 years. Most of them are subject to the Pro-Rata system, followed by Defined-Benefit (DB) and Notional Defined-Contribution (NDC) workers. In contrast, 45 individuals experienced no increase in their MRA due to the *grandfathering clause*, with the majority of them belonging to the DB scheme.

To account for potential non-linear effects, as well as to maintain consistency with the repeated cross-section analysis and the research conducted by [7] Carta and De Philippis (2021), men and women are defined as treated if they experienced an increase in their MRA of at least 4 and 6 years after the reform. Figure 8 illustrates the adjustment in reported expected retirement age among middle-aged individuals in response to the new rules: workers who experienced a larger increase in their MRA exhibited a more substantial increase. The distribution of the shock and the corresponding summary statistics for the treated and control groups are consistent across the panel and repeated cross-sections, suggesting limited panel selection bias[33]. Despite no group experienced a reduction in statutory replacement rates after the reform, the analysis of panel data reveals an average decline in expected pension benefits following the 2011 reform, particularly among workers enrolled in the DB scheme. This finding is consistent with the trends discussed in Section 4.3. The subsequent results shed light on the mechanisms through which the extension of the working horizon influenced these trends.

[33] Among women who experienced a MRA shock of at least 6 years, the average number of contribution years is 6 years lower compared to the control group, while there is no significant difference in terms of age. Additionally, the treated group has a higher proportion of unemployed women compared to the control group. Conversely, men who were most exposed to the reform are on average 3 years older and have 2 fewer contribution years compared to the control group, with no significant difference in terms of labor market activity.

To mitigate potential confounding effects arising from age and contribution years, the study compares the distributions of residuals obtained from regressing the continuous treatment on age and contribution years at the 2008 level. SHIW panel data further highlights the influence of age on the observed shock among men and the more prominent explanatory role of contribution years for women. The heterogeneous distribution of the shock across genders justifies the adoption of distinct controls for male and female middle-aged workers: contribution years at the 2008 level for men and age at the 2008 level for women.

Additional Working Years Post-Reform

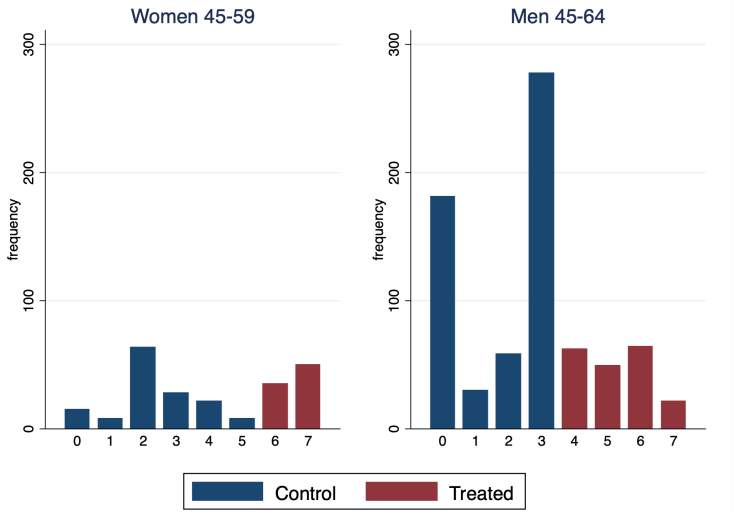


Figure 7: Source: SHIW Panel 2008-2014
NOTE - Distribution of the increase in MRA post-reform by gender. The sample includes individuals who had not retired and were not eligible to retire by 2010. Women are aged between 45-59 and men between 45-64. Women (men) are defined as treated if they experienced an increase in their MRA of at least 6 (4) years after the reform.

Expected Retirement Age

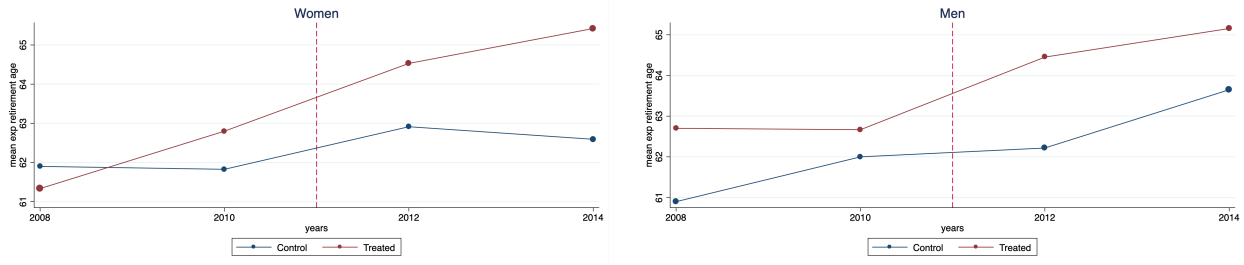


Figure 8: Source: SHIW Panel 2008-2014
NOTE - Expected Retirement Age by treatment and gender. The sample includes individuals who had not retired and were not eligible to retire by 2010. Women are aged between 45-59 and men between 45-64. Women (men) are defined as treated if they experienced an increase in their MRA of at least 6 (4) years after the reform.

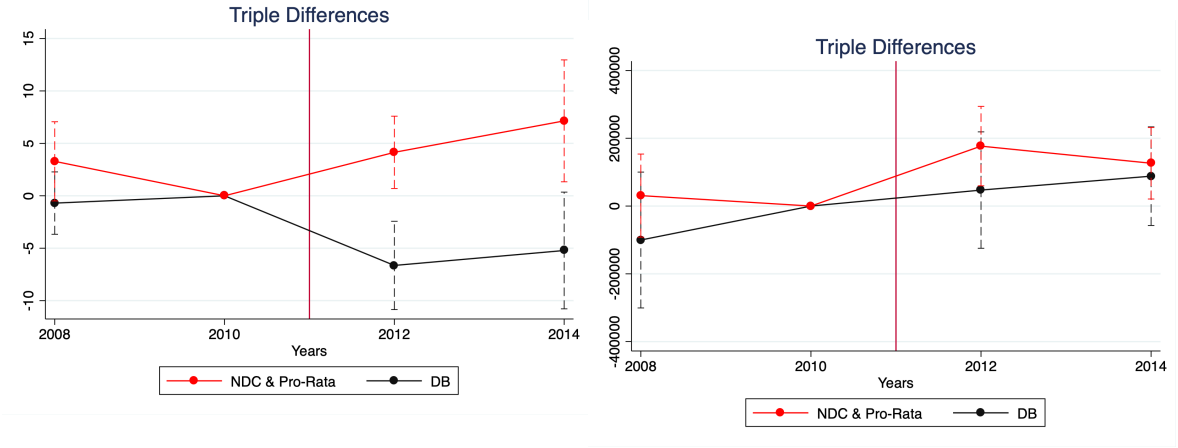
The decision to present results solely for male workers is motivated by the limited data availability and the sample selection for women. The results from the panel analysis validate the findings presented in Section 5. Male workers under actuarially fair pension regimes who experienced an increase in their MRA of at least 4 years and extra rewards from the government to work longer raised their expectations of future pension benefits, as shown in Figure 9. The simultaneous increase in expected labor earnings and replacement rates led to a substantial enhancement in expected human wealth. The magnitude[34] of these effects aligns with the findings from the repeated cross-sectional analysis. In contrast, workers under the generous Defined-Benefit scheme reduced their expectations of the pension system's generosity following the reform. This aligns with delayed constant pension benefits and the idea of concerns about being more vulnerable to potential future cuts. Figure 9 illustrates how the negative pension wealth channel offsets the positive income channel resulting from an extended working horizon, ultimately leading to no significant change in their expected human wealth. These results help elucidate the patterns observed for savings. In line with repeated cross-sections[35], Figure 9 reveals a significant increase in saving rates for workers in the Defined-Benefit pension scheme and a significant decrease in saving ratios for workers in the Notional Defined Contribution and Pro-Rata schemes. Specifically, the analyses indicate that for every additional working year, DB workers increased their saving rate by 2.85 percentage points, which represents 12% of the average saving rate for the control group during pre-reform years. On the other hand, NDC and Pro-Rata workers reduced their saving ratio by 0.729 percentage points, which corresponds to the 0.85% of the baseline level. Hence, aiming to achieve consumption smoothing over time, middle-aged men who internalized a longer working horizon and higher statutory replacement rates reduced the proportion of their increased lifetime wealth to set aside for the future. Conversely, men who faced a negative pension wealth channel due to the lack of incentives to work longer responded by increasing their savings relative to their current income, which remained unaffected by the reform. Finally, SHIW panel data further confirm that men who were most exposed to the reform and experienced an increase in their ratio of human wealth to financial wealth allocated a larger share of their portfolio to stocks. This finding is consistent with the results from repeated cross-sections and supports the theoretical predictions outlined so far. NDC and Pro-Rata workers enrolled in actuarially fair pension regimes increased their share of stocks by 4 percentage points following the reform, while individuals under the generous Defined-Benefit (DB) pension scheme reduced it by 1.7 percentage points. Figure 12 provides insights into the impact of the reform on all components of private wealth and reveals that the only

[34]Note that, in order to increase the dimensionality of the panel analyses, expected human wealth is build relying on statutory replacement rates when the expected ones are missing, as detailed in Appendix B. As expected replacement rates were generally lower than the statutory ones, the estimates of the change in expected human wealth presented may exhibit upward bias.

[35]The trends in savings relative to current disposable income and lifetime wealth throughout the sample period show a higher level of consistency compared to the cross-sectional analysis. Both indicators display a decline in 2012, followed by a recovery in 2014.

statistically significant effects are observed in relation to risky assets and stocks. Overall, the findings from the panel analyses corroborate the results from repeated cross-sections and offer additional support for the impact of reforms raising the MRA on the financial decisions of middle-aged workers.

Differential effects of Increased MRA by Pension Regime - Men
Expected Replacement Rate and Expected Human Wealth



Saving Rates and Saving Ratios

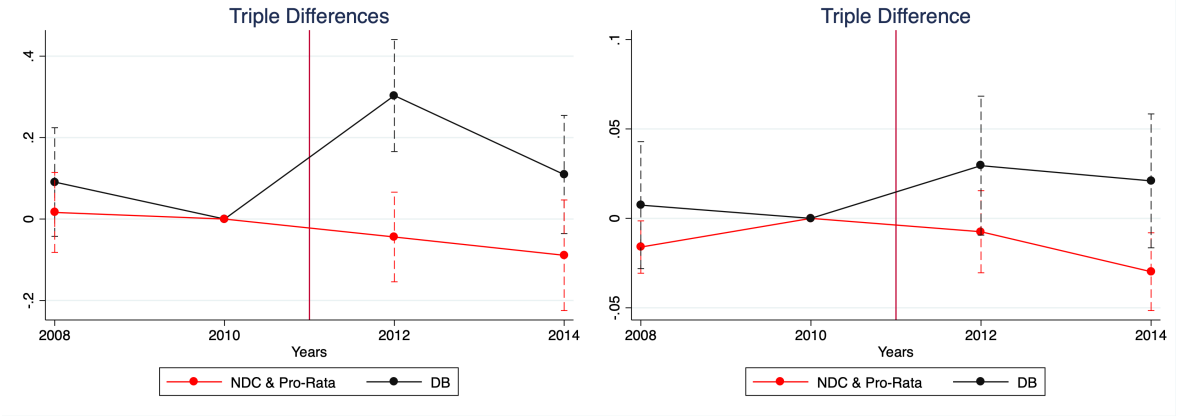


Figure 9: Source: SHIW Panel (2008-2014)
NOTE - The panels reports the estimated difference-in-differences coefficients of the extended working horizon for most exposed individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect of increasing the MRA for most exposed workers under the more generous Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). The first panel reports the effects of the Fornero reform on the expected generosity of future pension benefits. Replacement rates represent the expected ratio of the first pension benefit to the last salary. The second panel presents the effect on the expected human wealth defined in section B. The lower panels presents the effects on the standard saving rate and the saving ratios proposed by [33] Ordoñez and Piguillem (2022). The sample includes individuals who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). Men aged between 45-64 are treated if they experienced an increase in their MRA of at least 4 years after the reform. The specifications control for year and cell fixed effects. The control variables are assessed at the 2008 level and interacted with time dummies. Standard errors are clustered at the cell level.

6.2 Household-level Fornero Shocks

To validate the role of the household head's shock on financial decisions and ensure the robustness of the effects observed thus far, the following analyses consider the potential impact of the partner's MRA shock[36]. The study examines household-level effects by distinguishing between families with a male or female household head and those in which both partners are enrolled in either the Notional Defined-Contribution/Pro-Rata systems or the Defined-Benefit regime. The objective is to investigate how households respond when both partners are subject to an increase in the MRA and are middle-aged workers not eligible for retirement before the reform year. Figure 10 provides insights into the distribution of the average shock experienced by the two partners within these households. To gain further understanding of the response of the most affected families headed by a middle-aged worker, these analyses categorize households as "treated" if the average MRA increase within the family is at least 5 years. This threshold represents the average shock observed across this subgroup taking also into account the gender of the worker in charge of financial decisions. Household savings are studied in relation to the aggregate household disposable and labor income, while household expected human wealth is determined by aggregating the individual measures.

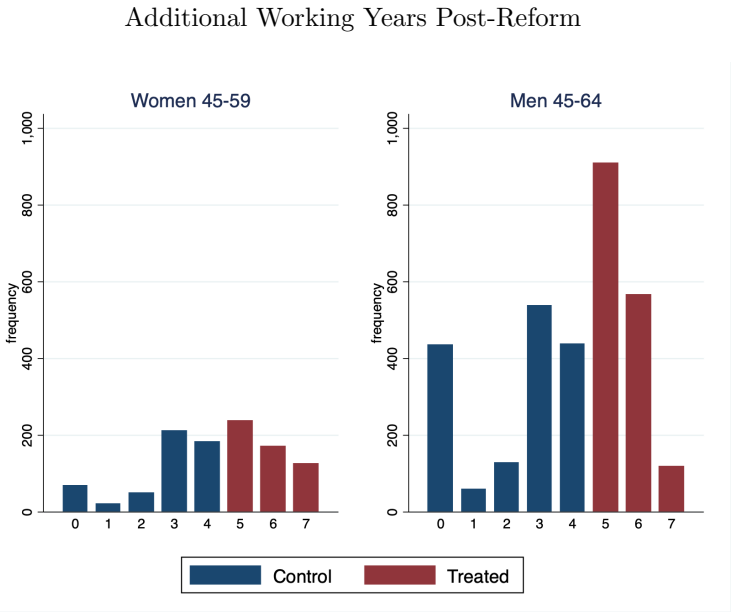


Figure 10: Source: SHIW 2006-2016
NOTE - Distribution of the increase post-reform in the average MRA of the two partners classified by the gender of the household head. The analysis includes a sample of families where the household head was not eligible to retire by 2010: women in charge of financial decisions are aged between 45-59 and men between 45-64. Households are defined as treated if they experience an increase in their average MRA of at least 5 years after the Fornero reform.

[36] Approximately 40% of the households analyzed in SHIW data provide individual information for both partners. Among these families, around one-third have one partner enrolled in a Defined-Benefit (DB) pension regime and the other one covered by an actuarially fair pension regime. These observations are omitted from the following analyses to focus on the role of different pension regimes.

Given the paucity of data available on household-level shocks when women assume financial decision-making roles, the following findings focus on men responsible for economic choices within households where the partner is also affected by the Fornero reform. The triple difference-in-difference estimates by pension regime shown in Figures 11 and 12 provide further support for the conclusions drawn in Section 5 for male workers. In households with both partners enrolled in an actuarially fair pension regime and an average MRA shock larger than 5 years, the analysis reveals how the male household head experienced a significant increase of 10.7 points in his expected replacement rate, which corresponds to an approximate monthly pension benefit rise of 200 euros based on the average male labor income recorded in SHIW data. This increase is twice the magnitude found when considering the individual-level shock alone. Conversely, in households where both partners fall under a Defined-Benefit scheme expected replacement rates decreased by nearly 4 points, resulting in a reduction of around 70 euros per monthly pension benefit for the male household head. Results for their partners are consistent. These differential effects on expected pension wealth have relevant implications for the changes in expected human wealth also at the household level. Specifically, families where both partners belong to the NDC/Pro-Rata schemes observed an average increase of 250503 euros, while families where both partners are subject to a DB scheme did not experience any significant change in their expected future labor earnings and pension benefits.

The impact on financial decisions is also noteworthy. Consistent with the main findings of this study, the most affected DB families exhibited a significant rise in savings as a percentage of current household disposable income by 7.6 percentage points. Conversely, the most affected NDC/Pro-Rata families did not save enough out of their increased expected human wealth to align with their pre-reform optimal rule, resulting in a decrease in savings as a proportion of household lifetime wealth of 3.4[37] percentage points following the 2011 reform.

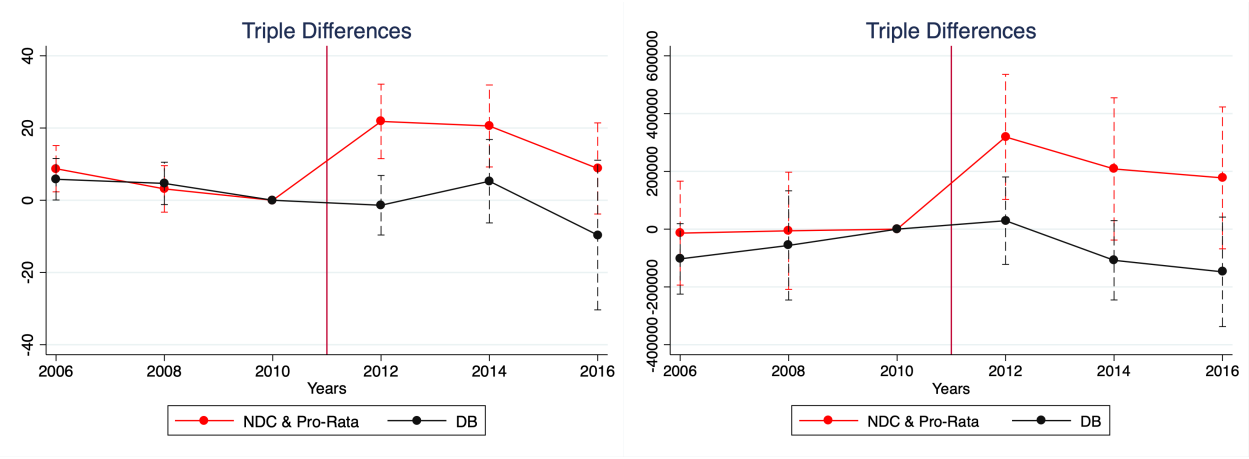
Regarding portfolio effects, households enrolled in actuarially fair pension regimes increased their allocation to risky assets by 3.6 percentage points. This shift was driven by a rise in their share of stocks and bonds out of net wealth equal to 2.3 and 1.2 percentage points, respectively.

Finally, it is worth noting that these findings remain robust when analyzing a subgroup of single-shock households where only the member responsible for financial decisions is affected by the reform. This sample includes household heads who are single, separated or married to a retired partner.

[37] For further clarification on the absence of a significant decrease in savings rates for this subgroup, refer to Section 5.

Differential effects of Increased Household MRA by Pension Regime - Male Household Heads

Expected Replacement Rate and Expected Human Wealth



Saving Rates and Saving Ratios

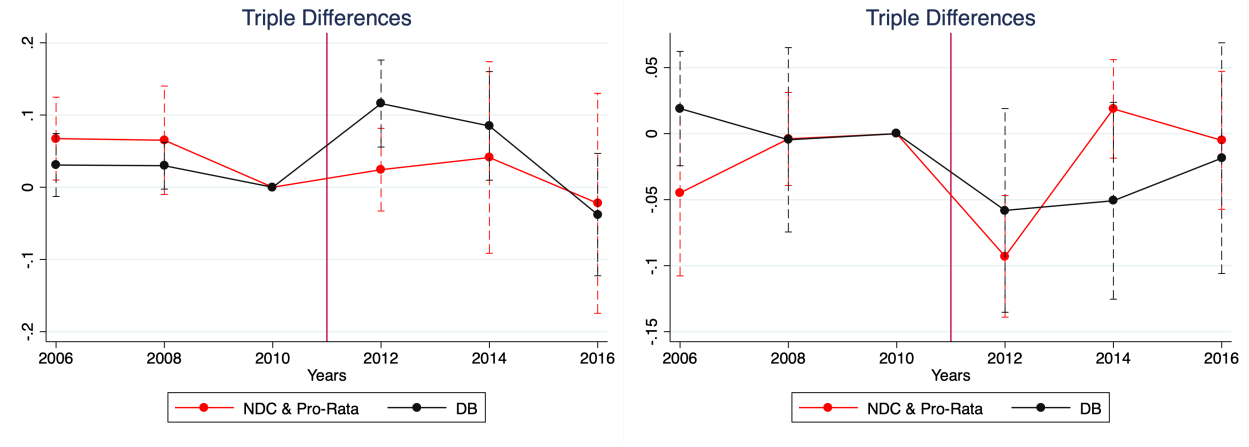
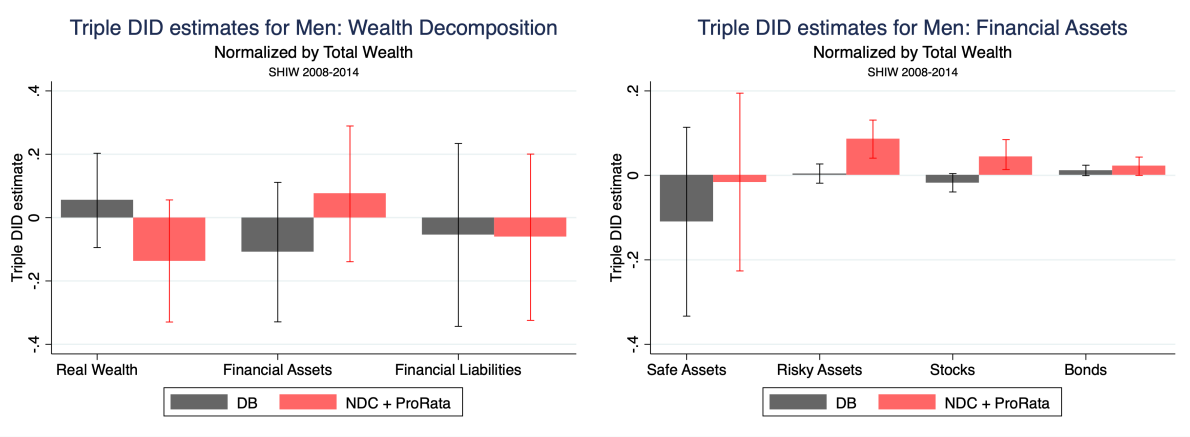


Figure 11: Source: SHIW 2006-2016
NOTE - The panels report the estimated difference-in-differences coefficients of the extended working horizon for most exposed individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect of increasing the MRA for most exposed workers under the more generous Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The first panel reports the effects of the Fornero reform on the expected generosity of future pension benefits. Replacement rates represent the expected ratio of the first pension benefit to the last salary. The second panel presents the effect on expected labor earnings and pension benefits aggregated at the household level. The lower panels presents the effects on the standard measure of savings out of income at the household level and the saving ratios proposed by [33] Ordoñez and Piguillem (2022). The sample includes families where the household head is a middle aged men between 45-64 who had not retired, was not eligible to retire by 2010 following [8] Carta and De Philippis (2022) and has a partner who is also subject to a MRA increase. Households are defined as treated if they experienced an increase in their average MRA of at least 5 years after the reform. The specification controls for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

Wealth Decomposition and Financial Assets
Differential effects of Increased MRA by Pension Regime

Male workers (Panel, 2008-2014)



Male Household Heads (Repeated Cross-Sections, 2006-2016)

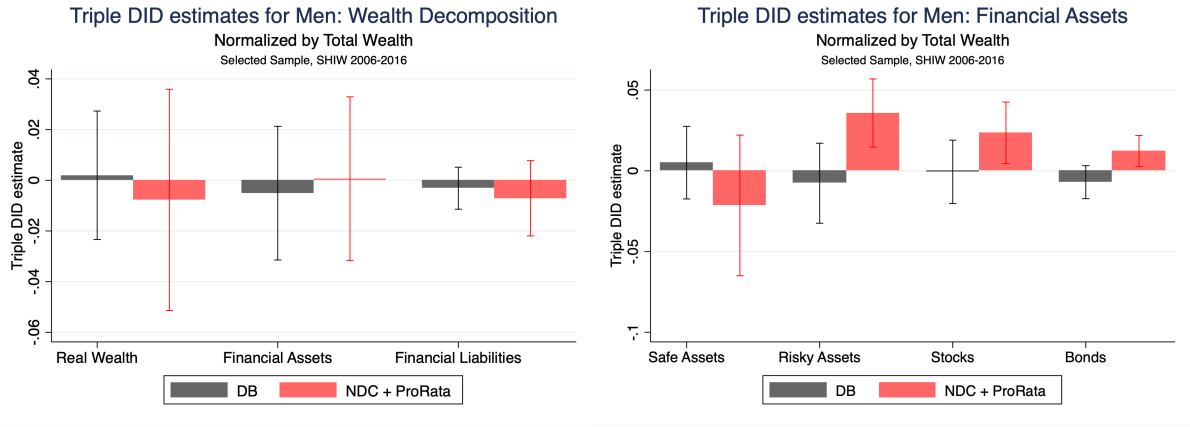


Figure 12: Source: SHIW Panel 2008-2014 & SHIW 2006-2016
NOTE - The panels report the difference-in-differences coefficients of the extended working horizon for individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect of increasing the MRA for workers under the Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The left panels present the effects of the 2011 reform on the decomposition of individual net wealth: real assets, financial assets and financial liabilities. The right panels present the effects of the 2011 reform on the decomposition of individual financial assets: the first two groups of bars represent the effects on the share of safe and risky financial assets, while the last two groups of bars decompose the latter category in stocks and bonds. The sample includes individuals who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The upper panels involve men aged between 45-64, with less than 40 and more than 10 years of accrued paid contributions, defined as treated if they experienced an increase in their MRA of at least 4 years after the reform. The lower panels include families where the household head is a middle aged men between 45-64 who has a partner also subject to a MRA increase. Households are defined as treated if they experienced an increase in their average MRA of at least 5 years after the reform. The specifications control for year and cell fixed effects. The control variables are assessed at the 2008 (2006) level and interacted with time dummies. Standard errors are clustered at the cell level.

7 Conclusions

This research project presents the first comprehensive evidence of the impact of reforms raising the Minimum Retirement Age (MRA) on expected human wealth, savings and portfolio allocations for workers relatively far from retirement. Such reforms typically increase years of labor earnings, shorten the period of non-employment to be financed and improve pension benefits under actuarially fair pension regimes. The resulting positive income shock suggests potential increases in expected pension benefits ([18] Fornero et al, 2019) and decreases in saving rates ([15] Etgeton et al, 2023). However, the analysis of SHIW data reveals puzzling results highlighted also by previous research. The 2011 reform results in a reduction of expected pension benefits for most exposed workers. A potential explanation advanced in the literature is the lack of awareness among Italian workers regarding the functioning of an actuarially fair pension system, where pension benefits increase with additional contribution years ([32] Oggero, 2022). This study contributes to the ongoing debate on the pension wealth effects of the Fornero reform by offering a different perspective. The results of this work show that the decrease in expected replacement rates after 2011 was driven by individuals with large MRA increases under the most generous Italian pension regime, who experienced a negative pension wealth shock due to an important delay of constant pension benefits. Conversely, most exposed workers under actuarially fair pension regimes raised their expected pension benefits in line with their pension formula and post-reform government rewards. These findings suggest that workers, on average, have a good understanding of the rules governing the pension system and their implications for future income sources.

The proposed pension wealth channel further explains the different impact of the Fornero reform observed in SHIW data on expected human wealth across pension regimes. In accordance with positive labor and pension shocks, most exposed workers under actuarially fair regimes increased their expected labor earnings and pension benefits after 2011. On the other hand, workers under the generous Defined-Benefit regime experienced no significant change, as lower expected replacement rates compensate for the additional years of labor earnings. Then, the study uncovers the role of expected human wealth in shaping saving and investment choices, providing a rationale for the average increase in savings observed in SHIW data after the reform, already noted by [8] Carta and De Philippis (2021) and in contrast to the narrative of enhanced lifetime wealth resulting from reforms raising the MRA. The results of this work reveal that individuals who concurrently experienced an extension in their working horizon and a reduction in their expected pension wealth drove the aforementioned increase in savings, in accordance with the literature on the substitutability between private and pension wealth. Conversely, workers experiencing a significant increase in lifetime wealth reduced their optimal proportion of savings out of total wealth aligning with intertemporal smoothing motives. Furthermore, this research project evaluates the portfolio effects of the Fornero reform and validates

the life-cycle model prediction of increasing stock investments in the ratio of human wealth to financial wealth.

In conclusion, this study provides evidence of *forward-looking* middle-aged Italian workers, internalizing the new rules imposed by the Fornero reform and adjusting their financial behavior in accordance with economic theories. By analyzing the impact of a reform raising the Minimum Retirement Age on saving and investment choices, this research fills a gap in the literature and sheds light on how expected changes in pension and lifetime wealth affect the composition of private wealth, with important implications for the "consumable" wealth of the next generations of retirees. Moreover, the observed heterogeneity in the impact of the Fornero reform across differently rewarded pension regimes not only validates the theoretical predictions mapping human wealth to savings and portfolio allocations, but also emphasizes the importance of government incentives in shaping workers' responses to an increase in their MRA. By designing pension reforms that reward individuals for extending their working horizon, policy makers can generate positive human wealth effects with the potential to increase consumption and stock holdings. Conversely, pension reforms raising the MRA without incorporating such incentives can lead to a decline in expected pension wealth, prompting workers to increase savings and reduce their exposure to risky assets.

References

[1] Orazio P Attanasio and Agar Brugiavini. "Social security and households' saving". In: *the Quarterly Journal of economics* 118.3 (2003), pp. 1075–1119.

[2] Erich Battistin et al. "The retirement consumption puzzle: evidence from a regression discontinuity approach". In: *American Economic Review* 99.5 (2009), pp. 2209–2226.

[3] Claudia Biancotti, Giovanni D'Alessio, and Andrea Neri. "Measurement error in the Bank of Italy's Survey of Household Income and Wealth". In: *Review of Income and Wealth* 54.3 (2008), pp. 466–493.

[4] Margherita Borella, Flavia CODA MOSCAROLA, et al. "The 2011 pension reform in Italy and its effects on current and future retirees". In: (2015).

[5] Renata Bottazzi, Tullio Jappelli, and Mario Padula. "Retirement expectations, pension reforms, and their impact on private wealth accumulation". In: *Journal of Public Economics* 90.12 (2006), pp. 2187–2212.

[6] Renata Bottazzi, Tullio Jappelli, and Mario Padula. "The portfolio effect of pension reforms: evidence from Italy". In: *Journal of Pension Economics & Finance* 10.1 (2011), pp. 75–97.

[7] Francesca Carta, Francesco D'Amuri, and Till M von Wachter. *Workforce aging, pension reforms, and firm outcomes*. Tech. rep. National Bureau of Economic Research, 2021.

[8] Francesca Carta and Marta De Philippis. "Working horizon and labour supply: the effect of raising the full retirement age on middle-aged individuals". In: *Bank of Italy Temi di Discussione (Working Paper) No* 1314 (2021).

[9] Emanuele Ciani. "Retirement, pension eligibility and home production". In: *Labour Economics* 38 (2016), pp. 106–120.

[10] Giulia Cifaldi and Andrea Neri. "Asking income and consumption questions in the same survey: what are the risks?" In: *Bank of Italy Temi di Discussione (Working Paper) No* 908 (2013).

[11] Joao F Cocco. "Portfolio choice in the presence of housing". In: *The Review of Financial Studies* 18.2 (2005), pp. 535–567.

[12] Joao F Cocco, Francisco J Gomes, and Pascal J Maenhout. "Consumption and portfolio choice over the life cycle". In: *The Review of Financial Studies* 18.2 (2005), pp. 491–533.

[13] Fernando Di Nicola, Melisso Boschi, and Giorgio Mongelli. "Effective marginal and average tax rates in the 2017 Italian tax-benefit system". In: *Effective marginal and average tax rates in the 2017 Italian tax-benefit system* (2017), pp. 67–90.

[14] Mark Duggan, Perry Singleton, and Jae Song. "Aching to retire? The rise in the full retirement age and its impact on the social security disability rolls". In: *Journal of public economics* 91.7-8 (2007), pp. 1327–1350.

[15] Stefan Etgeton, Björn Fischer, and Han Ye. "The effect of increasing retirement age on households' savings and consumption expenditure". In: *Journal of Public Economics* 221 (2023), p. 104845.

[16] Andreas Fagereng, Charles Gottlieb, and Luigi Guiso. "Asset market participation and portfolio choice over the life-cycle". In: *The Journal of Finance* 72.2 (2017), pp. 705–750.

[17] Martin Feldstein. "Social security, induced retirement, and aggregate capital accumulation". In: *Journal of political economy* 82.5 (1974), pp. 905–926.

[18] Elsa Fornero and Elsa Fornero. *Information and financial literacy for socially sustainable NDC pension schemes*. World Bank, 2019.

[19] Jonathan Gruber, Kevin Milligan, and David A Wise. *Social security programs and retirement around the world: The relationship to youth employment, introduction and summary*. Tech. rep. National Bureau of Economic Research, 2009.

[20] Luigi Guiso, Tullio Jappelli, and Daniele Terlizzese. "Income risk, borrowing constraints, and portfolio choice". In: *The American economic review* (1996), pp. 158–172.

[21] Luigi Guiso and Paolo Sodini. "Household finance: An emerging field". In: *Handbook of the Economics of Finance*. Vol. 2. Elsevier, 2013, pp. 1397–1532.

[22] XV Inps. *Rapporto annuale*. 2016.

[23] Tullio Jappelli and Luigi Pistaferri. "The consumption response to income changes". In: *Annu. Rev. Econ.* 2.1 (2010), pp. 479–506.

[24] Hanno Lustig, Stijn Van Nieuwerburgh, and Adrien Verdelhan. "The wealth-consumption ratio". In: *The Review of Asset Pricing Studies* 3.1 (2013), pp. 38–94.

[25] Livio Maccan, Nicola Rossi, and Ignazio Visco. "Saving and borrowing constraints". In: *Saving and the accumulation of wealth* (1994), pp. 273–304.

[26] Dayanand S Manoli and Andrea Weber. *The effects of the early retirement age on retirement decisions*. Tech. rep. National Bureau of Economic Research, 2016.

[27] Giovanni Mastrobuoni. "Labor supply effects of the recent social security benefit cuts: Empirical estimates using cohort discontinuities". In: *Journal of public Economics* 93.11-12 (2009), pp. 1224–1233.

[28] Robert C Merton. "Lifetime portfolio selection under uncertainty: The continuous-time case". In: *The review of Economics and Statistics* (1969), pp. 247–257.

[29] Robert C Merton. "Optimum consumption and portfolio rules in a continuous-time model". In: *Stochastic optimization models in finance*. Elsevier, 1975, pp. 621–661.

[30] Jan Mossin. "Optimal multiperiod portfolio policies". In: *The Journal of Business* 41.2 (1968), pp. 215–229.

[31] OECD. *Pensions at a Glance: Retirement-Income Systems in OECD and G-20 Countries*. 2011.

[32] Noemi Oggero. "Retirement expectations in the aftermath of a pension reform". In: *Italian Economic Journal* (2022), pp. 1–15.

[33] Guillermo Ordoñez and Facundo Piguillem. "Saving rates and savings ratios". In: *Review of Economic Dynamics* 46 (2022), pp. 365–381.

[34] Paul A Samuelson. "Lifetime portfolio selection by dynamic stochastic programming". In: *Stochastic optimization models in finance* (1975), pp. 517–524.

[35] Todd Sinai and Nicholas Souleles. "Owner occupied housing as insurance against rent risk". In: *Wharton School, University of Pennsylvania. rider. wharton. upenn. edu/˜ sinai/papers/Insurance05-15-01. pdf* (2001).

[36] Stefan Staubli and Josef Zweimüller. "Does raising the early retirement age increase employment of older workers?" In: *Journal of public economics* 108 (2013), pp. 17–32.

Appendix

A Appendix

Saving Rates and Saving Ratios

We now present a discrete-time dynamic consumption model with no aggregate risk from [33] Ordoñez and Piguillem (2022) to explicitate the relation between standard saving rates and saving ratios. People can save in a risky asset a financial or non-financial (e.g., housing) subject to *i.i.d.* idiosyncratic risk and a risk-free asset b. Assuming households have CRRA preferences, they maximize consumption c_t over the life cycle subject to the budget constraint and the natural debt limit (they can borrow up to the present value of their human capital) with the following optimization problem:

$$\begin{aligned} \max_{c_t, a_{t+1}, b_{t+1}} \quad & \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma} \\ \text{s.t.} \quad & c_t + a_{t+1} p_t + b_{t+1} \leq \pi_t^i a_t p_t + R_t b_t + \omega_t \\ & a_t \geq 0 \\ & b_t \geq h_t \end{aligned} \tag{3}$$

where ω_t is labor income and labor supply is fixed and normalized to 1, R_t is the relative price of the risk-free asset, p_t is the relative price of the risky asset and π_t^i their idiosyncratic return, namely capital plus dividends. The authors assume $\pi_t^i = (1 + \pi_t)\epsilon_i$ to simplify notation, but they show that the distribution of the stochastic process is inconsequential to their results as long as it is *i.i.d.* over time. Human wealth h_t is defined as the discounted sum of future wages from period t on:

$$h_t = \sum_{j=1}^{\infty} \frac{\omega_{t+j}}{\prod_{l=1}^{j} R_{t+l}}.$$

The stochastic household total wealth in each period t is:

$$W_t^i = pi_t^i a_t p_t + R_t b_t + \omega_t + h_t \tag{4}$$

so that higher wealth is driven by increases in p_t or h_t. The solution has the form

$$c_t = (1 - s_t) W_t^i \tag{5}$$

$$p_t a_{t+1}^i = \phi_t s_t W_t^i, \tag{6}$$

where s_t is the saving ratio and ϕ_t is the proportion of savings allocated to the risky asset. From the assumption of homothetic preferences and *i.i.d* idiosyncratic shocks, both measures are independent of consumers' wealth and income shocks, which is useful for tractability. The choice of s_t guarantees that total wealth grows at the optimal rate: a household with wealth W_t^i chooses financial assets such that next period $(t+1)$, after the shock realization, total wealth satisfies:

$$W_{t+1}^i = \underbrace{\left(\phi_t \pi_{t+1}^i \frac{p_{t+1}}{p_t} + (1 - \phi_t) R_{t+1} \right)}_{r_{t+1}^i} s_t W_t^i, \tag{7}$$

We can rewrite s_t recursively as

$$(1-s_t)^{-1} = 1 + \beta^{1/\sigma}[\mathbb{E}\, r_{t+1}^{1-\sigma}]^{1/\sigma}(1-s_{t+1})^{-1},$$

The stationary solution becomes

$$s = \beta^{1/\sigma}[\mathbb{E}\, r^{1-\sigma}]^{1/\sigma}, \tag{8}$$

which shows the fundamental drivers of the saving ratio: the discount rate β and σ, which governs precautionary and intertemporal smoothing motives. If β increases (for example, due to an increase in life expectancy), people care more about the future and want to save more out of total wealth. The return component can be written as $\left([\mathbb{E}\, r_{t+1}^{1-\sigma}]^{\frac{1}{1-\sigma}}\right)^{\frac{1-\sigma}{\sigma}}$: the certainty equivalent term $[\mathbb{E}\, r_{t+1}^{1-\sigma}]^{\frac{1}{1-\sigma}}$ captures the role that σ plays in affecting risk aversion, while the remaining part represents the inverse of the elasticity of substitution under CRRA preferences. Risk aversion affects precautionary motives: the larger is σ, the more people want to save out of total wealth to smooth consumption across states. Intertemporal smoothing depends on the elasticity of substitution: if $\sigma > 1$ and people expect higher future returns, they will reduce savings out of total wealth to smooth consumption over time. Now assumes R_t and ω_t are after-tax prices, so that

$$y_t = \pi_t a_t p_t + (R_t - 1)b_t + \omega_t$$

is the average disposable income. Then, the budget constraint can be rewritten as

$$c_t + a_{t+1}p_t + b_{t+1} = a_t p_t + b_t + y_t,$$

where $a_t p_t + b_t$ is the households' net worth. The standard measure of saving rates is defined as

$$s_t^d = \frac{(y_t - c_t)}{y_t} = \frac{p_t(a_{t+1} - a_t) + (b_{t+1} - b_t)}{y_t}, \tag{9}$$

Replacing in the budget constraint equation (2) and (3), the law of motion of assets becomes:

$$\begin{aligned} a_{t+1}p_t + b_{t+1} &= s_t Wt - h_t \\ a_{t+1}p_t + b_{t+1} &= s_t(a_t p_t + b_t + y_t + h_t) - h_t \\ \frac{p_t(a_{t+1} - a_t) + (b_{t+1} - b_t)}{y_t} &= (s_t - 1)\frac{a_t p_t + b_t + h_t}{y_t} + s_t \end{aligned} \tag{10}$$

Substituting the definition of saving rates in the last equation, we obtain the relation between the two:

$$s_t^d = (s_t - 1)\frac{a_t p_t + b_t + h_t}{y_t} + s_t \tag{11}$$

Now defining $\chi_t = \frac{p_t a_t + b_t + h_t}{y_t}$, we can rewrite equation (9) as follows:

$$s_t = \frac{s_t^d + \chi_t}{1 + \chi_t}. \tag{12}$$

This formula helps to grasp the economics behind potential discrepancies between saving rates and saving ratios. Indeed, it shows that the dynamic properties of s_t carry over to implications for s_t^d only if financial wealth $p_t a_t + b_t$ and human wealth h_t are stable.

B Appendix

Expected Human Wealth

Households rely on two key resources over their lifetime - tangible wealth and human capital. The latter is defined as the present discounted value of the future flows of disposable labor income and pension benefits and represents a major part of total wealth (92% according to [24] Lustig, Van Nieuwerburgh and Verdelhan, 2013). Its inherent uncertainty and illiquidity impose significant constraints on households seeking to access credit markets in the absence of alternative forms of wealth, such as savings or inheritance. In particular, the uncertainty in future labor earnings and limited opportunities for insurance make the return to human capital risky. As a result, it represents a source of background risk with substantial impact on investor portfolio choices. Moreover, empirical evidence suggests that its returns are poorly correlated with the ones of the stock market, leading to its characterization as a "risk-free bond". This feature affects the willingness to undertake financial risk and is a crucial factor for understanding portfolio rebalancing over the life cycle, as outlined in Section 2. Pension reforms raising the MRA can boost human wealth by prolonging periods of labor income and increasing pension benefits once retired. To investigate whether the 2011 Fornero reform elicited similar effects in Italy, this appendix presents the measure used to assess changes in individual expected human wealth.

Assessing the value of human capital is complex, as it requires predicting future earnings, a task inherently fraught with uncertainty. To address this challenge, this study assumes that labor income y_{it} grows at an age-gender-employment-specific rate g determined from Eurostat data[38]. Pension benefits are approximated by multiplying individual last salaries by their expected replacement rate[39]. The expected human wealth for an individual i with age a and expected retirement age $\tau+1$ is defined as:

$$H_{ia\tau} = \underbrace{y_i\beta(1+g)\left(\frac{1-[\beta(1+g)]^{(\tau-a)}}{1-\beta(1+g)}\right)}_{\text{PDV of future labor income up to year } \tau} + \underbrace{\beta^{(\tau-a)}\left(\frac{[y_i(1+g)^{(\tau-a)}]\cdot \text{expected replacement rate}}{1-\beta}\right)}_{\text{PDV of pension wealth from year } \tau+1}.$$

where the discount rate incorporates a gender-specific probability of survival and is measured as:

$$\beta = \frac{1-(\frac{1}{\text{life expectancy}})}{1+r_f},$$

This study adopts the average life expectancy for men and women during the years 2006-2016 (82 and 85 years, respectively), along with an interest rate of 4% [40]. In order to examine the impact on expected human wealth of the increase in the expected retirement age $(\tau+1)$ and heterogeneous changes in statutory replacement rates across different pension regimes, this study focuses on individuals with a positive number of working years remaining until retirement (namely with as $(\tau+1-a)>0$).

[38] The effects of the Fornero reform on expected human wealth are furthers validated by using an age-gender-employment-specific constant rate of income growth estimated from SHIW data

[39] In the panel analysis the scarcity of data on expected replacement rates is particularly relevant. Hence, in those specifications the missing ones are replaced with gender-employment-specific statutory replacement rates obtained from the microsimulation of [4] Coda Moscarola and Borella (2015), which vary depending on the pre- and post-reform periods. It is worth noting that after the reform expected replacement rates were on average lower than the statutory ones, which implies that the panel estimates of changes in human wealth may exhibit upward bias.

[40] This rate aligns with the estimated average real human wealth returns of 3.8% reported by [24] Lustig, Van Nieuwerburgh and Verdelhan (2013). The selection of the interest rate is further informed by an average real interest rate of 3.5% prevailing in Italy during that same period, as well as the assumption that human wealth is akin to an illiquid bond and thus riskier.

C Appendix

Descriptive Trends: Repeated Cross-Sections (2006-2016)

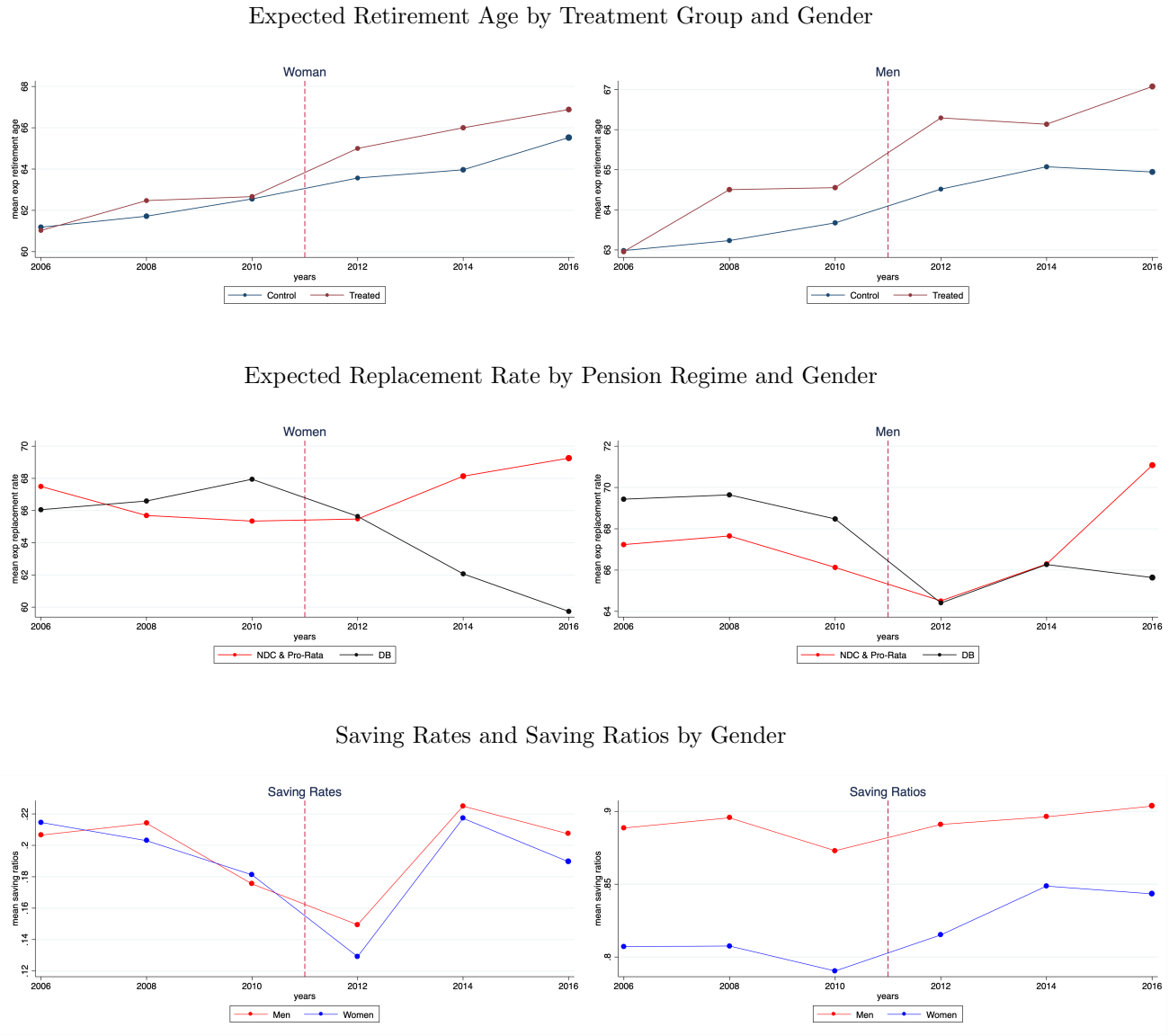


Figure 13: Source: SHIW 2006-2016

NOTE - The upper panels show trends in expected retirement age by treatment and gender. The middle panels present trends in expected replacement rate by pension regime and gender. DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The lower panels represent trends in saving rates and saving ratios by gender. The sample includes individuals who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). Women are aged between 45-59 and men between 45-64 in 2010. Both have less than 40 and more than 10 years of accrued paid contributions.

D Appendix

Summary Statistics

Summary Statistics Pre-Reform - Women

	(1) All			(2) Treated (MRA>=6y)			(3) Control			
	mean	sd	count	mean	sd	count	mean	sd	count	difference
Age	49.49	5.49	2447	49.23	5.54	835	50.61	3.97	792	-1.380***
Years of contributions	20.62	9.64	1943	19.06	7.81	835	26.07	7.95	792	-7.010***
Statutory MRA	59.98	2.03	1677	60.10	0.44	835	59.83	2.68	792	0.269***
Expected retirement age	62.20	3.89	1133	62.85	4.27	457	61.26	3.02	503	1.589***
Expected replacement rate	64.40	16.19	1133	63.55	14.92	457	67.26	14.48	503	-3.707***
Share DB workers	0.38	0.48	1943	0.30	0.46	835	0.50	0.50	792	-0.203***
Share married	0.57	0.50	2447	0.50	0.50	835	0.57	0.50	792	-0.069***
Share with retired partner	0.20	0.40	2447	0.15	0.36	835	0.23	0.42	792	-0.079***
Family members	2.88	1.27	2447	2.71	1.29	835	2.76	1.17	792	-0.041
Share high edu	0.10	0.30	2447	0.17	0.38	835	0.08	0.27	792	0.092***
Share South Italy	0.37	0.48	2447	0.31	0.46	835	0.21	0.40	792	0.102***
Share active	0.61	0.49	2447	0.74	0.44	835	0.83	0.37	792	-0.092***
Share unemployed	0.33	0.47	2447	0.20	0.40	835	0.17	0.37	792	0.038**
Human Wealth	461883	365084	1133	457864	340264	457	465907	329305	503	-8042
Financial Wealth	11290.79	62276.92	2447	13475.35	73564.65	835	12988.90	59010.44	792	486.452
Saving rate	0.18	0.32	2447	0.19	0.31	835	0.20	0.35	792	-0.011
Net wealth	239101	426809	2447	250266	500413	835	271719	348826	792	-21453
Share real wealth	0.85	1.26	2447	0.80	1.07	835	0.88	0.73	792	-0.082*
Share financial liabilities	0.04	1.35	2447	0.01	1.12	835	0.07	0.80	792	-0.060
Share financial assets	0.20	0.49	2447	0.21	0.40	835	0.19	0.37	792	0.022
Share bonds	0.01	0.05	2447	0.01	0.05	835	0.01	0.05	792	-0.001
Share stocks	0.03	0.10	2447	0.03	0.09	835	0.04	0.11	792	-0.009*
Share deposits	0.16	0.47	2447	0.18	0.38	835	0.14	0.34	792	0.033*
Observations	2447			835			792			

Table 1: Source - SHIW 2006-2016

NOTE - Column 1 reports means, standard deviations and number of observations during pre-reform years for all the sample of men aged between 45-64 in 2010 (also already eligible to retire under the seniority/quota scheme); Columns 2 and 3 report means, standard deviations, number of observations and average differences during pre-reform years for treated and control men 45-64 not eligible to retire by 2010. Men are defined as treated if they experienced an increase in their MRA of at least 6 years after the reform. The high edu variable is a dummy indicating whether men have at least a university degree. To analyse the composition of household assets, financial variable are presented as share of net wealth.

Summary Statistics Pre-Reform - Men

	(1) All			(2) Treated (MRA>=4y)			(3) Control			
	mean	sd	count	mean	sd	count	mean	sd	count	difference
Age	53.03	6.34	6203	52.31	5.64	1063	50.99	5.03	2936	1.315***
Years of contributions	28.18	8.89	6076	26.56	4.88	1063	27.12	7.78	2936	-0.559**
Statutory MRA	62.61	3.32	5696	63.36	1.76	1063	61.45	3.69	2936	1.909***
Expected retirement age	63.32	4.02	3285	64.39	3.04	727	62.84	4.25	2013	1.554***
Expected replacement rate	67.72	15.70	3285	69.76	14.99	785	67.73	15.34	2013	2.027***
Share DB workers	0.66	0.48	6076	0.75	0.44	2067	0.59	0.49	2936	0.156***
Share married	0.86	0.35	6203	0.87	0.34	1063	0.86	0.35	2936	0.012
Share with retired partner	0.15	0.36	6203	0.09	0.29	1063	0.08	0.27	2936	0.016
Family members	3.19	1.21	6203	3.29	1.22	1063	3.32	1.19	2936	-0.021
Share high edu	0.12	0.32	6203	0.20	0.40	1063	0.10	0.31	2936	0.097***
Share South Italy	0.33	0.47	6203	0.41	0.49	1063	0.30	0.46	2936	0.118***
Share active	0.74	0.44	6203	0.96	0.20	1063	0.95	0.21	2936	0.007
Share unemployed	0.04	0.20	6203	0.04	0.20	1063	0.05	0.21	2936	-0.007
Human Wealth	638650	460554	3285	650014	449893	785	645428	478819	2013	4586
Financial Wealth	22372	129752	6203	21166	102040	1063	21199	141859	2936	-32.478
Saving rate	0.20	0.40	6203	0.19	0.40	1063	0.19	0.38	2936	0.001
Net Wealth	337000	719337	6203	379088	1073551	1063	334426	671712	2936	44661
Share real wealth	0.84	1.45	6203	0.91	0.59	1063	0.86	0.82	2936	0.049*
Share financial liabilities	-0.00	1.93	6203	0.09	0.66	1063	0.03	1.25	2936	0.066
Share financial assets	0.16	1.18	6203	0.18	0.43	1063	0.17	0.85	2936	0.017
Share bonds	0.01	0.06	6203	0.01	0.06	1063	0.01	0.06	2936	0.001
Share stocks	0.03	0.11	6203	0.03	0.10	1063	0.03	0.11	2936	-0.006
Share deposits	0.11	1.17	6203	0.14	0.40	1063	0.12	0.84	2936	0.021
Observations	6203			1063			2936			

Table 2: Source - SHIW 2006-2016

NOTE - Column 1 reports means, standard deviations and number of observations during pre-reform years for all the sample of men aged between 45-64 in 2010 (also already eligible to retire under the seniority/quota scheme); Columns 2 and 3 report means, standard deviations, number of observations and average differences during pre-reform years for treated and control men 45-64 not eligible to retire by 2010. Men are defined as treated if they experienced an increase in their MRA of at least 4 years after the reform. The high edu variable is a dummy indicating whether men have at least a university degree. To analyse the composition of household assets, financial variable are presented as share of net wealth.

E Appendix

Role of Age and Contribution Years on the Treatment Variable

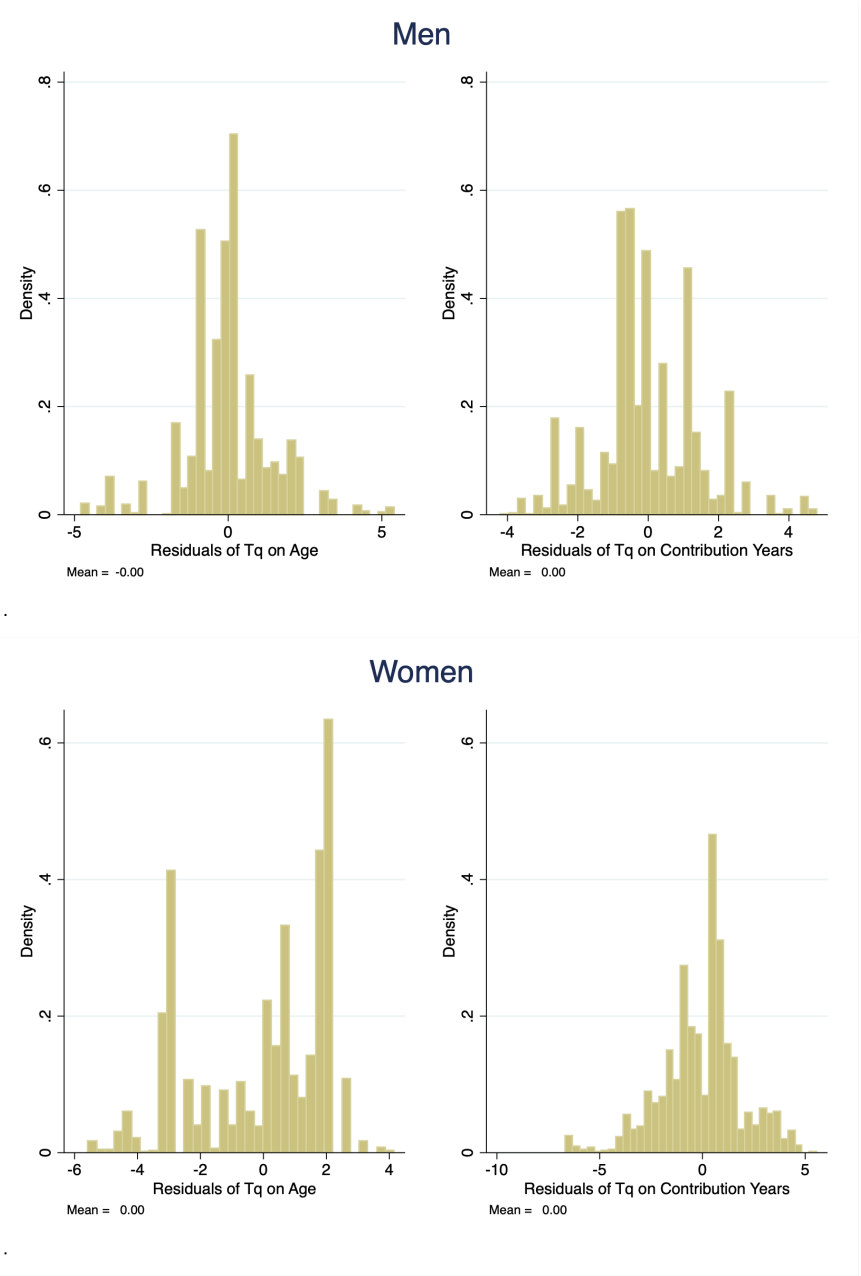


Figure 14: Source: SHIW 2006-2016
NOTE - The left (right) panel reports the distribution of the residuals from a regression of the continuous treatment $T_q = MRA_{q,post} - MRA_{q,pre}$ on age (contribution years) at the 2006 level. The upper and lower figures includes respectively men 45-64 and women 45-59 not eligible to retire by 2010. The extent to which the control variable accounts for the observed increase in MRA can be inferred from the degree of skewness towards zero in the distributions of the residuals. The figures suggest that age have a stronger explanatory role for the shock of men and contribution years for the shock of women.

F Appendix

Baseline Results: Tables

Effects of Increased MRA among most exposed Men
Saving Rates and Saving Ratios

	Saving Rates				Saving Ratios		
	SavRates	Sav/LaborIncome	Savings	LaborIncome	ExpHumanWealth	FinWealth	SavRatios
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All							
$\Delta MRA >= 4y$·post	0.0566**	0.0885*	3121.0*	-738.6	118180.6*	-6924.9	0.0149
	(0.0239)	(0.0475)	(1572.8)	(2500.7)	(61247.0)	(7149.2)	(0.0209)
N	4013	4013	4013	4013	3204	4013	4013
Mean Control Pre-reform	0.150	0.203	11392.8	22901.2	659184.6	26557.9	0.883
NDC & Pro-Rata workers							
$\Delta MRA >= 4y$·post	-0.0207	0.0119	-111.1	-5403.4	194568.9*	-17166.7	-0.0225
	(0.0444)	(0.0552)	(3159.1)	(5012.3)	(105885.2)	(13071.9)	(0.0369)
N	1701	1701	1701	1701	1576	1701	1701
Mean Control Pre-reform	0.135	0.155	11169.4	22676.5	746798.5	15535.3	0.928
DB workers							
$\Delta MRA >= 4y$·post	0.0636**	0.127*	1697.4*	-1955.9	-39908.8	-2335.7	0.0107
	(0.0311)	(0.0714)	(893.0)	(1633.5)	(54265.7)	(7819.3)	(0.0323)
N	2406	2406	2406	2406	1646	2406	2406
Mean Control Pre-reform	0.164	0.245	11592.1	23101.7	615082.7	31106.8	0.865
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ContributionYears_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educationlevel_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Civil status_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retiredpartner_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Illiquidity_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family members_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: Source - SHIW 2006-2016

NOTE - The table reports the difference-in-differences estimates of the extended working horizon due to the Fornero reform for most exposed male workers. Men are defined as treated if they experienced an increase in their MRA of at least 4 years after the reform. The first panel involves all men 45-64 with less than 40 years of accrued paid contributions not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The second and third panels split the sample among NDC & Pro-Rata workers and DB workers respectively. DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

*** Statistically significant at 1% level.

** Statistically significant at 5% level.

* Statistically significant at 10% level.

Effects of Increased MRA among most exposed Men
Wealth Decomposition and Financial Assets
Variables normalized by Net Wealth

	Wealth			Financial Assets		Risky Assets	
	Real Assets	Financial Assets	Financial Liabilities	Safe	Risky	Stocks	Bonds
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All:							
$\Delta MRA >= 4y$·post	-0.00560	-0.000765	-0.00636*	-0.0171	0.0151**	0.0153**	-0.000198
	(0.0203)	(0.0201)	(0.00379)	(0.0170)	(0.00750)	(0.00601)	(0.00414)
N	4962	4962	4962	4962	4962	4962	4962
Mean Control Pre-reform	0.816	0.191	0.00686	0.145	0.0401	0.0312	0.00888
NDC & Pro-Rata workers							
$\Delta MRA >= 4y$·post	-0.0391	0.0313	-0.00778	-0.0202	0.0559***	0.0445**	0.0114
	(0.0366)	(0.0383)	(0.00831)	(0.0312)	(0.0143)	(0.0122)	(0.00909)
N	2064	2064	2064	2064	2064	2064	2064
Mean Control Pre-reform	0.788	0.218	0.00625	0.165	0.0494	0.0387	0.0107
DB workers							
$\Delta MRA >= 4y$·post	0.0242	-0.0306	-0.00639	-0.0321	-0.00356	0.000369	-0.00392
	(0.0279)	(0.0272)	(0.00432)	(0.0236)	(0.00841)	(0.00693)	(0.00401)
N	2886	2886	2886	2886	2886	2886	2886
Mean Control Pre-reform	0.839	0.169	0.00735	0.128	0.0327	0.0253	0.00745
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ContributionYears_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educationlevel_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Civil status_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Illiquidity_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family members_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retiredpartner_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Source - SHIW 2006-2016
NOTE - The table reports the difference-in-differences estimates of the extended working horizon due to the Fornero reform for most exposed male workers. Men are defined as treated if they experienced an increase in their MRA of at least 4 years after the reform. The first panel involves all men 45-64 with less than 40 years of accrued paid contributions not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The second and third panels split the sample among NDC & Pro-Rata workers and DB workers respectively. DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The table provides a decomposition of household wealth. The first three columns depict the impact of the reform on net wealth, which encompasses real and financial assets minus financial liabilities. Column 4 captures the effects on deposits, denoting safe assets. Column 5 presents the impact of the reform on risky financial assets, further delineated in columns 6 and 7 as stocks and bonds. All variables are normalized with respect to net wealth. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.
*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Effects of Increased MRA among most exposed Women
Saving Rates and Saving Ratios

	Saving Rates				Saving Ratios		
	SavRates	Sav/LaborIncome	Savings	LaborIncome	ExpHumanWealth	FinWealth	SavRatios
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All							
$\Delta MRA >= 6y$·post	-0.0788**	-0.110**	-2989.7**	-1540.5	81055.2**	12642.4	0.00417
	(0.0373)	(0.0524)	(1395.0)	(1375.1)	(30715.7)	(8970.8)	(0.0218)
N	1644	1644	1644	1644	1241	1644	1644
Mean Control Pre-reform	0.198	0.335	10555.5	21915.9	471832.7	12988.90	0.798
NDC & Pro-Rata workers							
$\Delta MRA >= 6y$·post	-0.106**	-0.142**	-2019.4*	-1867.9	96495.1***	9800.9	-0.0499**
	(0.0420)	(0.0551)	(1164.7)	(1662.6)	(30721.8)	(10410.8)	(0.0235)
N	1037	1037	1037	1037	833	1037	1037
Mean Control Pre-reform	0.191	0.290	10406.0	22872.3	519026.9	10346.47	0.824
DB workers							
$\Delta MRA >= 6y$·post	0.000823	-0.0302	-583.3	-3805.7	-54157.5	-3179.0	0.0826
	(0.0619)	(0.129)	(2863.5)	(2530.7)	(70950.7)	(18968.7)	(0.120)
N	600	600	600	600	393	600	600
Mean Control Pre-reform	0.204	0.373	10679.0	21126.4	426717.5	15659.59	0.775
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educationlevel_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Civil status_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retiredpartner_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Illiquidity_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family members_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: Source - SHIW 2006-2016
NOTE - The table reports the difference-in-differences estimates of the extended working horizon due to the Fornero reform for most exposed female workers. Women are defined as treated if they experienced an increase in their MRA of at least 6 years after the reform. The first panel involves all women 45-59 with less than 40 years of accrued paid contributions not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The second and third panels split the sample among NDC & Pro-Rata workers and DB workers respectively. DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.
*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Effects of Increased MRA among most exposed Women
Wealth Decomposition and Financial Assets
Variables normalized by Net Wealth

	Wealth			Financial Assets		Risky Assets	
	Real Assets	Financial Assets	Financial Liabilities	Safe	Risky	Stocks	Bonds
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All:							
$\Delta MRA >= 6y$·post	-0.0582**	0.0685***	0.0103**	0.0389*	0.0294	0.0224	0.00696
	(0.0222)	(0.0227)	(0.00496)	(0.0228)	(0.0208)	(0.0181)	(0.00749)
N	1157	1157	1157	1157	1157	1157	1157
Mean Control Pre-reform	0.815	0.193	0.00825	0.139	0.0514	0.0373	0.0140
NDC & Pro-Rata workers							
$\Delta MRA >= 6y$·post	-0.0809**	0.0974***	0.0165***	0.0403	0.0557**	0.0489*	0.00680
	(0.0312)	(0.0318)	(0.00609)	(0.0313)	(0.0255)	(0.0254)	(0.00506)
N	654	654	654	654	654	654	654
Mean Control Pre-reform	0.813	0.193	0.00661	0.136	0.0542	0.0422	0.0120
DB workers							
$\Delta MRA >= 6y$·post	-0.182*	0.176*	-0.00597	0.158	0.0189	0.00568	0.0132
	(0.103)	(0.102)	(0.00593)	(0.101)	(0.0435)	(0.0259)	(0.0228)
N	493	493	493	493	493	493	493
Mean Control Pre-reform	0.817	0.193	0.00939	0.141	0.0494	0.0340	0.0155
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educationlevel_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Civil status_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retiredpartner_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Illiquidity_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family members_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Source - SHIW 2006-2016
NOTE - The table reports the difference-in-differences estimates of the extended working horizon due to the Fornero reform for most exposed female workers. Women are defined as treated if they experienced an increase in their MRA of at least 6 years after the reform. The first panel involves all women 45-59 with less than 40 years of accrued paid contributions not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The second and third panels split the sample among NDC & Pro-Rata workers and DB workers respectively. DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The table provides a decomposition of household wealth. The first three columns depict the impact of the reform on net wealth, which encompasses real and financial assets minus financial liabilities. Column 4 captures the effects on deposits, denoting safe assets. Column 5 presents the impact of the reform on risky financial assets, further delineated in columns 6 and 7 as stocks and bonds. All variables are normalized with respect to net wealth. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.
*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

G Appendix

Continuous Treatment Specifications: Tables

Effects of Increased MRA among Men
Saving Rates and Saving Ratios

	Saving Rates				Saving Ratios		
	SavRates	Sav/LaborIncome	Savings	LaborIncome	ExpHumanWealth	FinWealth	SavRatios
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All							
T_q·post	0.0152***	0.0236	806.2**	145.9	22664.7**	-855.6	-0.0144
	(0.00572)	(0.0154)	(333.5)	(634.5)	(10030.3)	(3093.0)	(0.00942)
N	4013	4013	4013	4013	3204	4013	4013
Mean Control Pre-reform	0.233	0.328	15233.0	24870.5	553278.3	39158.1	0.841
NDC & Pro-Rata workers							
T_q·post	0.0232	0.00173	950.2	110.2	22617.6	-5555.5	0.00885
	(0.0158)	(0.0258)	(1265.8)	(1311.3)	(28061.0)	(4826.2)	(0.00757)
N	1701	1701	1701	1701	1576	1701	1701
Mean Control Pre-reform	0.201	0.308	12001.9	18726.9	563234.8	7851.4	0.927
DB workers							
T_q·post	0.00933	0.0352**	260.0	-738.9	-1317.5	264.4	-0.0158
	(0.00629)	(0.0177)	(231.2)	(708.7)	(7986.8)	(3025.3)	(0.0100)
N	2406	2406	2406	2406	1646	2406	2406
Mean Control Pre-reform	0.234	0.326	15415.7	25299.0	558251.3	40896.6	0.838
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ContributionYears_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educationlevel_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Civil status_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retiredpartner_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Illiquidity_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family members_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Source - SHIW 2006-2016
NOTE - The table reports the difference-in-differences estimates of the extended working horizon due to the Fornero reform for forward-looking male workers. T_q represents the number of additional working years faced after the reform. The first panel involves all men 45-64 with less than 40 years of accrued paid contributions not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The second and third panels split the sample among NDC & Pro-Rata workers and DB workers respectively. DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.
*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Effects of Increased MRA among Women
Saving Rates and Saving Ratios

	Saving Rates				Saving Ratios		
	SavRates	Sav/LaborIncome	Savings	LaborIncome	ExpHumanWealth	FinWealth	SavRatios
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All							
T_q·post	-0.0137**	-0.0237*	-439.6	-155.8	6609.4	2462.4	0.00552
	(0.00671)	(0.0130)	(280.7)	(287.0)	(7534.0)	(1913.5)	(0.00512)
N	1644	1644	1644	1644	1241	1644	1644
Mean Control Pre-reform	0.197	0.358	10251.2	21216.7	430849.5	14068.1	0.763
NDC & Pro-Rata workers							
T_q·post	-0.0134	-0.0284	-1109.0	-745.7	12111.5	883.5	-0.0151**
	(0.0120)	(0.0322)	(735.1)	(448.4)	(7521.6)	(2367.1)	(0.00710)
N	1037	1037	1037	1037	833	1037	1037
Mean Control Pre-reform	0.185	0.303	9681.4	22015.1	488367.0	6815.9	0.784
DB workers							
T_q·post	0.00890	0.00684	-128.9	-89.03	-30918.4**	2630.8	0.0103
	(0.0148)	(0.0366)	(485.3)	(619.7)	(13831.4)	(3585.2)	(0.0241)
N	600	600	600	600	393	600	600
Mean Control Pre-reform	0.198	0.375	10177.7	21106.1	405740.8	19200.4	0.763
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educationlevel_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Civil status_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retiredpartner_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Illiquidity_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family members_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles_2006*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Source - SHIW 2006-2016
NOTE - The table reports the difference-in-differences estimates of the extended working horizon due to the Fornero reform for forward-looking female workers. T_q represents the number of additional working years faced after the reform. The first panel involves all women 45-59 with less than 40 years of accrued paid contributions not eligible to retire by 2010 following [8] Carta and De Philippis (2022). The second and third panels split the sample among NDC & Pro-Rata workers and DB workers respectively. DB workers were the sole group that encountered a negative pension wealth shock after the implementation of the Fornero reform. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables include marital status, area of residence, employment status, level of education, family size, wealth quartiles and whether the individual's partner is retired or not. These variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.
*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

H Appendix

Differential effects of Increased MRA by Pension Regime on the Allocation of Risky Assets

Share of Stocks and Bonds - Men

Share of Stocks and Bonds - Women

Figure 15: Source: SHIW 2006-2016
NOTE - The panels reports the difference-in-differences coefficients of the extended working horizon for individuals under the Notional Defined Contribution and Pro-Rata regimes ($Treat_q \cdot \alpha_t$), as well as the differential effect of increasing the MRA for workers under the Defined Benefit regime ($Treat_q \cdot DB_i \cdot \alpha_t$). The left panels reports estimates for the share of stocks out of net wealth for middle-aged men and women most exposed to the reform, while the right panels presents results for their share of bonds. The sample includes individuals who had not retired and were not eligible to retire by 2010 following [8] Carta and De Philippis (2022). Men aged between 45-64 and women aged between 45-59, with less than 40 and more than 10 years of accrued paid contributions, are defined as treated if they experienced an increase in their MRA of at least 4 (6) years after the reform. The specifications control for year and cell fixed effects, with each cell being assigned based on age, years of contributions, gender, and employment status. The control variables are assessed at the 2006 level and interacted with time dummies. Standard errors are clustered at the cell level.

Summary

Many pension systems need to recover long-term financial sustainability and grant equality of treatment within and across generations. In recent decades, the most widely adopted pension reforms were mainly focused on reducing future pension benefits or implementing *actuarially fair* pension regimes that link public pensions to accrued contributions. These reforms have been extensively studied in the literature concerning their effects on savings and portfolio allocations. However, in response to the demographic challenges posed by aging populations and declining fertility rates, governments are implementing another policy tool: the increase of the Minimum Retirement Age (MRA). While the important labor effects of extending the working horizon have been well-documented by existing research, little attention has been given to their consequences on saving decisions and portfolio allocations, particularly for workers further from retirement. In fact, despite the extensive public debate surrounding pension reforms, this area of research has focused primarily on individuals close to retirement, thereby neglecting the potential effects of raising the MRA on middle-aged workers. This study aims to fill this gap by examining the financial implications of such reforms on middle-aged workers, leveraging the 2011 Fornero reform in Italy as a quasi-natural experiment.

The effect of reforms raising the MRA on individual expected human wealth, and consequently on financial decisions, is an empirical question. These reforms have the potential to influence the discounted present value of future labor earnings and pension benefits through two primary channels: labor responses and state incentives. Indeed, by requiring individuals to wait longer before becoming eligible for public pension benefits, such policies can prompt workers to either rely solely on their existing wealth or, more commonly, to continue working for additional years. The consequential increase in expected labor earnings can lead to a decrease in saving rates through a positive income channel ([15] Etgeton et al, 2023). However, according to standard dynamic consumption models households should be mainly concerned about the proportion they save out of total wealth in order to smooth consumption over time, not out of current income. Hence, this study not only examines standard saving rates, but also explores individual *saving ratios*, a measure of the optimal stock of savings out of lifetime wealth proposed by [33] Ordonez and Piguillem (2022). Moreover, as human capital is typically compared to a bond endowment given its uncertainty, illiquidity and weak correlation with stock market returns, portfolio choices may be influenced by the potential change in expected future labor earnings and pension benefits resulting from reforms raising the MRA. Indeed, consistently with diversification motives, [29] Merton (1975) predicts that an increase in the ratio of human wealth out of financial wealth should lead to an increase in risky portfolio shares.

Government incentives can also play a significant role in shaping the impact of pension reforms raising the MRA on expected human wealth. If post-reform rules increase the annuity rates governing pension formulas

as rewards for each additional working year, individuals may reasonably anticipate enhanced human wealth due to both increased labor earnings and improved pension benefits at the time of retirement. However, if individuals face a postponement of constant pension benefits as a result of such reforms, they may internalize a reduction in their expected pension wealth. This negative pension wealth channel has been extensively studied in the literature exploring the effects of pension reforms on financial decisions. The baseline prediction of this research area is the substitution effect proposed by [17] Feldstein (1974): pension wealth crowds out discretionary wealth. Consequently, a decrease in the expected generosity of the pension system typically leads to increased savings rates ([1] Attanasio and Brugiavini, 2003) and portfolio shifts towards safer and real assets ([6] Bottazzi et al, 2010). The 2011 Italian pension reform provides an ideal setting to test these empirical predictions, as this reform not only suddenly increased the MRA up to 7 years, but also created heterogeneous pension wealth shocks across different pension regimes.

In 2011, at the peak of the sovereign crisis, a technical government was appointed in Italy to give a positive signal to the markets and improve the non-sustainability of the pension system. To harmonize pension rules among workers, the government introduced incentives to work longer for individuals under actuarially fair pension regimes. Specifically, each additional working year was rewarded by higher statutory replacement rates. Conversely, individuals enrolled in the more generous Defined-Benefit scheme experienced a negative pension wealth shock due to the postponement of constant pension benefits. The present work exploits these heterogeneous changes to disentangle the roles played by positive labor shocks and negative pension wealth shocks.

The primary aim of this work is to understand how reforms raising the MRA can affect financial decisions for middle-aged workers. The analyses leverage data from the Bank of Italy's biannual Survey on Household Income and Wealth, which provides comprehensive information on individual expectations of retirement age and replacement rates, as well as the composition of household wealth. The analyses involve a sample of nearly 6,000 workers not eligible to retire prior to the reform. The main results rely on repeated cross-sections spanning the period from 2006 to 2016 and are further validated by studying a rotating panel component covering the years 2008 to 2014. To examine the impact of the Fornero reform, this work employs a difference-in-difference methodology that leverages the variation in MRA within cells built on the key determinants of the Italian pension eligibility (age, contribution years, gender and employment status). To account for the potential nonlinear impact of the increase in the MRA on various variables of interest and the idea that middle-aged workers may not be highly responsive to small shocks, this study adopts a treatment assignment strategy that focuses on the workers most affected by the reform. Specifically, the treatment group consists of male and female workers who respectively experience increases in their working horizon of 4 and 6 years, following the approach proposed by [8] Carta and De Philippis (2021).

This study provide valuable insights into how government incentives can influence individuals' expected human wealth, saving and portfolio behaviors. The main findings presented refer to male workers, as they allow a more straightforward comparison between the treatment and control groups. In fact, while most exposed men are on average similar to the least exposed ones, the female treated group represents a more selected sample including all women with the most discontinuous working histories. The results reveal that an important MRA increase had different effects on expected human wealth depending on the generosity of the pension regime individuals were enrolled in prior to the reform. The average effect of the reform for most exposed men was a reduction in their expectations of future pension benefits, which aligns with previous literature highlighting this puzzling result. A potential explanation advanced in the literature is the lack of awareness among Italian workers regarding the functioning of an actuarially fair pension system, wherein pension benefits increase with additional contribution years ([32] Oggero, 2022). However, this study provides a different perspective. The results show that the decrease in expected replacement rates observed after the Fornero reform was primarily driven by individuals who experienced a negative pension wealth channel due to an important delay of unchanged pension benefits. In fact, most exposed male workers under actuarially fair pension regimes increased their expected replacement rates in line with post-reform rules. This pension wealth channel helps to explain the different change in expected human wealth across pension regimes. In accordance with positive labor and pension shocks, most exposed men under the actuarially fair Notional Defined-Contribution and Pro-Rata schemes increased their expected future labor earnings and pension benefits after the 2011 reform. On the other hand, workers under the generous Defined-Benefit method saw no significant change in their expected human wealth, as lower expected pension benefits compensated the positive income channel resulting from additional labor earnings. Then, the study uncovers the role of changes in expected human wealth in shaping saving and investment choices. Following the reform, on average saving rates increased by 1.5 percentage points for each extra working year. This increase represents approximately 6% of the average saving rate of the control group in the pre-reform period. At first glance, this result may appear puzzling as it contradicts the only empirical evidence of the financial effects of reforms that require individuals to work for more years: a decrease in savings out of current disposable income. However, triple difference-in-difference estimates analysing the impact of raising the MRA by pension regime illustrate how the observed increase in savings was driven by people experiencing a negative pension wealth channel, in line with Feldstein's substitution effect. On the other hand, individuals experiencing a positive human wealth channel did not show significant changes in their savings behavior out of current disposable or labor income. Still, SHIW data suffer from an important underestimation of consumption data. Moreover, when studying the saving ratios predicted by the theory, actuarially fair workers with a MRA increase larger than four years reduced their optimal proportion of savings out of lifetime wealth. This adjustment in savings

behavior could be attributed to intertemporal smoothing motives. Finally, the portfolios of the most exposed workers responded to the changes in expected human wealth induced by the Fornero reform. For individuals under the Notional Defined-Contribution (NDC) and Pro-rata pension schemes, the increase in the ratio of human wealth to financial wealth explains a substantial 5.57 percentage point rise in the proportion of risky assets relative to their net wealth, primarily attributable to a 4.89 percentage point increase in their share of stocks. When compared to the average share of stocks held by the control group before the reform, most exposed NDC and Pro-rata workers nearly doubled their allocation to stocks. In contrast, workers under the Defined-Benefit pension scheme reduced their exposure to risky assets by decreasing the share of bonds in their portfolios, suggesting a more conservative investment approach in response to their negative pension wealth shock. Overall, these results are validated by the analyses conducted for women and households where both partners experienced a MRA increase. Lastly, SHIW panel data provide additional evidence in support.

This research project presents the first empirical findings of the impact of reforms raising the MRA on expected human wealth, savings out of lifetime wealth and portfolio allocations. The findings align with the theoretical predictions linking changes in human wealth to financial decisions and provide evidence of *forward-looking* middle-aged Italian workers internalizing the new rules imposed by the Fornero reform. Moreover, this project contributes to the ongoing debate on the pension wealth effects of the Fornero reform. Specifically, the present study suggests that workers, on average, possess a comprehensive understanding of the pension system, including the implications of pension reforms on their future income sources. Finally, the heterogeneity of the new rules across pension regimes allows to disentangle the role of government incentives in shaping workers' expectations and financial decisions. By designing pension reforms that reward individuals for prolonging their working careers, governments can potentially generate positive human wealth effects and consequent decreases in savings and/or increases in stock holdings. On the other hand, pension systems that lack incentives or resources to reward a longer working horizon may result in a negative pension wealth channel, prompting workers to increase savings and allocate a larger portion of their assets to safer options.