Italian Economic Journal (2023) 9:353–367
https://doi.org/10.1007/s40797-021-00179-8

RESEARCH PAPER

Retirement Expectations in the Aftermath of a Pension Reform

Noemi Oggero[1,2]

Received: 1 December 2020 / Accepted: 6 December 2021 / Published online: 28 January 2022

Abstract
In this paper we investigate the effects of a pension reform on workers' retirement expectations. To assess whether individuals revise their expectations in the direction suggested by changes in legislation, we exploit the 2011 Italian pension reform. Using 2010 and 2012 data for a representative sample of the Italian population, we find that the reform worsened workers' expectations on replacement rate. Yet, this is not consistent with the tightening of age requirements in a defined contribution context. One explanation is that workers may not be fully aware of the mechanism of a defined contribution pension system.

Keywords Expectations · Pension reforms · Retirement · Information

JEL Classification D84 · H55 · J26 · D14

1 Introduction

In recent decades, the retirement landscape has undergone many radical changes. The shift from Defined Benefit (DB) to Defined Contribution (DC) pension schemes has increased individuals' responsibility for their retirement security, even in systems with high compulsory contributions. In this context, knowledge and information about pensions are critical to households' inter-temporal decisions, and investigating retirement expectations becomes increasingly relevant. Moreover, in most advanced economies, pension reforms have changed both the requirements for accessing retirement and the way benefits are computed, and the lack of knowledge of pension incentives "is troubling since workers may save or consume suboptimally, […] or retire earlier than they would have if equipped with better pension information" (Mitchell 1988). Especially

✉ Noemi Oggero
noemi.oggero@unito.it

1 University of Turin, Turin, Italy

2 CeRP-Collegio Carlo Alberto, Turin, Italy

in countries where the public pension is the major component of retirement income, understanding its functioning is crucial for retirement preparedness. An important issue in this context is to what extent people, and workers in particular, perceive changes in the pension legislation (Bottazzi et al. 2006). In fact, it is not clear whether individuals are aware of the economic and financial implications of pension reforms introduced in recent years.

In this paper, we investigate the effects of a pension reform on workers' expectations on retirement age and replacement rate, i.e., the ratio of the pension benefit to pre-retirement labor income. In order to identify the effects of a change in pension legislation on subjective expectations, we take advantage of a completely unanticipated reform introduced in Italy in 2011.[1] Differently from previous reforms implemented in Italy, such reform set higher retirement age leading to higher replacement rates. In fact, in a DC pension system, postponing retirement contributes in two ways to the increase of individual benefits: through higher contributions and lower expected longevity at the time of retirement (Fornero et al. 2019).

Our paper offers several innovations over the existing literature. First, we exploit rich nationally-representative longitudinal data, while previous studies faced the limitations of cross-sectional datasets. Second, we exploit a completely unanticipated pension reform, which has thus been a source of exogenous variation in retirement expectations. Third, this reform, differently from others, increased both the average retirement age and replacement rates, as a consequence of the application of the DC rule.

We investigate whether individuals revised their expectations in the *direction* imposed by the reform using data from the 2010 and the 2012 Bank of Italy's Survey of Household Income and Wealth (SHIW), analyzed with both pooled OLS and fixed effects models. Our framework allows us to control for potential confounders such as pessimism during a crisis in an effort to identify a causal effect. Our estimates show that the expected retirement age increased after the reform, consistently with the variation in the pension legislation. Yet, we also find that expected replacement rates decreased. While the increase in the expected retirement age is in line with the direction imposed by the pension reform, the expected decrease in the replacement rate is not consistent with the tightening of age requirements in a DC context. Indeed, if a reform increases the average retirement age, this translates into higher future pension benefits and replacement rates, due to both higher contributions and lower expected longevity. One explanation is that workers may not be fully aware of the functioning of a DC pension system, in particular of the principle according to which postponing retirement leads to higher pensions. Our findings suggest that individuals may benefit from pension information. Thus, it is fundamental for policymakers to adequately inform individuals to ensure they understand the pension system and its reforms.

The remainder of the paper is organized as follows. Section 2 summarizes the related literature, and Sect. 3 presents the institutional background of the Italian pension system. Section 4 provides an overview of our data and empirical strategy, and Sect. 5

[1] The 2011 pension reform is also known as the "Fornero reform" from the name of the Minister of Labor who proposed it.

discusses the estimation results. Finally, Sect. 6 discusses the policy implications of our findings and concludes the paper.

2 Literature Review

Expectations play a central role in life cycle models and inter-temporal choices, such as those concerning retirement. As individuals need to be forward-looking when it comes to pensions, measuring expectations has become especially relevant in the economics of ageing (Bissonnette and van Soest 2015). In fact, many recent empirical studies aim at measuring expectations directly using survey questions (Bissonnette and van Soest 2012). Moreover, as the responsibility for retirement security is increasingly left in the hands of individuals, retirees' financial well-being will depend increasingly on their decisions and behavior (Lusardi 2015; Lusardi et al. 2020).

As in recent decades reforms have changed age requirements and the rules to compute pension benefits, some studies have tried to estimate their effects on the revision of retirement expectations. In particular, Bottazzi et al. (2006) exploited a series of Italian pension reforms and found that expectations changed in the direction suggested by the new legislation. However, differently from the reform exploited in this paper, during the period they consider (i.e., 1989–2002), the Italian government enacted three reforms (in 1992, 1995, and 1997), whose ultimate effect was to increase the retirement age and reduce the replacement rate of young workers relative to older cohorts. Also, they compared replacement rates for a given retirement age. Baldini et al. (2019) considered a more recent period of reforms, but they concluded that the observed pessimism in pension expectations could be related to the macroeconomic crisis and/or the pension reform, i.e., they could not disentangle these effects and rule out the possibility that individuals' pessimism during a crisis could have driven pension expectations.[2]

Bissonette and van Soest (2012, 2015) analyzed retirement expectations in the Netherlands, and they found that expectations gradually became more pessimistic since the beginning of the crisis. The increased pessimism was in line with the ongoing Dutch debate on reforms aiming at reducing pension generosity. As several proposals were discussed and never implemented, those studies focused on a period of anticipated reforms, while the reform we exploit in our analysis has been completely unanticipated.

Using a micro-simulation model, Borella and Coda Moscarola (2015) analyzed the effects of the 2011 Italian pension reform, and showed that the reform increased the average retirement age for all the cohorts, especially the youngest ones. Also, they found that average replacement rates rose, with the largest increase for each year of postponement occurring among the youngest cohorts. This is due to the fact that in a contribution-based pension scheme, the notional capital is annuitized according to residual life expectancy at the time of retirement.[3] Hence, the retirement postponement imposed by the 2011 Italian pension reform increased replacement rates as a

[2] Younger individuals in particular have suffered from the economic downturn, since they faced a high unemployment and low average entry wages.

[3] Notional capital refers to the fact that contributions are not accumulated in a fund. In fact, current workers' contributions are used to pay for current retirees' pension benefits.

consequence of the application of the DC mechanism (Borella and Coda Moscarola 2015).

Finally, it is worth mentioning that a growing body of the literature raises concerns about how prepared households are to make sound pension decisions (Goda et al. 2014). The linkage of pension benefits to contributions paid altered the incentives to work longer, but incentives work only if people are aware of them. For example, US-based studies showed that individuals knowing that they can increase their pension wealth by postponing retirement are more likely to remain in the labor force (Chan and Stevens 2008; Liebman and Luttmer 2015). Also, workers who receive the public pension statement are more likely to be able to provide an estimate of their future benefits (Mastrobuoni 2011).

3 Institutional Background

In the Italian pension system, we can identify workers covered by three different types of pension schemes, depending on whether they had contributed for more or less than 18 years at the end of 1995, or started working after 1995. The pension for workers who accumulated at least 18 years of contributions at the end of 1995 is calculated with the DB rule, according to which the benefit depends on an average income earned at the end of the career. For workers who started to pay contributions before 1995 but accumulated less than 18 years at the end of 1995, the pension is calculated with a pro-rata system. The pro-rata mechanism works as a weighted average of DB and Notional DC (NDC) benefits, and the weights are represented by years of contribution accrued before and after January 1st, 1996 (Borella and Coda Moscarola 2015). Finally, workers who entered the labor market after 1995 are covered by an NDC system. The pension benefit in an NDC system is equal to the notional capital, i.e., the sum of all contributions paid, revalued to a rate equal to the five-year moving average of the nominal GDP growth, multiplied by an age-specific coefficient that is updated according to life expectancy.

In this context, while Italy was facing a financial crisis, a technical government introduced a major pension reform that could not be anticipated by workers, as it was implemented just one month after the government installed. Indeed, the reform was introduced in December 2011 through a decree, converted into law two weeks later, and enforced starting from January 1st, 2012. Moreover, it was introduced with no discussion with the social partners (Berton et al. 2017). The crucial changes brought by the reform regarded the introduction of stricter requirements for both the old age and the seniority pension, which allows to access pension benefits before the standard age, imposing obligations in terms of contributions paid (Borella and Coda Moscarola 2015).

To be eligible for the seniority pension before the reform, individuals needed either 40 years of contribution or a mix of age and years of contribution, called *quota*. For instance, the sum of age and years of contribution should have been 95 in 2010, with at least 35 years of contribution for employees and 59 years old.[4] The reform abolished

[4] The rules were slightly different depending on whether individuals were employees or self-employed.

the quota system and raised the minimum number of years of contribution from 40 to 41 for women and 42 for men in 2012.

To reach the eligibility for the old age pension before the reform, the age was 60 for women and 65 for men, and individuals needed at least 20 years of contribution if they were under DB or pro-rata pension schemes and at least 5 years if they were under the NDC one. With the 2011 reform, the age requirements rose to 66 years old by 2018 for individuals under DB or pro-rata pension schemes, and to 70 years old by 2050 for individuals under the NDC pension scheme. Moreover, the linkage of age requirements to the evolution of life expectancy at 65 was extended to contributory requirements. Finally, the reform extended the pro-rata mechanism to DB workers, but only for contributions paid from 2012, with little impact on their final pension.

4 Data and Estimation Strategy

The data used to carry out the empirical analysis are drawn from the SHIW, a survey that is conducted every two years by the Bank of Italy. The SHIW dataset is representative of the Italian population and it contains several information at both household and individual level. In particular, workers are asked about their expected retirement age and expected replacement rate. The wording of the questions is as follows: "When do you expect to retire?" and "At the time of retirement, what fraction of labor income will your public pension be? Consider the public pension only."

Since we want to investigate how expectations changed with the 2011 pension reform, and the transition phase was very short, we exploit the 2010 and 2012 waves of the SHIW.[5] We define as the pre-reform period the year 2010, while the post-reform period is given by the 2012 wave. The timing of the interview is compatible with our identification strategy, since the 2010 data were collected between January and August 2011, and the reform was introduced later, in December 2011, and enforced starting from January 2012.

The SHIW records whether respondents or their employers ever paid any pension contributions, and the number of years they have been paying. This information allows us to compute the years of contribution at the end of 1995 for each worker, and to define individuals' pension scheme accordingly, assuming that they did not face unemployment spans during their working life. Our sample is restricted to respondents age 20–65 who are employees or self-employed in the survey year, excluding the unemployed, retirees, and other individuals not in the labor force.[6] Overall, we have 7,717 individuals answering to both questions on subjective pension expectations. Also, the number of observations is balanced across the waves, with 3,872 respondents in the 2010 SHIW, and 3,845 in the 2012 wave.

Exploiting the fact that pension expectations are elicited right before and after the 2011 reform, we pool the data drawn from the 2010 and 2012 SHIW. This allows us to study how expected retirement age and expected replacement rate have been

[5] The datasets analyzed in the current study are available at the Bank of Italy's website.

[6] The questions on expected retirement age and expected replacement rate are asked to employed individuals only.

affected by the pension reform. We specify a reduced form for pension expectations, assuming that they are linear functions of socio-demographic characteristics. Both expected retirement age and expected replacement rate depend on the pension regime an individual belongs to. Hence, we first perform a pooled OLS regression specified as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 DB_{it} + \beta_3 Pro\text{-}rata_{it} + \beta_4 Post\text{-}reform_t + \beta_5 Post\text{-}reform_t * DB_{it} + \beta_6 Post\text{-}reform_t * Pro\text{-}rata_{it} + \varepsilon_{it}$$

where $i = \{1, \ldots, N\}$ and $t = \{2010, 2012\}$ are individual and wave identifiers, respectively. X_{it} is a set of controls for individual i in year t including gender, macro-region of residence, educational dummies, marital status, and dummies for income quartiles; ε_{it} is an idiosyncratic error term. The dummy variable *Post-reform* indicates the post-reform period and equals 1 for individuals surveyed in 2012, the first year of implementation of the reform. *Post-reform* is interacted with the pension regimes different cohorts belong to. *DB* is a dummy variable taking value 1 if the respondent's pension was calculated according to the DB rule, while *Pro-rata* refers to individuals for whom the first part of the pension is calculated with the DB formula, and the second part of the pension is instead calculated with the NDC formula.

The coefficients β_4, β_5, and β_6 measure what we are interested in, i.e., the change in pension expectations after the reform for different groups of the population. If pension expectations changed consistently with the variations imposed by the reform, we should see an increase in both expected retirement age and replacement rate. Moreover, these effects should be larger for individuals under a pure NDC pension scheme (the baseline category). Hence, through these interaction terms, we are comparing the change for the more exposed group, i.e., individuals under an NDC pension regime, with the change for the less exposed one.

Nevertheless, pension expectations may also depend on the macroeconomic scenario, as negative conditions can affect individuals' perceptions. In fact, in a period of economic downturn like the Great Recession, pension expectations may have worsened in relation to the perception of the crisis impact on future income streams (Bissonette and van Soest 2015). Since in the period we are considering individuals might be more pessimistic about their labor income and pension entitlements as a consequence, we include proxies for the crisis and its perception in the pooled OLS specification:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 DB_{it} + \beta_3 Pro\text{-}rata_{it} + \beta_4 Post\text{-}reform_t + \beta_5 Post\text{-}reform_t * DB_{it} + \beta_6 Post\text{-}reform_t * Pro\text{-}rata_{it} + \beta_7 Z_{it} + \varepsilon_{it}$$

where Z_{it} includes regional GDP growth in the following year and respondents' expected decrease in income in real terms. In fact, crisis perceptions contain private information reflecting heterogeneity in how the crisis affects households in different ways (De Bresser and van Soest 2015). Including regional GDP growth aims at

controlling for the business cycle that may have differently affected individuals' expectations.[7] While we elicit the expected decrease in real income from a survey question, data on regional GDP growth are calculated using the ISTAT database.

To overcome the potential problems with repeated cross-sections, we take advantage of the panel structure of a portion of the dataset (3414 out of 7717 observations). Through a fixed effects specification, we are able to control for individual-specific time-invariant observed and unobserved features. In particular, differently from what has been done in the literature, we try to control for a tendency of optimism or pessimism (in case of a recession), in case that is driving pension expectations. Since the economic and financial crisis started before 2010 and lasted a few years, we have reasons to believe that the pessimism related to the recession was time-invariant between 2010 and 2012. The estimated regression is specified as follows:

$$Y_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Post\text{-}reform_t + \alpha_3 Post\text{-}reform_t * DB_{it} + \alpha_4 Post\text{-}reform_t * Pro\text{-}rata_{it} + \delta_i + \varepsilon_{it}$$

where the coefficients α_2, α_3, and α_4 measure how pension expectations changed for individuals under an NDC, DB and pro-rata pension regime, and δ is an individual-specific time-invariant effect capturing observed and unobserved individual characteristics. As we did for the pooled OLS regression, also with the fixed effects estimation we include a proxy for the crisis perception and the regional GDP growth (Z_{it}):

$$Y_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Post\text{-}reform_t + \alpha_3 Post\text{-}reform_t * DB_{it} + \alpha_4 Post\text{-}reform_t * Pro\text{-}rata_{it} + \alpha_5 Z_{it} + \delta_i + \varepsilon_{it}$$

Finally, we exploit again the longitudinal sample to investigate whether the change in retirement expectations is stronger for those who have been impacted more by the pension reform. In fact, changes in the retirement age after the pension reform have been different among individuals depending on several characteristics like gender, age, years of contribution, the pension regime individuals belong to, and whether they were employees or self-employed. We therefore estimate the following fixed effects specification:

$$Y_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Post\text{-}reform_t + \gamma MRA_{it} + \alpha_3 Z_{it} + \delta_i + \varepsilon_{it}$$

where Y is the expected retirement age and *MRA* is the Minimum Retirement Age, i.e., the age of first eligibility for full retirement.[8] Following Carta and De Philippis (2021), we computed it as the minimum between the age at which an individual becomes eligible for retirement under the old age scheme and the age reached by

[7] Nevertheless, we acknowledge the possibility that individuals might have changed their expectation because of other factors we are not able to control for.

[8] In Italy individuals usually stop working as soon as they have reached the full retirement age. In fact, research has showed that the large majority of workers retire when they reach the first eligibility for full benefits (e.g., Ciani, 2016).

the individual to satisfy the seniority pension scheme requirements. Therefore, for all the individuals in the longitudinal sample interviewed in 2010, we computed both the retirement age according to the seniority pension requirements and the retirement age according to the old age pension requirements under the pre-reform rules, had they remained in place. We then took the minimum of the two in order to construct the pre-reform MRA. Next, we computed both the retirement age according to the seniority pension requirements and the retirement age according to the old age pension requirements using the post-reform rules to get the MRA for the same individuals in 2012. In this way, we constructed the actual degree of exposure to the pension reform of each individual, as the fixed effects estimation takes the difference between the MRA under the post-reform rules and the MRA under the pre-reform rules. The coefficient γ estimates potential differences in expectations among individuals that experienced different changes in the MRA because of their degree of exposure to the policy. However, in order to obtain the MRA before and after the reform, we need to make assumptions about the expected number of accrued years of contribution at the end of the working careers of the respondents. Hence, we assume that individuals in our sample will accumulate years of contribution continuously from the year of the interview onward. We acknowledge this assumption is very strong, as working careers can be fragmented.

5 Results

The dataset used in our empirical analysis, i.e., the SHIW, has a relatively large number of observations (19,836 in 2010 and 20,022 in 2012) which allow researchers to study population subgroups such as the one examined here, namely, working individuals age 20–65. Our sample includes 7717 respondents: 3872 from the 2010 wave and 3845 from year 2012. Table 1 reports the descriptive statistics by waves. The sample age appears to be slightly higher in the post-reform wave, while all the other socio-demographic characteristics such as gender, education, and marital status are very much similar in the two waves. The proportion of respondents under a DB pension scheme is lower in 2012 with respect to 2010, since new workers entering the labor market are covered by an NDC pension system, and individuals whose pension is computed according to the DB rule are retiring over time. The percentage of individuals expecting a lower income in real terms in the following year increased from 2010 to the subsequent wave. Looking at the descriptive statistics, we already notice that the average expected retirement age increased from 63.55 in year 2010 to 65.24 in year 2012,[9] while the average expected replacement rate decreased from 64.25 to 62.20.

To investigate how subjective pension expectations changed with the implementation of the pension reform, we conduct a multivariate analysis as specified in the previous section. In Table 2, we report the results for the expected retirement age. In the first column of Table 2, the coefficient on *Post-reform* is positive and strongly significant, implying that the expected retirement age for individuals under an NDC pension scheme (our baseline category) rose after the implementation of the pension

[9] This trend is consistent with the findings by Carta and De Philippis (2021).

Table 1 Descriptive statistics

	2010 SHIW (N = 3872)			2012 SHIW (N = 3845)		
	Mean	*Min*	*Max*	*Mean*	*Min*	*Max*
Age	45.97	20	65	46.52	20	65
Female	0.43	0	1	0.43	0	1
Center	0.23	0	1	0.21	0	1
South	0.28	0	1	0.30	0	1
High school	0.48	0	1	0.48	0	1
Degree	0.19	0	1	0.19	0	1
Married	0.70	0	1	0.69	0	1
DB	0.15	0	1	0.13	0	1
Pro-rata	0.48	0	1	0.49	0	1
NDC	0.37	0	1	0.38	0	1
Low expected income	0.54	0	1	0.67	0	1
GDP growth	−0.02	−0.05	0.02	−0.02	−0.08	0.01
Expected retirement age	63.55	50	100	65.24	45	90
Expected replacement rate	64.25	0	100	62.20	0	100

Data are drawn from the 2010 and 2012 SHIW

reform, even after controlling for many socio-demographics like age, geographical area, education, marital status, and income. The interactions between the post-reform dummy and the different pension schemes show that, consistently with the new legislative context, individuals under a DB pension scheme expect to retire later after the reform, but to a lower extent than workers under an NDC regime. As we would expect, respondents covered by DB and pro-rata pension schemes expect to retire earlier than individuals under an NDC pension regime. In the second column of Table 2, we include proxies for the crisis and its perception, namely, whether respondents expect a decrease in income in real terms (*Low expected income*), and GDP growth in the following year. The estimates show that our coefficients of interest remain the same as in the specification reported in the first column, and a low expected income is not statistically significant. Hence, our findings are different from Bissonette and van Soest (2015) who found a significant relation between the crisis perception and expected retirement age.

The results reported in Table 2 indicate that the direction of change in individuals' expectations concerning retirement age is consistent with the variation in the pension legislation occurred through an unexpected pension reform. Next, we investigate whether the same can be said about the direction of change in the expected replacement rate. Before looking at the estimation results of our multivariate analysis reported in Table 3, it is important to recall that under an NDC computational method, a higher retirement age contributes to the increase of individual benefits in two ways, i.e., through higher contributions and lower residual life expectancy at the moment of retirement. Hence, if individuals reacted consistently with the change in pension

Table 2 Multivariate regression model of expected retirement age

	Expected retirement age	Expected retirement age
DB	- 4.081***	- 4.084***
	(0.244)	(0.244)
Pro-rata	- 1.951***	- 1.946***
	(0.160)	(0.160)
Post-reform	1.525***	1.521***
	(0.142)	(0.144)
Post-reform*DB	- 0.432*	- 0.450*
	(0.242)	(0.242)
Post-reform*Pro-rata	0.135	0.126
	(0.181)	(0.181)
Low expected income		- 0.111
		(0.091)
GDP growth		4.991*
		(2.701)
Observations	7,717	7,717
R-squared	0.167	0.168

Data are drawn from the 2010 and 2012 SHIW. Controls included: Age, Female, North, Center, High school, Degree, Married, Second income quartile, Third income quartile, Fourth income quartile. Standard errors are adjusted for clustering at the individual level, robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01

legislation, we would observe an increase in the expected replacement rate after the reform was implemented.[10] In fact, micro-simulation studies analyzing the effects of the 2011 Italian pension reform found an increase in average replacement rates, with the largest increase among the youngest cohorts (Borella and Coda Moscarola 2015).

Yet, our results show that the expected replacement rate decreased after the pension reform for individuals under an NDC pension scheme, as indicated by the negative and statistically significant coefficient on *Post-reform*. In this case, the change in expectations is not different from individuals under diverse pension regimes, as the coefficients on the interaction terms are not different from zero. The decrease is significant even after controlling for individuals' negative perception about their income in the following year, which we use as a proxy for the crisis perception (second column of Table 3). We notice that our proxy for the crisis perception is negatively correlated with the expected replacement rate, meaning that individuals with a negative perception of their future income are also more likely to be pessimistic about their pension replacement rate. This result is in line with the literature showing that households thinking they will be affected by the crisis are more negative about their pension entitlements (De Bresser and van Soest 2015). However, using this estimation strategy, we cannot rule out the possibility that individuals' tendency to be optimistic or pessimistic (in the

[10] An increase in the retirement age for an individual under a DB pension scheme could also determine a higher replacement rate if accompanied by a higher seniority at retirement.

Table 3 Multivariate regression model of expected replacement rate

	Expected replacement rate	Expected replacement rate
DB	14.552***	14.532***
	(0.912)	(0.912)
Pro-rata	7.133***	7.185***
	(0.613)	(0.612)
Post-reform	- 1.359**	- 1.159**
	(0.543)	(0.547)
Post-reform*DB	0.563	0.502
	(0.969)	(0.971)
Post-reform*Pro-rata	- 0.829	- 0.880
	(0.701)	(0.700)
Low expected income		- 1.849***
		(0.366)
GDP growth		13.718
		(11.882)
Observations	7717	7717
R-squared	0.087	0.090

Data are drawn from the 2010 and 2012 SHIW. Controls included: Age, Female, North, Center, High school, Degree, Married, Second income quartile, Third income quartile, Fourth income quartile. Standard errors are adjusted for clustering at the individual level, robust standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01

case of a recession) can affect crisis perceptions and retirement expectations in the same way.

With a fixed effects specification, we try to control for individuals' tendency of optimism or pessimism, and confidence in future public pension provisions, which, in turn, may drive pension expectations.[11] When using a fixed effects estimation technique, our sample drops from 7717 to 3414 observations, as only a portion of respondents in the SHIW dataset are surveyed in both the 2010 and 2012 waves. Notwithstanding the reduction in our sample size, the results reported in Tables 4 and 5 confirm the previous findings from the pooled cross-section regressions. In particular, we notice that the expected retirement age increased after the pension reform and this upward trend is significant even after controlling for other factors like individuals' self-reported perception of the crisis (second column of Table 4). The coefficients on the interaction terms also confirm that individuals under a DB pension scheme expect to retire later after the reform, but to a lower extent than workers under an NDC regime. Our estimates show that, with the implementation of the pension reform, the expected retirement age increased on average by 1.8 years among workers under an NDC scheme.

Similarly, results from the pooled cross-sections concerning the expected replacement rate are confirmed by the fixed effects estimates reported in Table 5. In particular,

[11] Through the fixed effects specification, we are also able to control for individuals' expectations on their own carrier and possible spells of unemployment, had they been stable between 2010 and 2012.

Table 4 Fixed effects estimation results of expected retirement age

	Expected retirement age	Expected retirement age
Post-reform	1.836***	1.792***
	(0.175)	(0.178)
Post-reform*DB	- 0.608**	- 0.608**
	(0.297)	(0.297)
Post-reform*Pro-rata	- 0.119	- 0.115
	(0.218)	(0.218)
Low expected income		0.218
		(0.162)
GDP growth		3.607
		(5.407)
Observations	3414	3414

Data are drawn from the 2010 and 2012 SHIW. Controls included: High school, Degree, Married, Second income quartile, Third income quartile, Fourth income quartile. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01

Table 5 Fixed effects estimation results of expected replacement rate

	Expected replacement rate	Expected replacement rate
Post-reform	- 1.827***	- 1.867***
	(0.667)	(0.677)
Post-reform*DB	1.664	1.609
	(1.128)	(1.128)
Post-reform*Pro-rata	- 0.143	- 0.197
	(0.829)	(0.829)
Low expected income		- 0.453
		(0.617)
GDP growth		28.017
		(20.563)
Observations	3414	3414

Data are drawn from the 2010 and 2012 SHIW. Controls included: High school, Degree, Married, Second income quartile, Third income quartile, Fourth income quartile. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01

we find that the expected replacement rate decreased even when including fixed effects to control for time-invariant individual characteristics. Also, this decrease was not statistically different among individuals under different pension schemes. More specifically, individuals' expected replacement rate fell on average by 1.9 percentage points with the pension reform. Hence, the reform worsened workers' expectations on replacement rate, but the expected decrease is not consistent with the implication of a

Table 6 Fixed effects estimation results of expected retirement age, including the minimum retirement age

	Expected retirement age	Expected retirement age
Post-reform	1.476***	1.419***
	(0.172)	(0.176)
Minimum retirement age	0.055	0.059
	(0.039)	(0.039)
Low expected income		0.237
		(0.163)
GDP growth		3.441
		(5.406)
Observations	3414	3414

Data are drawn from the 2010 and 2012 SHIW. Controls included: High school, Degree, Married, Second income quartile, Third income quartile, Fourth income quartile. Standard errors in parentheses. *p < 0.10, **p < 0.05, ***p < 0.01

reform which tightened the age requirements in an NDC context. One explanation is that many workers are not fully aware of the functioning of an NDC pension system, in particular that postponing retirement leads to higher pensions.

Finally, we investigate whether the change in retirement expectations was stronger for those individuals who had been impacted more by the pension reform. The coefficient on MRA estimates indeed whether the actual individual level of exposure to the reform affected the change in pension expectations. However, Table 6 seems to suggest this is not the case. In fact, while the estimates confirm that individuals revised their expected retirement age upward after the implementation of the pension reform, the rise was not driven by the actual increase in the Minimum Retirement Age. This could be explained by the fact that individuals are unlikely to know the exact impact the reform had on themselves, that is the precise number of years of postponed retirement. Indeed, changes in the retirement age after the pension reform have been different among individuals depending on several characteristics like gender, age, years of contribution, the pension regime individuals belong to, and whether they were employees or self-employed. Carta and De Philippis (2021), who found that people with different exposure to the reform revised their expectations accordingly, focused on the much more restricted sample of middle-aged individuals and their partners.[12]

6 Discussion and Conclusion

In the last decades pension reforms have brought radical changes to the retirement landscape, but it is not clear whether individuals, and workers in particular, are aware

[12] More specifically, Carta and De Philippis (2021) focused on women aged between 45 and 59, with at least 10 but less than 40 accrued years of contribution, and men aged between 45 and 64, with at least 20 but less than 40 accrued years of contribution.

of the economic and financial implications of such reforms. In this paper, we study the effects of changes in pension legislation on workers' expectations on retirement age and replacement rate, by exploiting an unexpected reform introduced in Italy in 2011. In particular, we investigate whether individuals revised their expectations in the *direction* imposed by the pension reform. Using data from the 2010 and 2012 SHIW, we find that the expected retirement age increased after the reform, consistently with the variation in the pension legislation. Yet, even when controlling for individual characteristics such as pessimism during a crisis, we find that the expected replacement rate decreased after the pension reform, whose implication was instead to increase it. Indeed, if a reform increases retirement age in an NDC pension system, this translates into higher future pension benefits and replacement rates, due to both higher contributions and lower residual life expectancy at the time of retirement. A possible explanation is that many workers are not fully aware of the implications of an NDC pension regime, and in particular the mechanism according to which postponing retirement leads to higher future pension levels.

As transparent pension information is likely to affect individuals' behavior (see, among others, Duflo and Saez 2003; Dolls et al. 2018; Debets et al. 2020), it is fundamental for policymakers to adequately inform people to ensure that they understand the pension system and its reforms. Interestingly, there is evidence of demand for pension information during periods of reforms, as individuals try to gather information on the Internet. As showed by previous research, online searches about pensions in Italy showed a peak when the 2011 pension reform was introduced (Fornero et al. 2019). In this context, individual-specific pension projections provided by the public pension institution may represent a fundamental tool to help individuals secure their retirement well-being.

Funding Information is not applicable.

Declarations

Conflict of interest The author declares that she has no conflict of interest.

Data availability The datasets analyzed in the current study are available at the Bank of Italy's website, https://www.bancaditalia.it/statistiche/tematiche/indagini-famiglie-imprese/bilanci-famiglie/distribuzione-microdati/index.html.

References

Baldini M, Mazzaferro C, Onofri P (2019) Pension expectations, reforms and macroeconomic downturn in Italy. What can microdata tell us? Appl Econ 51(13):1396–1410

Berton F, Guarascio D, Ricci A (2017) Ageing and firm-sponsored training: the role of pension reforms in Italy. LABOR Working paper No. 158

Bissonette L, van Soest A (2012) The future of retirement and the pension system: how the public's expectations vary over time and across socio-economic groups. IZA J Eur Econ Studies 1(1):2

Bissonette L, van Soest A (2015) Heterogeneity in consumers' income and pension expectations. J Pension Econ Finance 14:439–465

Borella M, Coda Moscarola F (2015) The 2011 pension reform in Italy and its effects on current and future retirees. CeRP Working Paper No. 151
Bottazzi R, Jappelli T, Padula M (2006) Retirement expectations, pension reforms, and their impact on private wealth accumulation. J Public Econ 90:2187–2212
Carta F, De Philippis M (2021) Working horizon and labour supply: The effect of raising the full retirement age on middle-aged individuals. Bank of Italy Working Paper No. 1314
Chan S, Stevens AH (2008) What you don't know can't help you: pension knowledge and retirement decision-making. Rev Econ Stat 90(2):253–266
Ciani E (2016) Retirement, pension eligibility and home production. Labour Econ 38:106–120
Debets S, Prast H, Rossi M, van Soest A (2020) Pension communication, knowledge, and behaviour. J Pension Econ Finance 2020:1–20
De Bresser J, van Soest A (2015) Retirement expectations and satisfaction with retirement provisions. Rev Income Wealth 61(1):119–139
Dolls M, Doerrenberg P, Peichl A, Stichnoth H (2018) Do retirement savings increase in response to information about retirement and expected pensions? J Public Econ 158:168–179
Duflo E, Saez E (2003) The role of information and social interactions in retirement plan decisions: Evidence from a randomized experiment. Quart J Econ 118(3):815–842
Fornero E, Oggero N, Puglisi R (2019) Information and financial literacy for socially sustainable NDC pension schemes. In: Holzmann R, Palmer E, Palacios R, Sacchi S (eds) Progress and challenges of nonfinancial defined pension schemes. World Bank, Washington, DC, pp 187–216
Goda GS, Manchester CF, Sojourner A (2014) What will my account really be worth? Experimental evidence on how retirement income projections affect saving. J Public Econ 119:80–92
Liebman JB, Luttmer EF (2015) Would people behave differently if they better understood social security? Evidence from a field experiment. Am Econ J Econ Pol 7(1):275–299
Lusardi A (2015) Risk literacy. Italian Econ J 1:5–23
Lusardi A, Mitchell OS, Oggero N (2020) Debt and financial vulnerability on the verge of retirement. J Money Credit Bank 52(5):1005–1034
Mastrobuoni G (2011) The role of information for retirement behavior: evidence based on the stepwise introduction of the Social Security Statement. J Public Econ 95(7–8):913–925
Mitchell OS (1988) Worker knowledge of pension provisions. J Lab Econ 6(1):21–39