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SOCIAL SECURITY UNCERTAINTY AND DEMAND FOR RETIREMENT SAVING

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The life-cycle model predicts an association between increased demand for retirement saving and the level of expected future social security benefits. The precautionary saving model shows that the risk associated to future benefits also matters. If social security benefits become more uncertain, individuals should react by increasing their demand for retirement saving. To assess the empirical relevance of this mechanism, we relate individual level measures of social security risk to demand for retirement saving vehicles. Using the Bank of Italy Survey of Household Income and Wealth, we find higher participation in private pension funds among individuals who expect lower and more uncertain social security benefits.

JEL Codes: D12, D14, E21

Keywords: social security uncertainty, retirement saving, subjective expectations

1. Introduction

In January 2019, the newly elected Italian government passed a law reducing the retirement age for public and private employees, and the number of years of contributions for eligibility for social security benefits. This implies that worker cohorts born in the 1950s will be able to retire earlier than originally expected but will receive a smaller than expected public pension. However, it is unclear whether the new government installed in September 2019 will retain this legislation or will phase it out. This is one of many examples of how workers' retirement plans are affected by one or more sources of political uncertainty.

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Other uncertainties derive from the slow transition in Italy from an earnings to a contributions model implemented in 1995 to compute the pension benefits for later generations of workers, the numerous changes to the retirement age over the past 30 years, and the modifications to the eligibility rules that apply to men and women, or to particular groups of workers. Thus, during the working lives of many individuals the features of the social security system have changed and can change—often quite dramatically.

Predicting future benefits is difficult particularly for young workers even in the absence of social security reforms. Under the current regime in Italy, benefits depend on future contributions that, in turn, are proportional to future earnings, which are uncertain. Future benefits depend also on GDP projections and population-wide survival rates. In short, future social security benefits reflect idiosyncratic risk, aggregate risk and the political risk of legislation changes. This paper attempts to measure these sources of risk and to assess their impact on demand for retirement saving.

Our paper builds on several previous contributions. Dominitz and Manski (2006) provided a first estimate of individual social security uncertainty in the US case. Their Survey of Economic Expectations was designed to identify the subjective distribution of benefits payable to individuals in the US on retirement. Delavande and Rohwedder (2011) use the US Health and Retirement Study Internet Survey to derive systematic variation in respondents' uncertainty about their future social security benefits. They focus on individual characteristics and find that respondents with higher levels of uncertainty hold a smaller share of their wealth in stocks. In the context of Italy, Guiso *et al*. (2013) focus on uncertainty about social security replacement rates for a sample of Unicredit customers. They find that the way uncertainty varies across individuals reflects different information sets and social security schemes.

For the Netherlands, Van Santen (2019) uses the Pension Barometer module from the DNB Household Survey and finds that pension risk is associated positively to household saving. This paper is the closest to our study although there are several differences: (1) Van Santen refers to the expected pension and pension risk related to the combined replacement rate from social security and occupational pension funds (first and second pillars), whereas our focus is on the uncertainty related to social security (first pillar); (2) we define the replacement rate as the ratio of pension benefits to earnings at retirement not the current wages of employees; (3) the methods used are different; (4) we relate social security expectations (first pillar) to demand for retirement saving vehicles (second and third pillars combined), rather than pension expectations (first and second pillars combined) to total saving.

The present paper contributes to the literature on subjective expectations and increasing reliance of economists on probabilistic expectations about significant personal events (Manski, 2004).[1] We derive individual social security risk based on the responses to a large-scale, representative survey of the Italian resident

[1]Francesconi *et al*. (2019) use cross-country European SHARE (Survey of Health, Ageing and Retirement) data on subjective expectations about future pension reforms and examine how expectations about pension reforms vary with proximity to reforms and information costs. They find that the effect of information on expectations varies substantially across workers and systematically with observed characteristics which proxy for cognitive ability and information value.

population (2016 Survey of Household Income and Wealth, SHIW) and study the interaction between social security and saving targeted to retirement. The SHIW provides information on the subjective distribution of the social security replacement rate, income, wealth, portfolio allocation, and other socioeconomic variables.

The first step in our analysis relies on the subjective distribution of the social security replacement rate, and for each individual we estimate the mean and standard deviation of the distribution of the replacement rate. The average expected replacement rate is 65 percent; in line with the legislation, it is higher for public employees and lower for the self-employed. We find considerable heterogeneity in the social security risk. For instance, younger workers are more uncertain about their future social security benefits. The individual expected replacement rate and its riskiness depend crucially on the expectation of future changes in social security legislation, and, therefore, are exogenous with respect to saving decisions.

The second step tests the hypothesis that individuals who expect lower social security benefits and perceive higher risk have a greater incentive to supplement their public pension by increasing their demand for retirement saving. Both our hypotheses are supported by the empirical results. A 10 percentage points increase in the expected replacement rate is associated to a 2.5 percentage points reduction in private pension fund participation. Also, a one standard deviation increase in the standard deviation of the replacement rate distribution is associated to a 1.6 percentage points increase in participation. We find also that the results are stronger for the sample of individuals with a relatively high level of financial literacy.

The paper is organized as follows. Section 2 describes the main features of the Italian social security system and the retirement instruments available to supplement social security benefits. Section 3 presents the data and the methodology used to estimate the subjective replacement rate distribution, paying special attention to three important issues: heaping (Section 3.2), potential correlation of social security uncertainty with other beliefs about asset markets (Section 3.4). Section 4 reports the regression results, and various robustness results, in particular for non-responses of the subjective replacement rates. Section 5 concludes.

2. The Italian Pension System

In the post-second world war period, spending on social security in Italy increased steadily as a result of generous benefits and longer life-expectancy. As a result, in the early 1990s, spending had reached 16 percent of GDP, due to provision for early retirement and indexing of benefits to wages in the years before retirement (5 years for private sector employees, 10 years for self-employed, and 1 year for public employees).

These unsustainable trends triggered reforms in 1992 and 1995, which had several effects. For those who entered the labor market after 1995, the reforms linked benefits to contributions rather than to earnings, increased the minimum retirement age, and indexed pensions to the cost of living rather than to wages.[2]

[2]In the contributions model, yearly contributions are capitalized according to a 5-year moving average of GDP growth. Contributions are transformed into benefits by applying a formula that depends on retirement age and population-wide life expectancy; see Bottazzi *et al*. (2006) for more details.

These reforms kept in place the first pillar of the system—the *pay-as-you-go* social security system but tried also via tax incentives to promote participation in occupational pension funds (second pillar) and individual pension plans (third pillar).[3] A 2000 law introduced the ETT regime,[4] exempting contributions up to 5,146 euro for collective and individual pension funds and giving preferential taxation on returns and benefits. A further reform in 2005 introduced a more homogeneous regulatory framework for the different pension funds, and de facto eliminated the distinction between occupational and individual funds.

By end 2019, 8.3 million individuals were enrolled in one or more second and third pillar schemes. Currently, these schemes involve the management of 185 billion euro of assets, and collection of 16 billion euro of contributions annually. Unlike the situation in many other countries, enrollment in and contribution to an occupational fund are not mandatory in Italy. Newly hired workers are enrolled automatically into an occupational fund but can withdraw after 6 months. Those who remain enrolled contribute to the fund 7 percent of their gross annual earnings (the TFR contribution). Employers can match contributions according to the limits set by contractual agreements. Individual pension schemes (the third pillar) are market products managed by banks or insurance companies. Private sector employees can channel their TFR to these pension funds, and employers can (and sometimes do) contribute also.

With the exclusion of a few pension funds established before 1993, all current pension funds operate according to a defined contributions model: the benefits depend on the contribution history, market returns, and costs. Typically, these funds offer multiple investment lines with different exposures to equity market risk. After 2 years of enrollment in a fund, workers can switch among investment lines at no cost. Although there are some differences, in practice occupational and individual pension funds are quite similar, and both operate under the same fiscal rules and regulatory framework.[5] Therefore, in our empirical analysis we do not distinguish between them.

3. The Subjective Distribution of Replacement Rates

Previous research adopts several approaches to estimate the subjective social security risk. Dominitz and Manski (2006) designed a set of questions in the Survey of Economic Expectations to elicit the minimum and maximum, and six intermediate points of the subjective probability distribution of pension benefits. Based on this distribution, they calculated measures of individual uncertainty, and show that both younger and older respondents are more uncertain about future social security benefits. They note also that younger individuals are concerned about the persistence of the social security system.

[3]In the 1990s, only financial sector employees and white-collar workers in large companies had access to an occupational pension fund.

[4]Exemption of contributions, and taxation of accrued interest and benefits.

[5]Occupational funds tend to be less expensive than individual plans and are not available to self-employed workers.

Delavande and Rohwedder (2011) study the relation between individual uncertainty about future social security benefits and households' portfolio choices in the US. They use an innovative visual format in the US Health and Retirement Study Internet Survey. Like Dominitz and Manski (2006), they find that younger respondents report greater uncertainty, and that uncertainty is associated to a smaller share of wealth invested in stocks. Van Santen *et al*. (2012) focus on the subjective distribution of the replacement rate distribution in the Netherlands. The major finding from their study is that one in three respondents is unable to provide probabilities satisfying the requirements of a cumulative distribution function.

Guiso *et al*. (2013) rely on the 2006 Unicredit Customer Survey of a representative sample of Unicredit customers. To elicit the subjective distribution, they use a simple method based on the minimum, maximum, and one point in the distribution of social security replacement rates. Based on the assumption of a uniform or triangular distribution, they calculate the mean and standard deviations of the individual distributions. They find that younger individuals are more uncertain about the social security replacement rate, and that those facing higher income risk and more uncertain future contributions are more uncertain also about their future benefits. Van Santen (2019) based on the Pension Barometer module in the Dutch DNB Household Survey focuses on the combined replacement rate from social security and an occupational pension fund. He defines the replacement rate as the ratio of expected total pension to current earnings and uses probabilistic survey questions of the type suggested by Dominitz and Manski (2006). He finds that pension risk is positively associated to the level of saving and the saving rate. Since people can choose a particular pension fund, the pension risk from occupational funds is potentially endogenous, hence the study uses an instrumental variables approach.

The present paper complements previous work by employing recent data derived from the SHIW—a representative biannual survey of the Italian population. In 2016, the SHIW surveyed 7,421 households and provides detailed information on demographic characteristics, income, consumption, wealth (broken down into real assets and various asset and debt components), and portfolio decisions including the choice to invest in a pension fund. In 2016, the SHIW for the first time included questions on the subjective distribution of future replacement rates.

To elicit the minimum (y_m) and maximum (y_M) values of the replacement rate, the SHIW relies on two questions posed to all workers (employees, self-employed, managers, and professionals):

> *Think about when you will retire, and consider only the public pension (i.e. exclude any contractual pension fund or private pension, if you have one)*
>
> *(a) At the time of retirement, what is the minimum fraction of labor income that you expect to receive as public pension? (y_m)*
>
> *(b) And what is the maximum value? (y_M)*

From the total number of workers (5,361), we dropped 164 respondents aged over 65 years, and 1,946 observations with missing values for y_m, y_M, or both variables.[6] This left an estimation sample of 3,249 observations, 61 percent of the total number of workers. The fraction of non-missing values of y_m and y_M is in line with the 66 percent value in Dominitz and Manski (2006) but much lower than the 97 percent of usable responses in Delavande and Rohwedder (2011).[7] In no case did respondents provide inconsistent answers ($y_m > y_M$), while 6.7 percent of the sample reported point expectations ($y_m = y_M$).

To estimate the replacement rate distribution, we rely on the methods used in Guiso *et al*. (2002) and Guiso *et al*. (2013), respectively, who estimate subjective income risk and social security risks in the Unicredit Household Survey. We assume that the subjective distribution of the replacement rate at retirement is either uniform or triangular. The mean and standard deviation of the individual distribution can be computed based on the observed values of y_m and y_M. By construction, the two distributions have the same mean, but the standard deviation is lower for the triangular distribution.[8]

3.1. *The Cross-Sectional Distributions*

Figure 1 plots the cross-sectional distribution of the minimum, maximum, and mean of the replacement rate subjective distributions, and Table 1 reports the sample statistics. The upper left-graph shows that for 60 percent of the sample, the minimum is between 50 percent and 70 percent, a realistic interval given current pension rules. About 8 percent of respondents expect a minimum replacement rate lower than 30 percent, while 10 percent of the workers in our sample expect a minimum replacement rate over 85 percent.

This optimistic portion of the sample appears also in the distribution of the maximum replacement rate plotted in the upper right-graph: 10 percent of respondents report a maximum replacement rate above 95 percent. The lower right-graph plots the cross-sectional distribution of the expected replacement rate, that is, the mid-point between the maximum and minimum. The average is 66 percent, and most observations are concentrated within the 40–80 percent range. The cross-sectional average of the expected replacement rate is also quite close to the value estimated by Guiso *et al*. (2013) in the case of the Unicredit Household Survey, a different (and much smaller) sample of 940 observations.

The reliability of the individual replacement rate distributions can be confirmed based on the responses to the following question in the SHIW: *Think about when you will retire, and consider only the public pension (i.e. exclude any*

[6]Notice that the questions on y_m and y_M are not asked to family members that are absent during the interview and that, differently from other questions, present members cannot act as proxy respondents.

[7]In an internet survey, Delavande and Rohwedder (2011) compare a visual and a percentage chance format and find that the response rate is considerably higher in the visual format. Our response rate is high (63 percent) but is not directly comparable to previous studies given the different sample characteristics, elicitation method, and survey design (internet v.s. face-to-face interviews).

[8]Van Santen (2019) uses a more elaborate strategy to elicit the moments of the subjective replacement rate distribution. The respondents are asked to indicate among 7 points along a subjective cumulative distribution function of the pension income. The complete distribution for each respondent is obtained using linear interpolation between thresholds.

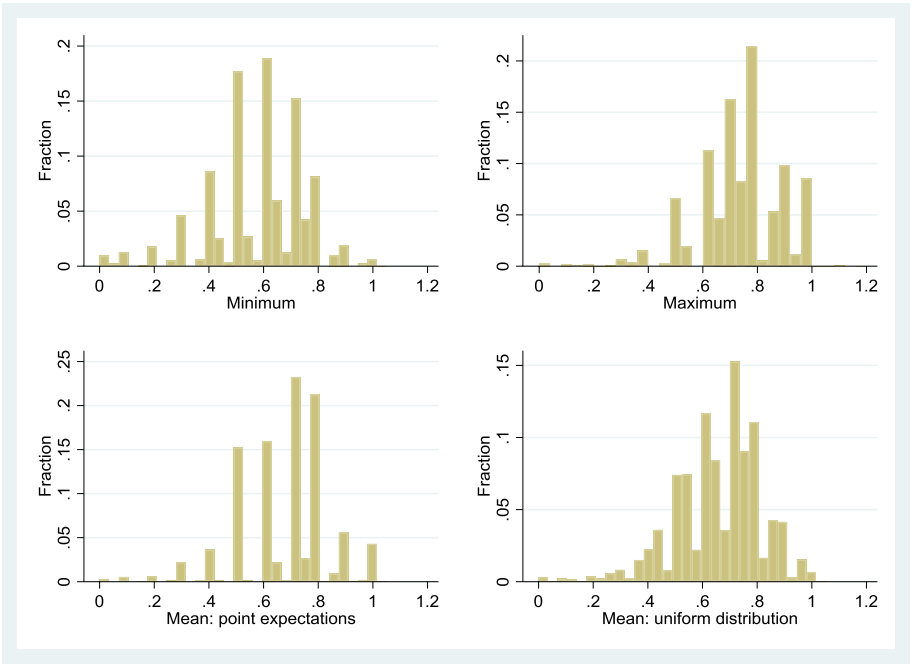

Figure 1. The Distribution of the Subjective Replacement Rate

Note: The figure plots the cross-sectional distribution of the replacement rate subjective minimum (upper left panel), maximum (upper right panel), and mean (lower panels). In the lower left-graph the mean is the point expectation. In the lower right-graph the mean is the midpoint of the minimum and the maximum subjective replacement rate. Bins are defined as (0–4, 5–9, 10–14, … up to 120). [Colour figure can be viewed at wileyonlinelibrary.com]

contractual pension fund or private pension, if you have one). What is the fraction of labor income that you expect to receive as public pension? We refer to this question as the "point expectation estimate" of the mean of the replacement rate distribution. Figure 2 compares the two distributions by plotting their quantiles in a Q-Q plot. Specifically, the set of quantiles is plotted from the cross-sectional distribution of the mean in the format "point expectation estimate" (vertical axis) against the set of quantiles from the mean computed as the mid-point of the expected maximum and minimum replacement rate (horizontal axis). The observations line up along the x = y line, and show that the two distributions are similar. Overall, the cross-sectional averages of the expected replacement rate computed using the point expectation estimate (lower left-graph in Figure 1) and the min-max elicitation method (lower right-graph) are very similar (66 percent against 67 percent). This supports our assumption that the individual distributions are symmetric around the mean.

The dispersion of the subjective replacement rate distribution is a summary indicator of social security risk. Figure 3 plots the cross-sectional distribution of the individual standard deviations and coefficient of variations. The dispersion of the replacement rate distribution depends on the assumptions about the underlying distribution.

TABLE 1
THE REPLACEMENT RATE DISTRIBUTION

	Mean	Standard Deviation
Minimum expected replacement rate	0.574	0.175
Maximum expected replacement rate	0.738	0.159
Expected value of the replacement rate	0.656	0.155
Expected replacement rate (point estimate)	0.671	0.167
Standard deviation		
Uniform distribution	0.047	0.036
Triangular distribution	0.033	0.026
Coefficient of variation		
Uniform distribution	0.080	0.077
Triangular distribution	0.057	0.054
Number of observations	3,249	

Note: Statistics are computed on the estimation sample.

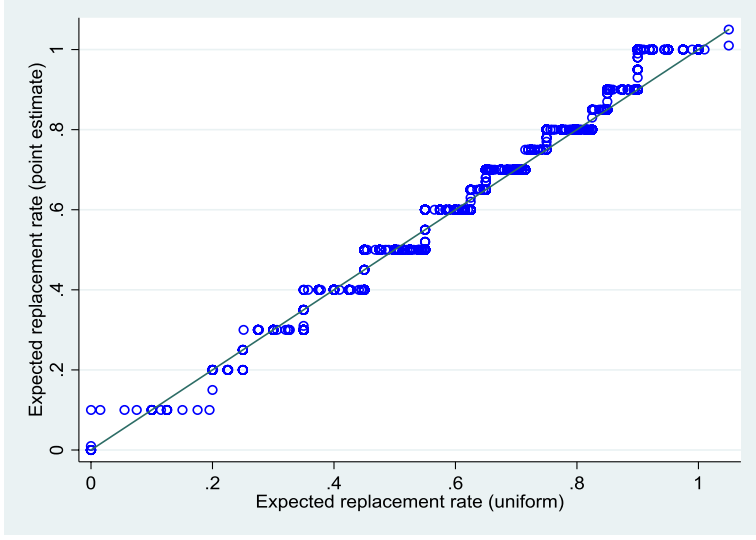

Figure 2. Quantile-Quantile Plot

Note: The figure shows the Q-Q scatter plot created by plotting the set of quantiles from the cross-sectional distribution of the mean in the formats of point expectation estimate (vertical axis), against the set of quantiles from the mean computed as the mid-point of the expected maximum and minimum expected replacement rate distribution (horizontal axis). [Colour figure can be viewed at wileyonlinelibrary.com]

Table 1 shows an average standard deviation of 4.7 percent assuming that the individual distributions are uniform, and 3.3 percent assuming that they are triangular. These values are higher than the estimates obtained based on the Unicredit Survey (2.5 percent and 1.8 percent, respectively), due possibly, to the different sample period and the increased uncertainty about the sustainability of the system after the Great Recession.

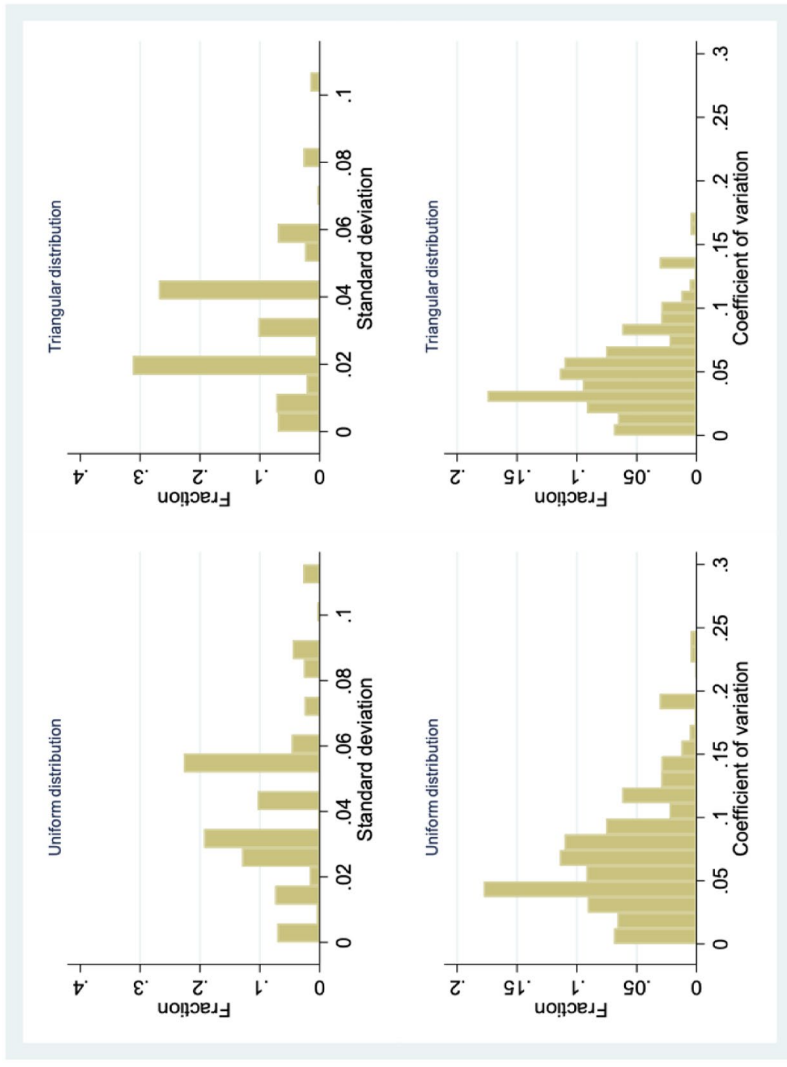

Figure 3. Subjective Replacement Rate Standard Deviation and Coefficient of Variation

Note: The figures plot the cross-sectional distribution of the replacement rate subjective standard deviation (upper panels) and coefficient of variations (lower panels). Left panels assume that the subjective replacement rate distribution is uniform, right panels that it is triangular. [Colour figure can be viewed at wileyonlinelibrary.com]

3.2. *Heaping and Rounding*

A recurring issue in the literature on subjective expectations is that individual answers tend to heap around certain values. This might be the result of rounding, which might complicate the analysis because people do not necessarily round at the same level, because some people might round at multiples of ten or five, while others might focus on extreme values like 0, 50, 100. A related issue is that values like "50" might reflect a form of ignorance or interpreted as a symptom of the respondent's uncertainty (Bruine de Bruin *et al*., 2002). Giustinelli *et al*. (2020) show that rounding and heaping are associated with observable respondent characteristics, such as personal finances, health, and macroeconomic events.

To investigate the amount of heaping, we report in Table B3 of the Appendix narrow intervals of the distribution of the expected minimum and maximum replacement rates. As it is also apparent from Figure 1, the highest frequency for the minimum expected replacement rate is 60 percent (provided by 18.8 percent of respondents), while the highest frequency for the maximum expected replacement rate is 80 percent (provided by 21 percent of sample). These two values deserve, therefore, special attention. The pension regime introduced in 1995 was designed for a target replacement rate of 70 percent, equivalent to a working career of 35 years in the old, earnings-related regime (when the pension accrual formula was simply 2 percent times years of contributions times an average of the last salaries). Thus, a 60–80 range for the min-max expected replacement rate is a good benchmark forecast for many workers. We take this as an indication of good understanding of the survey question on the part of respondents.[9]

To dig deeper in this issue, we do three types of calculations: (i) we report statistics on heaping for our variables of interest and for other questions of the survey that ask respondents to report values in percentages; (ii) we check if rounding is correlated with households' characteristics; (iii) we check if our results change when we consider explicitly rounding errors in estimating the expected replacement rate and the standard deviation of the replacement rate.

Concerning the first point, following the analysis of Manski and Molinari (2010), we report the item non-response rate, the fraction of those who respond with values less than 50 percent, equal to 50 percent, and greater than 50 percent (see Appendix, Table B4). We find that people tend to report values in multiples of 10 or 5, particularly for the maximum replacement rate (only 15 percent do not round in 5).

We also examine other questions in the survey that ask to express a value as a percentage, and focus on the expected replacement rate (the point value), the set of questions about the percentage that respondents assign to the home value

[9]There are 7 values of the maximum expected replacement rate and 2 values of the minimum expected replacement rate higher than 100 percent (see Appendix, Table B3). These are not necessarily inconsistent values, because in the past some workers were entitled to very generous pension schemes, and some still are (for instance, pilots and flight crews, and some categories of politicians). Notice that only for the 2 observations with the minimum greater than 100 percent, the expected replacement rate exceeds 1. More problematic are some very low values (9 percent report a minimum replacement rate of less than 30 percent), that are likely to reflect lack of confidence in the social security system. But it should also be noticed that only 2 percent of the sample expects a maximum replacement rate of less than 30 percent.

changes ("decrease by over 5 percent," "decrease between 2 and 5 percent," "fluctuate between −2 and 2 percent," "increase between 2 and 5 percent," "increase by over 5 percent"), and to a question about the percentage that people would save from a tax refund equal to 1 month of income. The wording of these questions is reported in Appendix A. In each of these questions, the tendency to round in 10 or 5 is greater than in the min/max expected replacement rate questions.

Concerning the second point, we estimate probit regressions for the probability of reporting M5 and M10 for the minimum replacement rate, the maximum replacement rate, the percentage saved of a refund, and the probability of nonresponse for the minimum and the maximum replacement rates (see Appendix, Table B5). We find that there is no significant evidence of systematic rounding according to age and education. There is a tendency to round in M5 and M10 for people in the top income quartile for the minimum, but not for the maximum.

Concerning the third point, following Heitjan and Rubin (1990), we draw sets of the true minimum and maximum replacement rates independently and uniformly from the heaping intervals defined by the reported minimum and maximum replacement rates[10]:

$$[x-k, x+k]$$

where x is the minimum (maximum) reported replacement rate and:

$$k = \begin{cases} 2.5 \text{ if } mod\ (x, 10) = 5 \\ 5 \text{ if } mod\ (x, 10) = 0 \end{cases}$$

In Figure B1 of the Appendix we plot the imputed minimum and maximum of the replacement rate distribution, which, by construction, are less spiky compared to the histograms of the reported minimum and maximum replacement rates. In Section 4.2 we report regressions for the demand for retirement saving replacing the reported values of replacement rates with these imputed values.

3.3. *Descriptive Statistics*

Another way to assess the validity of the subjective distributions of the replacement rates is to check whether they vary in a way that is consistent with expectations a priori, given different information sets and pension schemes. First, the subjective distributions are in line with the expectations of different employment groups based on the legislation. The expected replacement rate is lower for professionals and self-employed (59 percent) than for private employees (66 percent) and public employees (71 percent). The first group will receive lower pensions because of their lower contribution rates. Professionals and self-employed perceive more risk (5 percent standard deviation against 4 percent for private employees and public employees) which is in line with their higher income volatility.

Expectations differ also by age group. Figure 4 plots the relation between age (grouped in 10 equal-sized bins), and the mean, standard deviation, and coefficient

[10]Notice that we assume that the lower and upper bounds of the heaping intervals are symmetric around the reported replacement rate, as in Manski and Molinari (2010).

of variation of the replacement rate distributions. Younger workers (30 years or less) expect a replacement rate of about 63 percent, much lower than the 70 percent replacement rate expected by older workers (60+). The age-difference reflects current social security legislation, which grants more generous benefits to older cohorts. For those who entered the labor market before 1995 benefits will generally be computed using a favorable earnings-related formula, while the benefits for younger cohorts will be proportional to their contributions.

The age-profiles of the standard deviation (upper right panel of Figure 4) and the coefficient of variation (lower panel of Figure 4) are negative. For instance, the coefficient of variation is 8 percent for 30-year-old respondents and 6 percent for older workers (60+). This reflects the fact that younger workers perceive more risk than workers close to retirement.

The upper left-graph in Figure 5 depicts a positive correlation between log earnings and expected replacement rates except at high levels of earnings. The other two graphs in Figure 5 show a negative correlation between earnings and social security risk. This might be because higher earnings tend also to show more volatility, and, therefore, will be associated to more unpredictable contributions to the social security system.

Table 2 reports the sample statistics for the variables in the empirical analysis, comparing the estimation sample (3,249 observations) with the sample of

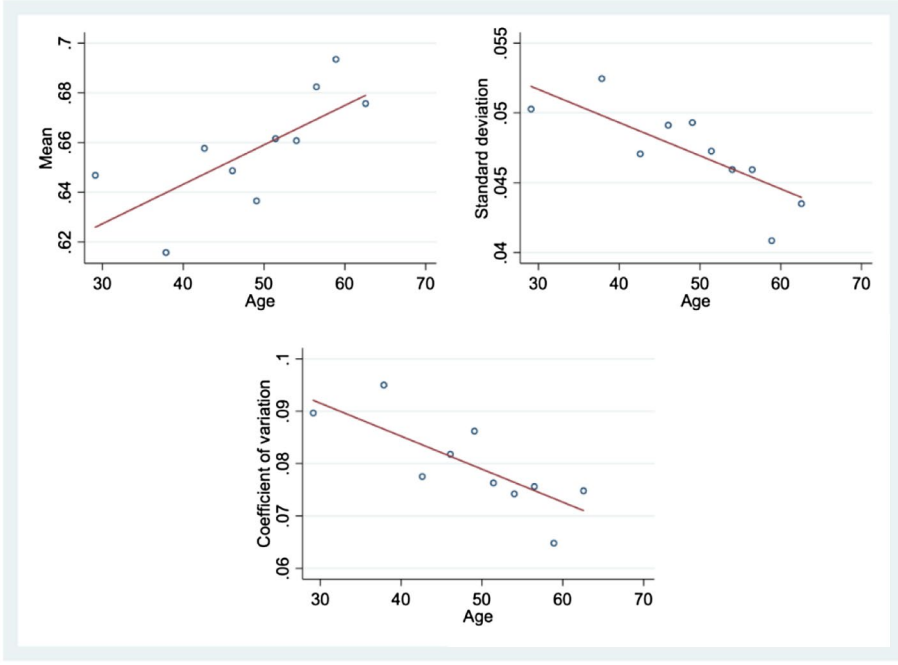

Figure 4. The Relation Between Age and the Replacement Rate Distribution

Note: The figures plot the replacement rate subjective mean (upper left panel), standard deviation (upper right panel) and coefficient of variations (lower left panel) against the age of the respondents. The figures assume that the subjective replacement rate distribution is uniform. [Colour figure can be viewed at wileyonlinelibrary.com]

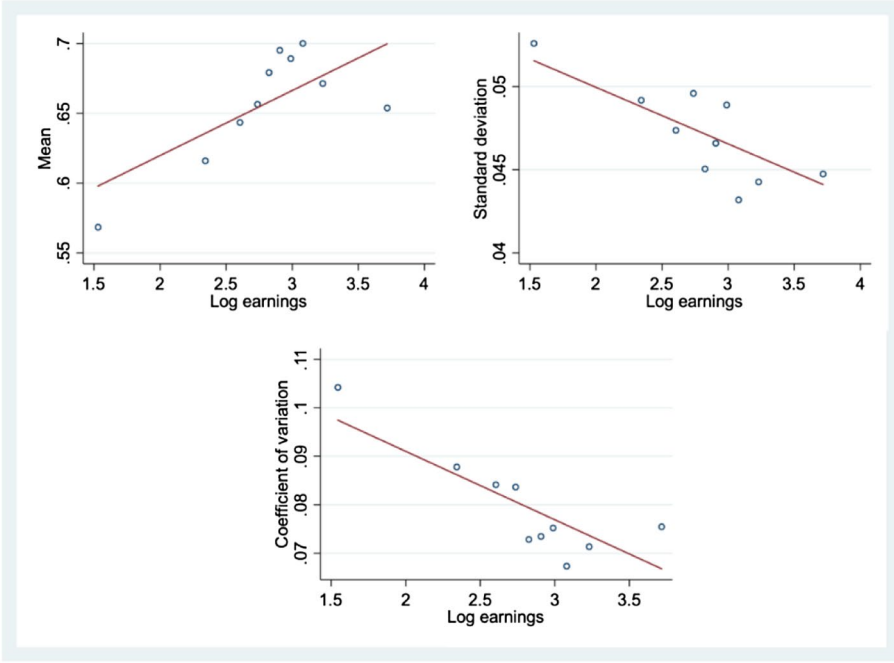

Figure 5. The Relation Between Earnings and the Replacement Rate Distribution
Note: The figures plot the replacement rate subjective mean (upper left panel), standard deviation (upper right panel) and coefficient of variations (lower left panel) against the log earnings of the respondents. The figures assume that the subjective replacement rate distribution is uniform. [Colour figure can be viewed at wileyonlinelibrary.com]

non-respondents (1,946 observations) and the full sample (5,195 observations).[11] In terms of education, the percentage of those who attended elementary and/or junior high school is 42 percent among respondents and 40 percent among non-respondents. The fraction of those who attended high school is the same in the two groups (38 percent), while 19 percent completed college among respondents (21 percent among non-respondents). The proportion of public employees is slightly higher among respondents. The sample of non-respondents has also a slight prevalence of males (59 percent against 56 percent), workers employed in small firms, and residents in the South. Most workers are employed in firms with less than 15 employees (45 percent), and only 30 percent are employed in firms with more than 100 employees.

The most notable differences between the full and the estimation sample are that respondents are older (48 against 42 years) and more likely to be married (59 against 53 percent). The sample of respondents has also higher earnings, but lower real and financial assets. To gauge the potential impact of sample biased, we relate the probability of this item non-response to income and a full set of demographic variables (see Appendix, Table B5, column 7). We find that older individuals with

[11]In most cases, the reasons for non-responses to the replacement rate questions is that the information is available only for family members who are present at the interview.

TABLE 2
Sample Statistics

	Respondents		Non Respondents		Full Sample	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
	(1)	(2)	(3)	(4)	(5)	(6)
Pension funds participation	0.185	0.388	0.106	0.308	0.155	0.362
Earnings	19.03	15.560	16.35	9.456	18.03	13.66
Financial assets	28.59	115.13	34.51	161.7	30.81	134.5
Real assets	211.7	331.94	256.5	334.5	228.5	333.6
Elementary and junior high school	0.425	0.494	0.400	0.490	0.416	0.493
High school	0.383	0.486	0.385	0.487	0.384	0.486
College	0.191	0.393	0.215	0.411	0.200	0.400
Financial literacy	0.692	0.462	0.681	0.466	0.688	0.463
Age	48.33	9.755	42.31	12.37	46.08	11.20
Male	0.563	0.496	0.595	0.491	0.575	0.494
Married	0.590	0.492	0.527	0.499	0.567	0.496
Agriculture	0.050	0.218	0.045	0.207	0.048	0.214
Industry	0.370	0.483	0.411	0.492	0.385	0.487
Finance and real estate	0.041	0.198	0.033	0.180	0.038	0.191
Public sector	0.155	0.362	0.140	0.347	0.150	0.357
Services	0.384	0.486	0.371	0.483	0.379	0.485
N. workers < 5	0.280	0.449	0.285	0.452	0.282	0.450
N. workers < 5–15	0.173	0.378	0.195	0.396	0.181	0.385
N. workers < 16–99	0.227	0.419	0.238	0.426	0.232	0.422
N. workers> 99	0.317	0.465	0.279	0.449	0.303	0.460
North	0.482	0.500	0.445	0.497	0.468	0.499
Center	0.226	0.418	0.225	0.418	0.225	0.418
South	0.293	0.455	0.330	0.470	0.307	0.461
Expected retirement age	66.48	4.195			66.48	4.195
Number of observations	3,249		1,946		5,195	

Note: Sample statistics in columns (1–2) and (3–4) are computed on the sub-samples of respondents and non-respondents, respectively. Statistics in columns (5–6) are computed on the full sample of working individuals.

high income and a college degree are more likely to report the min/max of the replacement rate expectations. To make sure that sample selection does not bias our results, in Section 4.2 we impute missing values in the sample of non-responses.

Our main outcome variable is participation in a pension fund. Given the characteristics of the pension funds and their similar regulation, we do not distinguish between occupational and individual funds. Overall, 18 percent of employees contribute to at least one pension fund but there is considerable heterogeneity across employment groups. Participation is higher in the private sector (20 percent) and for workers employed in relatively large firms (28 percent), and highest for financial sectors employees (40 percent). Overall, comparison between the two samples suggests that selection in terms of socioeconomic variables is unlikely to be a major issue in the empirical estimates.

3.4. *Potential Correlation of Social Security Risk With Other Beliefs*

The heterogeneity in the subjective distributions of replacement rates provides the basis for estimating the relation between the demand for retirement saving and

social security expectations. Notice that there are two possible effects biasing this relation. Both arise from the potential correlation between perceived social security risk and beliefs about financial market risk. On the one hand, it is possible that those who perceive higher social security risk, are pessimists who perceive also higher risk in private financial markets or in the real estate market. This correlation would induce a negative bias (an attenuation effect) in the relation between social security risk and the demand for private pension funds. On the other hand, those that have low confidence in social security might have higher confidence in private asset markets, raising their demand for private pension funds, and biasing our estimates in the opposite direction.

In principle, the potential correlation of social security risk with other beliefs and household traits can be addressed using a quasi-experiment approach. For instance, Giavazzi and McMahon (2012) use German microdata and relate the increase in perceived economic uncertainty before the 1998 general elections to saving and labor supply decisions. Using a difference-in-difference approach, and civil servants as control group, they find that households that perceived more uncertainty saved and worked more. The saving result is particularly interesting in our context, because the saving response was likely to be associated with the possibility that Schröder might win the 1998 election and the social security system returned to an unsustainable path.

Since our measure of social security risk is available only in a single cross-section, the quasi-experimental approach is not feasible in our case. However, we can use additional information to shed some light on the potential bias arising from the possible correlation of social security risk and other asset risks. The 2016 SHIW has data on the distribution of expected house price changes. In particular, SHIW respondents distribute 100 points into 5 categories of expected house price changes (decrease by over 5 percent; decrease between 5 and 2 percent; fluctuate between −2 percent and +2 percent; increase between 2 and 5 percent; increase by over 5 percent).[12]

Having obtained the first two moments of the expected house price distribution, we correlate them with the first two moments of the distribution of replacement rates. The correlation matrix (reported in Table B1 of the Appendix) shows that the expected values of the two distributions are negatively correlated, but the standard deviations are positively correlated. To the extent that house price risk is correlated with other asset risks (including private pension funds), the effect of social security risk on the demand for retirement saving could be underestimated. In Section 4.2, we explore the robustness of our results introducing house price expectations as additional controls in the baseline regression, but still we assume that social security expectations reflect only to the risk arising from social security, and that this risk is independent from other individuals' decisions. Of course, the validity of our results rests on this assumption.

[12]As reported in Appendix A, in the SHIW the question is asked in two slightly different formats in two subsamples (called "rotations 1 and 2"). We combine the two formats into a single indicator and construct, for each respondent, the expected house price change and the standard deviation of house price changes.

4. The Demand for Retirement Saving

People who expect low social security benefits can supplement their retirement income by increasing their current saving. The link between social security and private wealth accumulation has received much attention since Feldstein's (1974) seminal work on an extended life-cycle model in the presence of a social security system.

The data on the subjective distribution of future replacement rates allow us to focus on a relevant but unexplored question related to whether uncertainty about future replacement rates (social security risk) is associated to retirement saving, over and above any effect that the expected replacement rate might may have.

Under certainty equivalence, risk should not affect saving, and investment in a private pension fund (the main vehicle for retirement saving) should be negatively associated to the expected replacement rate but not to the social security risk. However, if people engage in precautionary saving, an increase in the riskiness of future resources should prompt higher saving. Of course, wealth is fungible so the increased saving can take many forms. The specific channel we test in this paper is whether social security risk is negatively associated to demand for contractual and individual pension funds, that is, the main retirement saving vehicles.

Figure 6 plots the correlation of pension fund participation to the expected value, the standard deviation, and the coefficient of variation of the individual

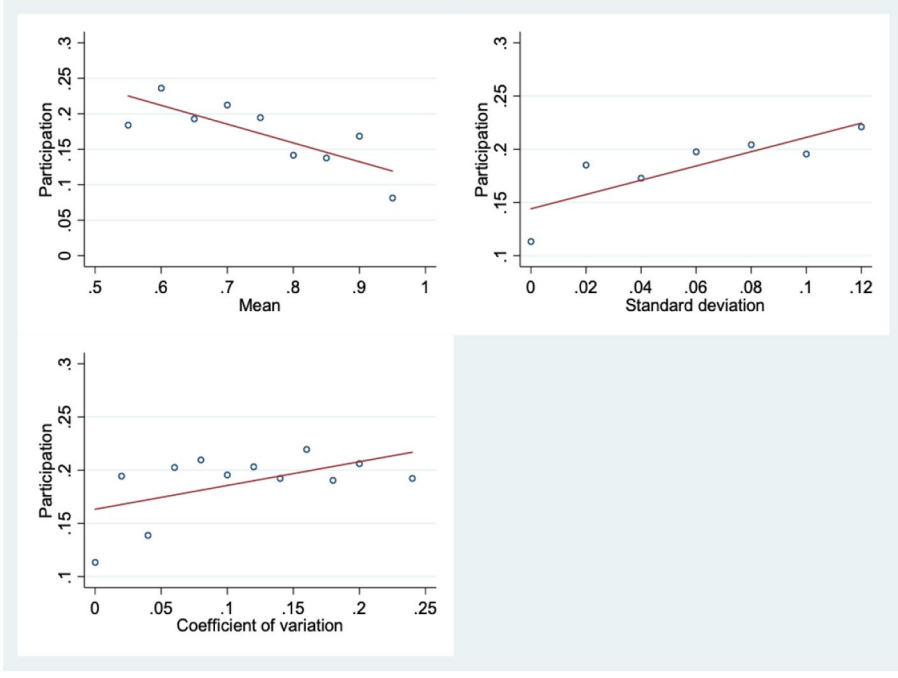

Figure 6. The Relation Between Pension Funds Participation and the Replacement Rate Distribution

Note: The figures plot participation in pension funds against the replacement rate subjective mean (upper left panel), standard deviation (upper right panel) and coefficient of variations (lower left panel). The figures assume that the subjective replacement rate distribution is uniform. [Colour figure can be viewed at wileyonlinelibrary.com]

replacement rate distributions. It suggests that pension fund participation is positively associated to the expected replacement rate and that social security risk (measured as the standard deviation or the coefficient of variation of the replacement rate distribution) is positively associated to pension fund participation. This is consistent with a precautionary saving motive and our regression analysis below confirms the descriptive evidence.

4.1. *Baseline Estimates*

We relate the probability of pension fund enrollment to the mean and standard deviation (or coefficient of variation) of the replacement rate distribution. In the baseline specification we control for the expected replacement rate and several socioeconomic characteristics (earnings, education, age, gender, and marital status).

Table 3 reports the marginal effects and the associated standard errors of the coefficients of the baseline specification. In the first column, we assume that the individual distributions of the replacement rate are uniform; in column 2, we assume that they are triangular. In line with our expectations and the descriptive evidence,

TABLE 3
Pension Funds Participation, Baseline Specification

	Uniform Distribution	Triangular Distribution
Expected replacement rate	−0.157	−0.157
	(0.045)***	(0.045)***
Standard deviation	0.450	0.636
	(0.183)**	(0.259)**
Expected retirement age	−0.004	−0.004
	(0.002)**	(0.002)**
II income quartile	0.043	0.043
	(0.025)*	(0.025)*
III income quartile	0.124	0.124
	(0.027)***	(0.027)***
IV income quartile	0.235	0.235
	(0.028)***	(0.028)***
High school	0.029	0.029
	(0.016)*	(0.016)*
College	0.038	0.038
	(0.021)*	(0.021)*
Age 36–45	0.075	0.075
	(0.031)**	(0.031)**
Age 46–55	0.104	0.104
	(0.028)***	(0.028)***
Age > 55	0.059	0.059
	(0.031)*	(0.031)*
Male	−0.007	−0.007
	(0.014)	(0.014)
Married	−0.017	−0.017
	(0.015)	(0.015)
N	3,249	3,249

Note: The table reports average marginal effects and the associated standard errors in parenthesis for an estimated probit model, where the dependent variable is a dummy equal to one if the individual contributes to at least one pension plan. *** indicate statistical significance at the 1% confidential level, ** statistical significance at the 5% level, * statistical significance at the 10% level. Standard errors are clustered at household level.

the coefficient of the expected replacement rate is negative, and the coefficient of the standard deviation is positive. Both coefficients are statistically different from zero, regardless of the distribution considered, and are economically important.

A 10 percentage points increase in the expected replacement rate is associated to a 2.5 percentage points reduction in the probability of pension fund participation. Furthermore, a one standard deviation increase in the standard deviation of the replacement rate distribution is associated to a 1.6 percentage points increase in participation. Thus, the heterogeneity of social security risk is an important driver of the demand for private pensions, and is at least as important as the offset effect, the focus of earlier studies.

The probit regressions show that pension fund participation peaks in the 46–55 age group and is positively correlated with education. Participation increases across the income distribution and is negatively related to the expected retirement age. There is no evidence of different participation by gender or marital status.

4.2. *Robustness Checks*

In the rest of this section, we explore the robustness of the results when controlling for additional variables that might affect the demand for retirement saving, and considering heaping and non-responses of the replacement rate distribution. Table 4 adds sector and regional dummies to the baseline specification. The results show that participation in pension funds is higher among financial sector and real estate sector employees, and lowest among public employees. There are no significant differences in participation associated to the regional dummies. In this extended specification the size, precision, and economic significance of the

TABLE 4
Pension Funds Participation, Controlling for Sector and Regional Effects

	Uniform Distribution	Triangular Distribution
Expected replacement rate	−0.145	−0.145
	(0.046)***	(0.046)***
Standard deviation	0.523	0.739
	(0.184)***	(0.260)***
Agriculture	−0.033	−0.033
	(0.037)	(0.037)
Industry	0.042	0.042
	(0.017)**	(0.017)**
Finance and real estate	0.135	0.135
	(0.042)***	(0.042)***
Public sector	−0.017	−0.017
	(0.021)	(0.021)
Center	0.000	0.000
	(0.017)	(0.017)
South	−0.008	−0.008
	(0.017)	(0.017)
N	3,249	3,249

Note: The table reports average marginal effects and the associated standard errors in parenthesis for an estimated probit model, where the dependent variable is a dummy equal to one if the individual contributes to at least one pension plan. The set of controls also includes sector and regional dummies, in addition to the socioeconomic characteristics included in the baseline regression (Table 3). *** indicate statistical significance at the 1% confidential level, ** statistical significance at the 5% level, * statistical significance at the 10% level. Standard errors are clustered at household level.

expected replacement rate and the standard deviation of the replacement rate distribution are not affected.

The household finance literature suggests that risk averse individuals tend to invest in bonds and savings accounts which usually offer lower returns (Munnell *et al*., 2001), and that risk aversion decreases with wealth (Guiso and Paiella, 2008). Financial wealth is associated also to a more diversified portfolio, and a possibly higher propensity to invest in a pension fund. To control for these effects, Table 5 extends the baseline specification by including quartile dummies for financial and real wealth. The results show that the propensity to invest in a pension fund is associated positively to both forms of wealth. Participation is 9 percentage points higher for the upper quartile of the financial wealth distribution, and 5.5 percentage points higher for the upper quartile of the real wealth distribution relative to the lowest quartiles. Also, in this specification, the effects of the expected replacement rate and the standard deviation are still statistically different from zero and of a similar magnitude to the baseline specification.

Table 6 provides evidence of a positive association between pension fund participation and firm size. Unions and employers' associations are more active in large firms and promote engagement in an occupational pension fund. Moreover, in small firms (less than 50 employees) severance pay tends to persist rather than participation in a pension plan.

Financial literacy is associated to workers' ability to process information and plan for retirement (Lusardi and Mitchell, 2014). Table 7 investigates the role played by financial literacy by including in the baseline specification an indicator of financial literacy. Following other works on the role of financial literacy such as

TABLE 5
Pension Funds Participation, Controlling for Financial and Real Assets

	Uniform Distribution	Triangular Distribution
Expected replacement rate	−0.144	−0.144
	(0.045)***	(0.045)***
Standard deviation	0.443	0.626
	(0.182)**	(0.257)**
II financial assets quartile	−0.013	−0.013
	(0.020)	(0.020)
III financial assets quartile	0.025	0.025
	(0.021)	(0.021)
IV financial assets quartile	0.088	0.088
	(0.026)***	(0.026)***
II real assets quartile	0.014	0.014
	(0.021)	(0.021)
III real assets quartile	0.043	0.043
	(0.023)*	(0.023)*
IV real assets quartile	0.055	0.055
	(0.025)**	(0.025)**
N	3,249	3,249

Note: The table reports average marginal effects and the associated standard errors in parenthesis for an estimated probit model, where the dependent variable is a dummy equal to one if the individual contributes to at least one pension plan. The set of controls also includes financial and real assets quartile dummies, in addition to the socioeconomic characteristics included in the baseline regression (Table 3). *** indicate statistical significance at the 1% confidential level, ** statistical significance at the 5% level, * statistical significance at the 10% level. Standard errors are clustered at household level.

TABLE 6
Pension Funds Participation, Controlling for Firm Size

	Uniform Distribution	Triangular Distribution
Expected replacement rate	−0.208	−0.208
	(0.046)***	(0.046)***
Standard deviation	0.483	0.682
	(0.185)***	(0.261)***
N. workers 5–15	0.050	0.050
	(0.026)*	(0.026)*
N. workers 16–99	0.084	0.084
	(0.024)***	(0.024)***
N. workers > 99	0.148	0.148
	(0.023)***	(0.023)***
N	3,184	3,184

Note: The table reports average marginal effects and the associated standard errors in parenthesis for an estimated probit model, where the dependent variable is a dummy equal to one if the individual contributes to at least one pension plan. The set of controls also includes firm size dummies, in addition to the socioeconomic characteristics included in the baseline regression (Table 3). *** indicate statistical significance at the 1% confidential level, ** statistical significance at the 5% level, * statistical significance at the 10% level. Standard errors are clustered at household level.

Lusardi and Mitchell (2007), and Fornero and Monticone (2011), we construct an indicator based on the responses to three questions in the 2016 SHIW:

1. *Suppose you put 100 euros into a "no fee, tax free" savings account with a guaranteed interest rate of 2 percent per year. You don't make any further payments into this account and you don't withdraw any money. How much would be in the account at the end of 5 years, once the interest payment is made?* [Less than 102 euros | Exactly 102 euros | More than 102 euros| Don't know]
2. *Suppose you put 1,000 euros into a "no fee, tax free" savings account with a guaranteed interest rate of 1 percent per year. Suppose furthermore inflation stays at 2 percent. In one year's time will you be able to buy the same amount of goods that you could buy by spending today 1,000 euros?* [Yes | No, less than I could buy today | No, more than I could buy today | Don't know | No answer]
3. *In your opinion, the purchase of shares of one company usually provides a safer return than buying shares of a wide range of companies through a mutual fund?* [True | False | Don't know | No answer]

We define a dummy that takes the value 1 ("High financial literacy") for at least two correct answers and zero otherwise ("Low financial literacy"). Table 7 column 1 shows that financial literacy and pension fund participation have a positive association. Since financial literacy might be endogenous to saving and portfolio choice, we cannot offer a causal interpretation of the estimated coefficients (Jappelli and Padula, 2013).[13] From the perspective of the present analysis, the insight from this regression is that the relation between social security expectations and pension find participation is unaffected.

[13]Using an alternative proxy for financial literacy based on a count of the number of correct answers to the 3 questions provides very similar results.

TABLE 7
Pension Funds Participation, Controlling for Financial Literacy

	Total Sample	Low Financial Literacy	High Financial Literacy
Expected replacement rate	−0.148	−0.039	−0.199
	(0.045)***	(0.070)	(0.059)***
Standard deviation	0.482	0.214	0.653
	(0.186)***	(0.221)	(0.280)***
Expected retirement age	−0.004	−0.006	−0.004
	(0.002)**	(0.003)**	(0.002)*
II income quartile	0.042	0.039	0.039
	(0.024)*	(0.034)	(0.032)
III income quartile	0.119	0.138	0.109
	(0.027)***	(0.043)***	(0.034)***
IV income quartile	0.227	0.156	0.248
	(0.028)***	(0.047)***	(0.034)***
High school	0.023	0.018	0.026
	(0.016)	(0.024)	(0.021)
College	0.028	−0.012	0.037
	(0.021)	(0.031)	(0.027)
Age 36–45	0.076	0.091	0.073
	(0.031)**	(0.053)*	(0.039)*
Age 46–55	0.101	0.118	0.095
	(0.028)***	(0.048)**	(0.035)***
Age > 55	0.059	0.058	0.062
	(0.031)*	(0.048)	(0.039)
Male	−0.008	0.000	−0.013
	(0.014)	(0.021)	(0.018)
Married	−0.018	−0.021	−0.017
	(0.015)	(0.022)	(0.019)
Financial literacy	0.050		
	(0.015)***		
N	3,249	999	2,250

Note: The table reports average marginal effects and the associated standard errors in parenthesis of an estimated probit model, where the dependent variable is a dummy equal to one if the individual contributes to at least one pension plan. The specification in column 1 also includes as control the Index of financial literacy. *** indicate statistical significance at the 1% confidential level, ** statistical significance at the 5% level, * statistical significance at the 10% level. Standard errors are clustered at household level.

To further explore the role of financial literacy, we split the sample based on the financial literacy dummy and replicate the baseline regressions. The coefficients of social security risk are statistically different from zero (and economically important) only for the sample of individuals with "High financial literacy." The difference in size and significance between the two coefficients could be interpreted as meaning that retirement planning and the incentive to protect retirement consumption from social security risk depend also on the ability to understand basic financial concepts and to process information. However, given the large standard error of the coefficient estimated in the low literacy sample, the p-value associated with a test that the two coefficients are equal is 0.21, so we cannot reject the null hypothesis at standard confidence levels.

As mentioned, heaping and non-responses are a potential threat to the reliability of our estimates. To address the issue of heaping, in Table 8 we repeat the baseline specification using the imputed values of the replacement rate distribution

TABLE 8
USING IMPUTED VALUES OF THE REPLACEMENT RATE FOR HEAPING

	Uniform Distribution	Triangular Distribution
Expected replacement rate	−0.155	−0.155
	(0.055)***	(0.055)***
S.d of replacement rate	0.400	0.565
	(0.209)*	(0.296)*
II income quartile	0.043	0.043
	(0.024)*	(0.024)*
III income quartile	0.124	0.124
	(0.026)***	(0.026)***
IV income quartile	0.234	0.234
	(0.028)***	(0.028)***
High school	0.029	0.029
	(0.016)*	(0.016)*
College	0.038	0.038
	(0.021)*	(0.021)*
Age 36–45	0.074	0.074
	(0.031)**	(0.031)**
Age 46–55	0.103	0.103
	(0.028)***	(0.028)***
Age > 55	0.058	0.058
	(0.030)*	(0.030)*
Male	−0.007	−0.007
	(0.014)	(0.014)
Married	−0.017	−0.017
	(0.014)	(0.014)
Expected retirement age	−0.004	−0.004
	(0.002)**	(0.002)**
N	3,249	3,249

Note: The table reports average marginal effects and standard errors in parenthesis of an estimated probit model, where the dependent variable is a dummy equal to one if the individual contributes to at least one pension plan. *** indicate statistical significance at the 1% confidential level, ** statistical significance at the 5% level, * statistical significance at the 10% level. Standard errors are clustered at household level.

obtained applying the Heitjan and Rubin (1990) procedure described in Section 3. Results for the uniform and triangular distributions are reported in columns 1 and 2, respectively.

To address the issue of non-responses (described in Section 3.2) we impute the minimum, the maximum and the expected retirement age in three ways: (i) replacing the missing values with the mean of each distribution, and introducing a dummy variable for the missing values in our baseline regression; (ii) replacing the missing values using the predicted values from the regression reported in the Appendix (Table B5, column 7); (iii) using a multiple imputation method with 5 replicates, based on the same set of regressors as in the regression reported in the Appendix (Table B5, column 7). In Table 9 we report the results for our baseline specification for the uniform distributions using the imputed variables from these three strategies in the full sample of 5,195 observations (results for the triangular distributions are similar and not reported for brevity).

Tables 8 and 9 confirm the signs and the magnitudes of the relation between the demand for private pensions and the mean and the standard deviation of the replacement rate distribution. Using the uniform distribution, in the regressions of Table 8 the coefficients of the expected replacement rate is −0.155 and the

TABLE 9
USING IMPUTED VALUES OF THE REPLACEMENT RATE FOR NON-RESPONSES

	Mean	Predicted Value	Multiple Imputation
Expected replacement rate	−0.135	−0.139	−0.126
	(0.039)***	(0.039)***	(0.040)***
Standard deviation	0.390	0.403	0.391
	(0.159)**	(0.159)**	(0.184)**
Non-response dummy	−0.054	−0.052	−0.058
	(0.009)***	(0.009)***	(0.010)***
II income quartile	0.051	0.054	0.050
	(0.018)***	(0.018)***	(0.016)***
III income quartile	0.113	0.119	0.103
	(0.020)***	(0.020)***	(0.016)***
IV income quartile	0.212	0.217	0.179
	(0.022)***	(0.023)***	(0.016)***
High school	0.030	0.030	0.029
	(0.012)**	(0.012)**	(0.012)**
College	0.024	0.024	0.024
	(0.016)	(0.016)	(0.015)
Age 36–45	0.031	0.029	0.027
	(0.019)	(0.019)	(0.018)
Age 46–55	0.056	0.054	0.052
	(0.018)***	(0.018)***	(0.017)***
Age > 55	0.021	0.020	0.018
	(0.020)	(0.020)	(0.019)
Male	−0.008	−0.008	−0.008
	(0.009)	(0.010)	(0.010)
Married	−0.006	−0.007	−0.007
	(0.012)	(0.012)	(0.012)
Expected retirement age	−0.004	−0.004	−0.004
	(0.001)**	(0.001)**	(0.001)***
N	5,195	5,195	5,195

Note: The table reports average marginal effects and standard errors in parenthesis of an estimated probit model, where the dependent variable is a dummy equal to one if the individual contributes to at least one pension plan. The three columns refer to the different methods adopted to impute missing values for the minimum and the maximum expected replacement rate. The mean and standard deviations of the expected replacement rate are computed using the uniform distribution. *** indicate statistical significance at the 1% confidential level, ** statistical significance at the 5% level, * statistical significance at the 10% level. Standard errors are clustered at household level.

coefficient of the standard deviation is 0.40. In the regressions of Table 9, the coefficient of the expected replacement rate ranges from −0.135 to −0.126, while the coefficient of the standard error ranges from 0.39 to 0.40. Overall, the results suggest that heaping and non-responses do not represent a major source of concern in the present context.

Finally, to address at least in part the concern that social security uncertainty is correlated with other beliefs about asset markets, we introduce the expected house price change and its standard deviation in our baseline regression (see Appendix, Table B2). We find that the coefficients of house price expectations are not statistically different from zero, and that our main coefficients of interest are unchanged.[14]

[14]In these regressions we introduce also an indicator for whether the two variables are computed from rotations 1 or 2, and also the coefficient of this dummy is not statistically different from zero.

5. Conclusions

For 20 years, various Italian governments have implemented series of social security system reforms that have increased the retirement age and reduced replacement rates. At the same time, these reforms have tried to increase participation in the second and third pillars of the pension system, to offset in part the reduction in future social security benefits.

However, the reforms have also increased uncertainty about future benefits because the system has switched from an earnings-based formula to a model where benefits are computed based on past contributions. In a contributions system benefits typically are more uncertain and more difficult to predict than under the previous earnings-based regime, where they depend only on the last few years of earnings. Pension legislation has been revised almost annually, sometimes reversing previous reforms but always including a further source of uncertainty. Finally, what matters for financial decisions is the individual's perceived subjective risk which might over or underestimate the risks related to further reforms.[15]

This paper measures the subjective expectations of the replacement rate distribution in the 2016 SHIW and relates these expectations to the demand for retirement saving. We find that subjective expectations are aligned to some of the key features of the Italian social security system. For instance, public employees and older individuals expect a higher replacement rate and perceive less risk, while self-employed and younger workers expect lower benefits and perceive more risk.

In the second step of our analysis, we showed that participation in private pension funds is associated negatively to the expected replacement rate, and positively to social security risk, measured by the standard deviation of the replacement rate distribution. Both effects are statistically and economically significant. A 10 percentage points decrease in the expected replacement rate increases the propensity to invest in pension funds by 2.5 percentage points. Moreover, a one standard deviation increase in the standard deviation of the replacement rate distribution is associated to a 1.6 percentage points increase in participation.

The evidence provided by our study supports the view that Italians consider social security expectations when planning for retirement: those who expect a relatively low expected replacement rate and those who perceive a relatively high social security risk show increased demand for retirement saving. Future research should assess whether this response compensates partly or fully for the projected fall in future benefits, and overcomes the potential adequacy of saving issue implied by the reforms to the social security system.

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[15]Bottazzi *et al*. (2006) show that the offset effect of pension wealth on private wealth is stronger for households with a better understanding of the changes to pension legislation. In this context, for many years Italy has made no serious attempts to communicate the effects of its pension reforms. Information about future social security benefits—similar to the Swedish 'orange pension letter', was sent for the first time in 2018 to selected groups of workers.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Supplementary Material
Appendix A. Variables' Definition
Appendix B. Additional Results