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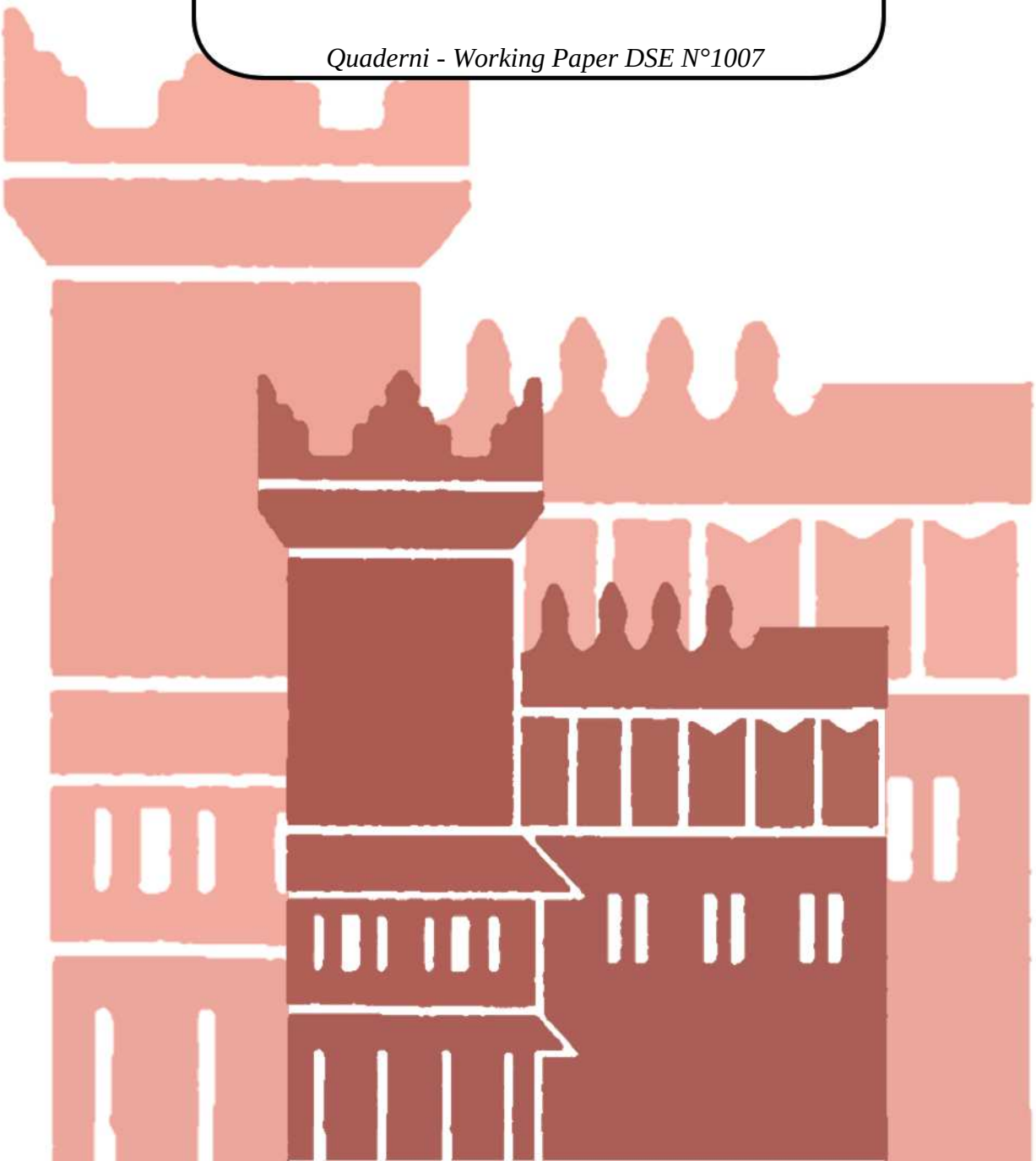

Pension expectations and reality. What do Italian workers know about their future public pension benefits?

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Abstract

We use 6 waves of the Bank of Italy's Survey on household income and wealth (SHIW) to check the evolution of workers' expectations on future pension benefits and retirement age from 2000 to 2012. Based on these two subjective evaluations, we compute a measure of expected pension benefit and compare it with a "true" measure of the same variable that we estimate on the basis of the pension rules in each year of the considered time lapse. By comparing subjective and "true" measures of the variable, we are able to measure the evolution over time of the "expectation error" and its distribution among different economic and demographic subsets of the population. Finally, we estimate a subjective measure of social security wealth and the degree of substitution between this variable and the private net worth of workers' households, in order to quantify the effects of pension reforms approved in the period considered on wealth accumulation.

Jel codes: H55, D91, E21
Keywords: Pension benefits, Expectations, Information, Saving, Private Accumulation

1. Introduction

Public pension benefits are currently and will be in the future the major source of income for older people. A good knowledge of rules of the pension system should help individuals to avoid reaching retirement with inadequate resources and/or working longer than previously expected. This kind of information is particularly important in countries like Italy, where reforms in the public pension system have radically changed both the expected level of future pension benefits and the retirement age and where the phasing in of an NDC formula, coupled with the development of private pension schemes based almost completely on DC rules, is moving responsibilities and risks from the Government to workers, a common trend among developed and also developing countries [Sunden 2011].

The changing landscape in the Italian pension system means that current Italian workers (and future pensioners) will accrue their pension rights with a much less generous (even if more sustainable and homogenous) rule when compared with that of current pensioners and, at the same time, they will be forced to retire considerably later than current pensioners did [Marano, Mazzaferro and Morciano 2012]. If the first factor should encourage workers to increase now their personal saving in order to face a future reduction in the level of the social security wealth, the second one goes in the opposite direction, since it increases the active lifespan and reduces the length of the retirement period[1]. According to the standard life cycle hypothesis the sign of the net effect is uncertain [Feldstein 1974].

In this study we describe how information on the future of the public pension system has evolved among Italian workers, using data from the Survey of Households Income and Wealth (SHIW) from 2000 to 2012. Since year 2000, respondents of the survey are asked about their expectations on both the future level of the replacement ratio (i.e. the ratio between the first pension benefit and the last wage) and of the retirement age. These two variables are used here to estimate the expected level of the future public pension benefit for workers in the survey. Subsequently we compute the "pension error" defined as the difference between the expected value and the "statutory" value of the pension benefit, the second variable defined as the pension benefit level computed, at the expected retirement age, on the basis of the pension rule that was in force in the year of the survey. We study the distribution of the pension error among social and demographic categories of the surveys' population and its evolution over time. Using then the expected value of the pension benefit, together with information on lifetime expectation at retirement, we construct a measure of net and gross social security wealth. Finally we study the degree of substitutability of this variable with respect to private wealth.

[1] As a matter of fact the future adequacy of public pension benefits and the necessity to increase current saving to compensate their eventual reduction both depend on the relative strength of these two opposite effects.

2. Data

Since year 2000 individuals participating to the SHIW survey of the Bank of Italy are asked to answer two questions regarding their future pension, namely: i) “at what age do you expect to retire?” ii) “what will be the percentage of your first year pension benefit with respect to earnings gained the year before retirement?”. Using these two pieces of information we implement a procedure first proposed by Jappelli [1995] to compute the expected value of the pension benefit at the age of retirement for those workers in the survey who responded positively both to the first and to the second question.

The sample has a yearly dimension of around 20,000 observations for a total of 143,882 observation over the whole period. Among these observations we first select those who classify themselves as dependent workers or as self-employed (50,699 observations). We then drop all observations that did not respond at both the selected questions about the expected retirement age and replacement ratio (9,020 observations). Some other adjustments were necessary before starting to compute the expected value of future pension benefits. In particular we drop from the sample all individuals that declared they had not previously paid pay-roll taxes to a pension scheme (1,767 observations) and those older than 70 (167 observations). Finally we adjusted the expected retirement age, imposing that it cannot be lower than 57 and greater than 70 (441 changes made). After all these adjustments we end up with a sample of 31,665 dependent workers and 8,080 self-employed.

Table 1 reports the total population of the survey, the number of dependent workers and self-employed and the number of those that are selected for further investigation.

Table 1
Number of selected individuals

Year	Total	Dependent	Selected Dep	Self Employed	Selected SE
2000	22,336	6,147	5,232	1,795	1,428
2002	21,215	5,817	5,531	1,642	1,509
2004	20,659	5,792	5,520	1,526	1,371
2006	19,639	5,746	5,491	1,413	1,280
2008	19,989	5,800	3,668	1,336	877
2010	19,918	5,546	3,099	1,424	831
2012	20,126	5,383	33124	1,332	784

Following this procedure we end up with a population that, as reported in table 2, presents an important discontinuity in correspondence to the year 2008. Indeed, starting from this year only individuals who were

physically present to the interview are allowed to answer the two questions. This innovation was not neutral on the composition of the selected population, which appears to be older after 2008.

Table 2
Average age of the original and of the selected population of workers

year	Dep workers	Selected Dep workers	Self employed	Selected Self Employed
2000	39.7	40.7	43.4	44.0
2002	40.2	40.2	44.2	44.3
2004	40.7	40.7	44.2	44.2
2006	41.4	41.4	44.7	44.8
2008	41.8	43.9	46.0	47.7
2010	43.0	45.4	47.0	49.2
2012	43.9	46.0	48.3	50.3

The next steps describe the hypotheses used to estimate the expected value of pension benefits. First, we need to impute to each individual of the selected sample a value of his/her labour income gross of the income tax and of the part of the social security contribution that is paid by the worker. The SHIW survey contains only the information on net incomes, i.e. after the payment of the personal income tax, but for the computation of future pensions we need the data on gross incomes. In order to overcome this shortcoming we moved to another survey of the Italian population, namely the SILC survey on households' living conditions, carried out every year by the Italian national statistical institute, that gathers data on both gross and net income. We have therefore performed a regression, on the workers aged between 25 to 65 year in the SILC survey for the year 2012 (containing 2011 incomes) of gross income as a function of net income and a set of personal characteristics (age, gender, dependent or self-employed, education, number of children in the household, geographic area). The following table shows the results of the regression.

We use the coefficients estimated from this regression to impute to each SHIW observation a value for his/her gross income.

Table 3
Regression results of gross income on the SILC survey

	Coef.	Std. Err.	t
Net income	1.551	0.003	502.54
Net income squared	0.00000035	0.00000001	26.02
Age	-5.647	25.647	-0.22
Age squared	0.164	0.290	0.57
Man	-12.484	60.978	-0.2
High school	211.175	66.341	3.18
Degree	1097.723	87.541	12.54
Employee	-994.470	68.446	-14.53
N. children 0-3	-325.869	83.271	-3.91
N. children 4-10	-352.799	54.967	-6.42
N. children 11-17	-394.831	57.183	-6.9
North	-48.065	67.768	-0.71
Centre	11.202	82.556	0.14
Constant	-2275.339	544.075	-4.18

R^2=0.97; N. obs. 18977

We also computed on the pseudo panel of the SHIW (2000-2012) different rates of growth of lifetime earnings. To get these rates of growth, we split the sample of workers in the SHIW survey into six groups, resulting from the interaction between gender and three education levels (less than high school, high school, degree). Then for each group we regress yearly gross income on age and its square, obtaining a life-cycle profile for earnings. For each individual of the sample, this fitted profile passes through the actual earning of the survey, at the corresponding age. Then we obtain the average growth rate of gross earnings for each group, and depending on the age compute the earning of the last year of work.

After all these steps we are able to estimate the expected value of the pension benefit in the first year after retirement for each individual in the sample $(P\_ex)_i$ as:

$$P_i^{exp} = RR_i^{exp} * Y_i^{last} \qquad (1)$$

where

RR_i^{exp} is the individual expected replacement ratio for individual (i) reported in the survey

Y_i^{last} is the value of individuals' earning the year before retirement

The computation of Y_i^{last} is obtained as:

$$Y_i^{last} = Y_{i,t} * (1 + m_k)^{(ret_i - age_i)} \qquad (2)$$

where

$Y_{i,t}$ is the estimated gross earning of individual i at time t (the observation's year)

m_k is the group specific rate of growth of earning, k=1, 2,….,6

ret_i is the expected age at retirement for individual (i) in the year he/she is observed in the survey

age_i is the age of individual (i) in the year he/she is observed in the survey

In fact equation (2) projects forward the current value of the (estimated) gross earning for a number of years equal to the difference between the expected age of retirement reported in the survey and the current age of each individual. In doing so we hypothesize that all individuals in the sample will not experience periods of unemployment. We also impose different growth rates of earnings, taking into account both gender and educational level (see above).

In order to compute the error in the pension computation we need to estimate the "statutory" value of the pension benefit for each individual in the sample and then compute the difference between the two levels of benefit. We introduce a number of (necessary) simplifications that allow us to reach our aim. In particular:

i. The statutory pension benefit is computed at the expected retirement age.

ii. We split our sample into three groups in order to take into account the different phasing in of the NDC system. In particular we distinguish, on the basis of the accrued seniority in 1995, the DB workers (i.e. those that in 1995 had at least 18 years of seniority at work); the mixed workers (i.e. those that in 1995 had less more than 0 years but less than 18 years of seniority at work) and the NDC workers (i.e. those that started to work after 1995).

iii. We distinguish three occupational schemes: private dependent workers, public dependent workers and self-employed.

iv. We impose that workers will not experience periods of unemployment.

v. We compute the statutory pension benefit (P_i^{true}) according to the rules described in the appendix A. For each individual in the sample we have then:

$$P_i^{error} = P_i^{true} - P_i^{exp} \qquad (3)$$

3. How Italian workers estimate their future pension benefits

As a starting point to interpret our results it is useful to describe the evolution of both the expected replacement ratio and of the expected retirement age. Results are presented in table 4. Figures in the table tell us that workers in the sample substantially revised their expectations on the future of the public pension system: the expected replacement ratio decreased by about 10%, while the expected retirement age, during the same period, increased by 3.5 years. So at a first glance it seems that, at least on average, the message

that in the future the public pension system will not be as generous as it has been in the past was perceived by Italian workers who expect both to receive a lower pension benefit and to retire later.

Looking first at the expected replacement ratio it is worth to notice that its reduction is continuous through time. Starting from 72.5% in 2000 this indicator has reached the average value of 62.3% twelve years later. The reduction is much intense in the initial years of the period and from 2010 to 2012. As for the expected retirement age, differently from the replacement ratio, changes are more concentrated in the second part of the period. In particular from 2010 to 2012 the expected retirement age increases by 1.6 years, nearly half of the total changes.

Table 4
Average value of the expected replacement ratio and of the expected retirement age. 2000-2012.

Year	Expected replacement ratio	Expected retirement age
2000	72.5% (19.9)	61.6 (3.8)
2002	69.0% (16.1)	61.9 (3.7)
2004	67.8% (16.0)	62.3 (3.6)
2006	65.6% (16.1)	62.2 (3.6)
2008	65.4% (15.5)	63.1 (3.5)
2010	64.3% (15.1)	63.5 (3.4)
2012	62.3% (15.9)	65.1 (3.3)
2012-2002	-10.2%	+3.5

Standard deviation in parenthesis

Table 5 and table 6 decompose changes in the expected replacement ratio and in the expected retirement age by different socio-economic subsamples of the population.

Even if the reduction in the ratio between first year pension and last year wage is common to all the socio-economic characteristics here considered, it is worthwhile noticing that some groups appear to be more

affected than others. In particular the reduction is stronger among dependent workers than among self-employed; among future NDC pensioners than among future DB pensioners, among highly educated individuals than among individuals with first level education.

Table 5
Expected replacement ratio by subsamples of the population. Percentage values. 2000-2012

Year	*Priv dep*	*Pub dep*	*Self empl*	*Men*	*Wom*	*DB*	*MIX*	*NDC*	*FIR DEG*	*SEC DEG*	*HIGH DEG*
2000	73.3	79.1	62.1	72.9	71.7	75.0	71.1	69.3	71.1	73.5	74.8
2002	69.7	75.3	59.6	69.2	68.7	71.9	67.9	66.2	68.0	70.0	69.9
2004	68.5	73.6	58.7	68.1	67.5	70.9	67.5	64.5	66.9	68.9	68.1
2006	65.6	71.7	57.8	66.0	65.2	71.0	64.9	62.3	65.5	65.7	66.1
2008	65.3	71.3	57.8	66.1	64.2	70.9	65.2	60.9	64.7	66.2	65.3
2010	64.7	70.2	56.4	65.2	63.2	70.4	65.2	59.6	64.2	64.9	63.5
2012	62.4	68.1	54.6	62.9	61.4	68.5	62.9	58.4	62.2	62.8	61.2
2012-2000	-10.9	-11.0	-7.5	-10	-10.3	-6.5	-8.2	-10.9	-8.9	-10.7	-13.6

Table 6
Expected retirement age by subsamples of the population. 2000-2012

Year	*Priv dep*	*Pub dept*	*self emp*	*Men*	*Wom*	*DB*	*MIX*	*NDC*	*FIRST DEG*	*SEC DEG*	*HIGH DEG*
2000	61.2	61.3	63.1	62.2	60.5	60.7	62.1	62.6	61.2	61.7	62.8
2002	61.6	61.5	63.0	62.6	60.7	61.0	62.3	62.7	61.5	62.0	63.0
2004	62.1	61.7	63.3	63.1	61.0	61.1	62.7	63.1	62.0	62.3	63.3
2006	62.1	61.6	63.4	62.9	61.2	61.3	62.3	63.0	62.0	62.2	63.1
2008	62.8	62.7	64.3	63.7	62.1	61.8	63.3	63.9	62.8	63.1	64.0
2010	63.2	63.3	64.9	64.0	62.9	62.3	63.4	64.4	63.0	63.6	64.7
2012	64.9	64.8	66.0	65.4	64.7	63.6	65.1	65.8	64.7	65.0	66.0
2012-2000	+3.7	+3.5	+2.9	+3.2	+4.2	+2.9	+3.0	+3.2	+3.5	+3.3	+3.2

Also in the case of the expected retirement age, the change appears not uniformly spread among the population. In this case women and dependent workers expect the larger increase in their retirement age.

In table 7 we compare the "statutory" replacement ratio, defined as the ratio between P_i^{true} and the last gross wage Y_i^{last} for each individual in the sample, and the expected replacement ratio RR_i^{exp}, already presented and discussed above. In general terms we note a progressive convergence of the expected replacement ratio towards the statutory one. Remembering that we compute pension benefits at the expected retirement age and that this variable increases from 2000 to 2012, it is interesting to note that the reduction in the statutory replacement ratio over the years is not particularly pronounced and that from 2010 to 2012 (i.e. corresponding to the period that records the higher increase in the expected retirement age) the statutory replacement ratio grows from 59.4% to 62.7%.

Table 7
"Statutory" and expected replacement ratio,
given expected retirement age. 2000-2012.

Year	Statutory RR	Expected RR
2000	62.8%	72.5%
2002	61.9%	69.0%
2004	61.5%	67.8%
2006	59.6%	65.6%
2008	60.6%	65.4%
2010	59.4%	64.3%
2012	62.7%	62.3%

The fact that in the last two years the expected replacement ratio decreases from 64.3% to 62.3% seems to suggest that workers, at least on average, did not correctly understand the positive relation between retirement age and replacement ratio.

Moving now to the error between expected and statutory pension, we compute its average absolute value over the whole sample as equal to 5,651 Euro at 2012 prices. The median value equals 3,408 Euro. 63.1% of observations report a positive (or zero) value, while 36.9% estimate a pension benefit which is smaller than the statutory value. Remembering that the average value of the estimated pension benefits equals 22,929 Euro, the average percentage error is equal to 24.6%.

Figure 1 shows that there is, as expected, a positive relation between the sign of the error and the expected replacement ratio. The average value of errors is negative for very low values of the expected replacement ratios. It monotonically increases thereafter reaching a value round to zero for expected replacement ratios

between 50% and 70%. For higher values of the expected replacement ratios the error becomes positive and quite large for values higher than 100%.

Figure 1
Average errors and expected replacement rate in the whole sample.
Euro at 2012 prices

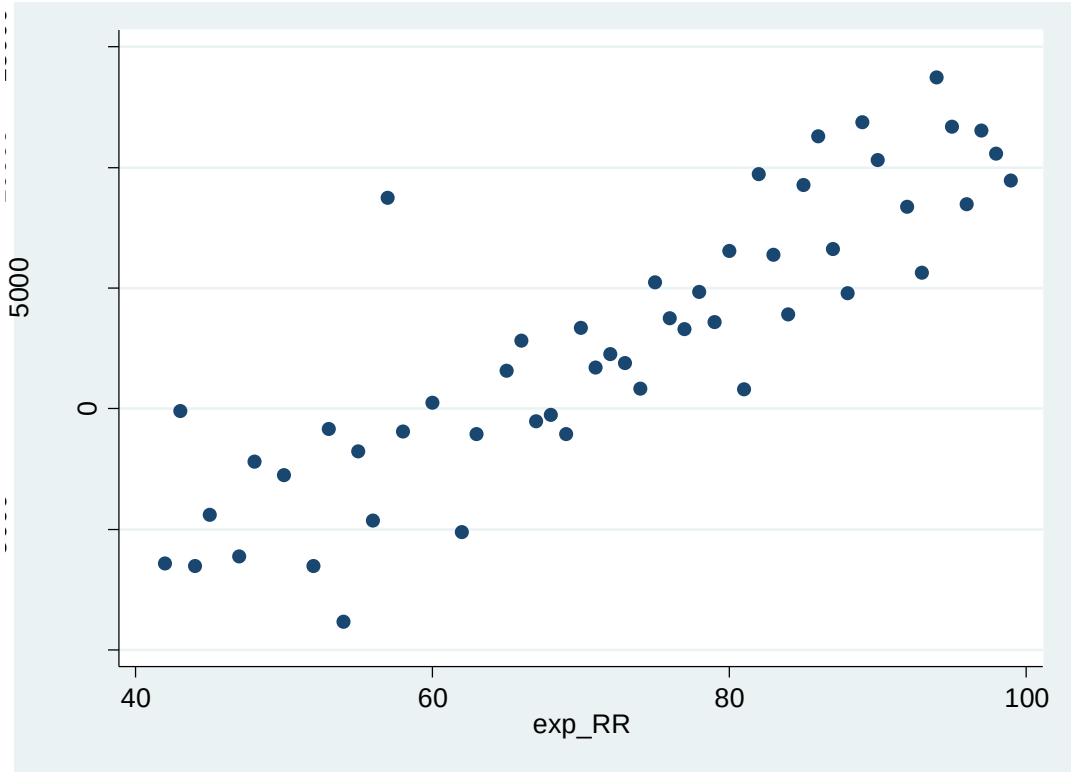


Figure 2 a) and b)
Average error by year (a) and by expected retirement age (b).
Euro at 2012 prices

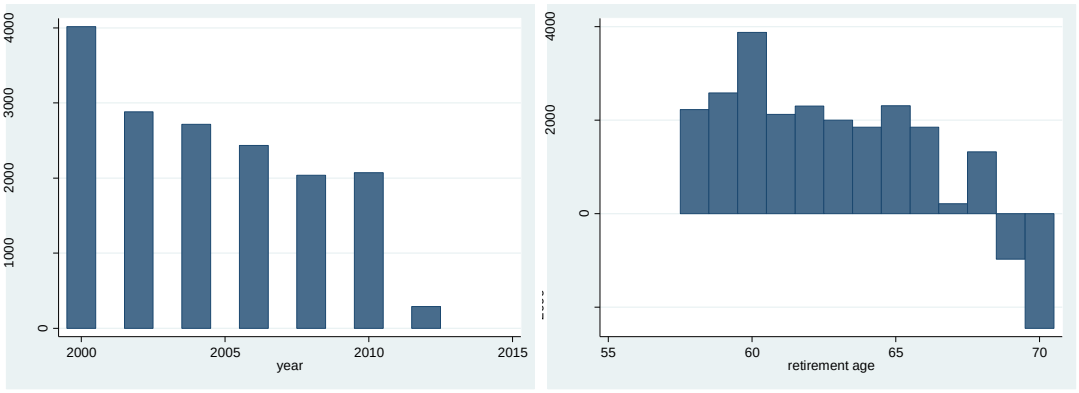


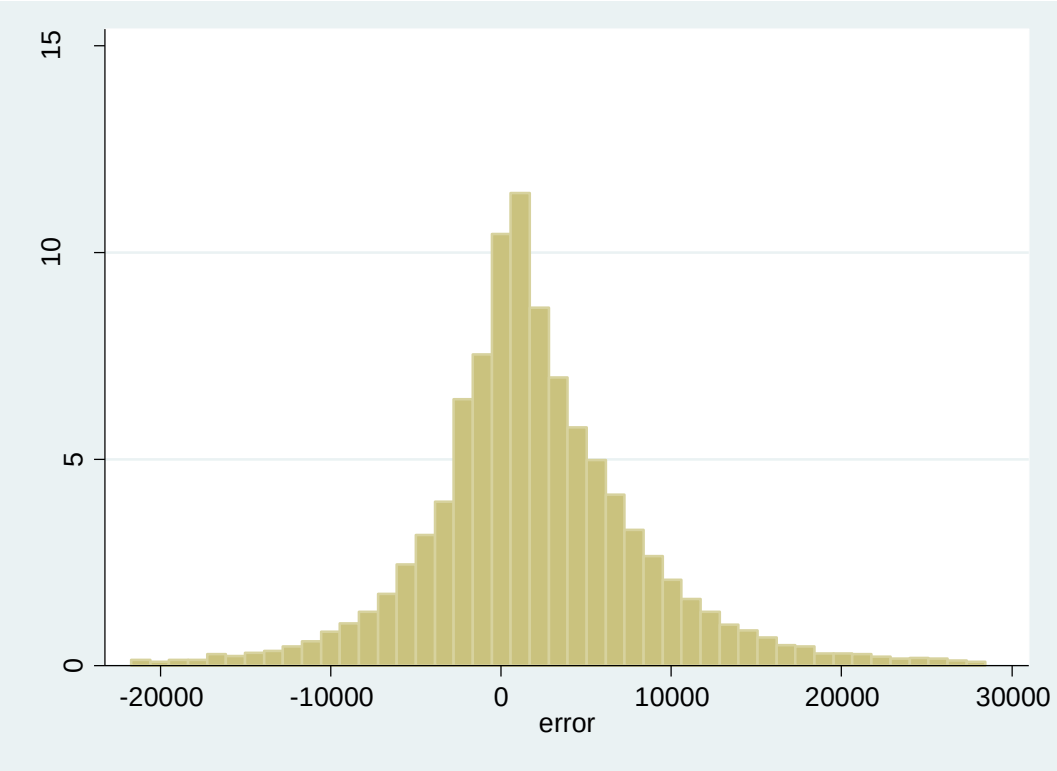
Figure 2a and 2b display respectively the time evolution of the average error in the computation of pension benefits and its relation with the expected retirement age. As for the part a) of the figure, it is clear the continuous downward adjustment of workers' expectations. Workers, on average, overestimate their future level of benefits until 2010, but they progressively become less and less confident on the adequacy of their future pension benefits. Interestingly part b) of the figure reports that individuals who expect to retire earlier than 66 have an estimated value of their pension benefit that is higher than the "true" one. On the opposite, as retirement age increases beyond this value the difference between the "true" and the expected value becomes on average negative. Figure 2a and 2b confirm our perception that the positive relation between the replacement ratio and the retirement age are still not completely understood by Italian workers.
Table 8 reports the evolution over years of the average error for specific subsamples of the whole population.

Table 8
Average error for subsamples of the population. 2000-2012. Euro at 2012 prices.

YEAR	PRIV DEP	PUB DEP	SEL EMPL	MEN	WOMEN	DB	MIXED	NDC	FIRST	SECOND	THIRD
2000	2,430	5,816	2,212	3,427	3,084	1,595	4,314	5,158	515	3,879	11,972
2002	1,174	4,436	1,350	1,828	2,378	-143	2,761	4,334	-313	2,642	9,670
2004	829	3,867	1,293	1,390	2,153	-697	2,160	3,941	-934	1,866	10,870
2006	195	4,469	541	759	2,157	-849	1,545	2,755	-876	1,200	8,705
2008	70	2,920	846	553	1,519	-891	922	2,480	-1,017	1,009	6,843
2010	-9	3,285	424	682	1,217	-1,309	1,122	1,982	-907	600	5,674
2012	-1,957	1,161	-894	1,072	-855	-2,000	-1,581	225	-2,148	-1,717	2,984

The downward trend in expectations is common to all subgroups. As for the level of the average error, it is interesting to notice that it is higher for those with a high level of education, those who will compute their pension benefit under the NDC system (i.e., younger workers), women and public dependent workers.
Average values however do not convey a complete picture of the phenomenon. In fact the errors distribution is very dispersed, as the figure 3 shows.

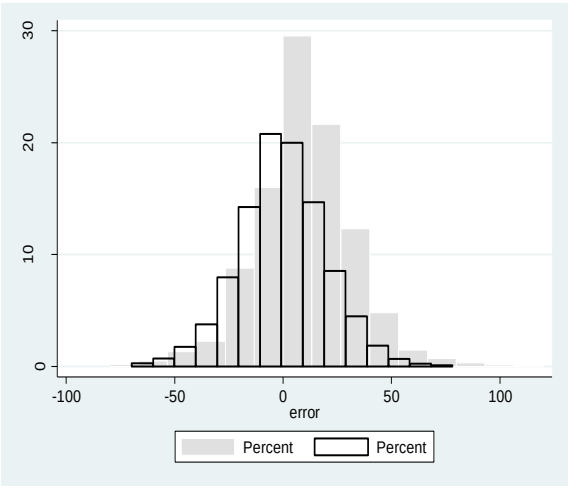
Figure 3
Errors distribution over the whole sample. Euro at 2012 prices.



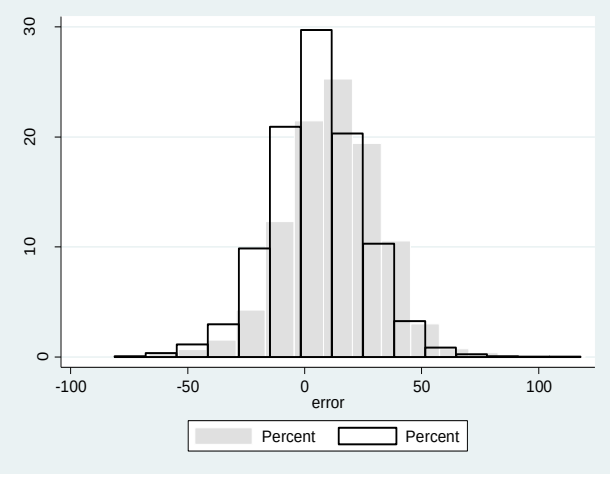
Errors' distribution also changes through time and among different categories of workers as the following graphs show.

Figure 4
Error distribution in the replacement ratio.

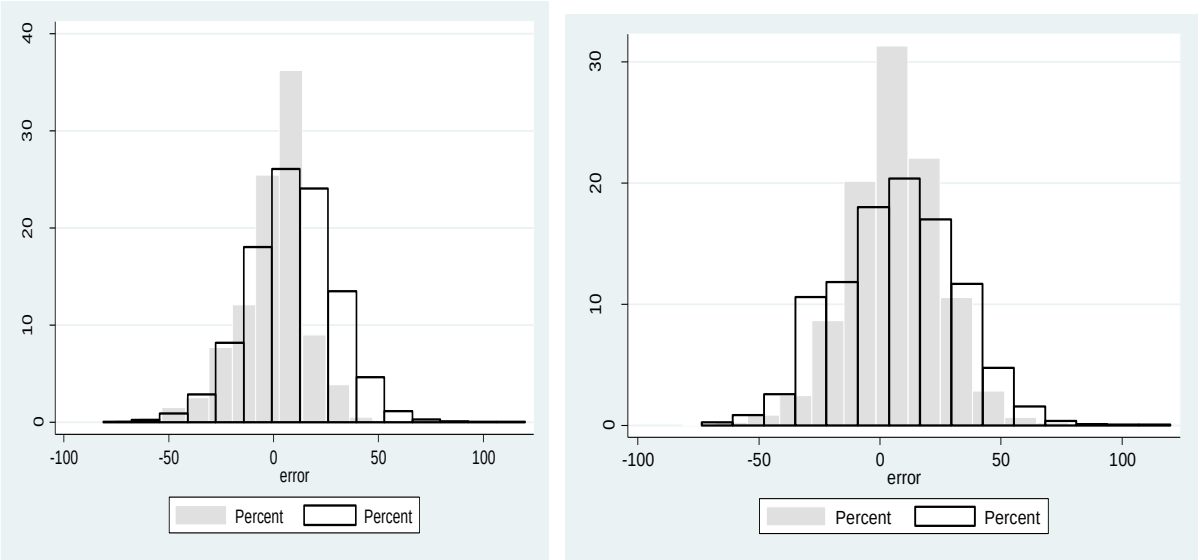
a)



b)



c) d)



a. At the beginning (2000) (gray) and at the end (2012) (no color)
b. Among high level education (gray) and middle-low level (no color)
c. Among DB pensioners (gray) and mixed-NDC pensioners (no color)
d. Among dependent (gray) and self-employed (no color)

In order to better understand the degree of understanding of the future of the pension system in the sample, we introduce three new variables.

The first variable approximates the ability of individuals to correctly predict the future level of their pension benefit. We split the sample into three groups according to the distance between the expected and the statutory pension benefit. The first group is composed of individuals whose pension error is in a bracket of +/- 10% with respect to the true value of the pension benefit. The second group is composed of individuals whose pension error ranges from +- 10% to +/- 50% and finally the third group is composed of individuals whose pension error exceeds +/- 50%.

The second variable splits the sample between those who overestimate and those who underestimate their future level of pension benefit with respect to its statutory value . Finally, the third variable splits the sample between those who correctly predict their future retirement age and those who do not.

Table 9 displays the evolution of these variables over time. As for the ability to correctly predict the future level of the pension benefit things do not change dramatically: roughly 40% of the sample is in the first group and 60% is in the second. These results appear to be in line with other empirical investigations [Gustman and Steinmaier 2001, Bottazzi et al. 2006]. The second variable shows that an increasing share of individuals start to be pessimist on the future of their pension benefits: those who underestimate its level grew from 30.4% in 2000 to 51.7% in 2012.The degree of pessimism is at its maximum in 2012, when for the first time the number of individuals who underestimate their future pension benefits exceed those who overestimate it. The

macroeconomic and financial background might in this case contribute to explain the evolution of the expectations. As for retirement age, as already stressed, figures in the table show that an increasing share of the Italian workers is getting confused and did not catch the novelty introduced in the Italian pension law after 2010, that linked automatically retirement age to the lifetime expectations at 65.

Table 9
Variables that measure the degree of comprehension of the public pension system. 2000-2012.

Year	**Pension error < |0.25%|**	**Pension error > |0.25%|**	**Underestimate pension**	**Overestimate pension**	**Wrong retirement age**	**Right retirement age**
2000	43.8%	56.2%	30.4%	69.6%	20.4%	79.6%
2002	38.8%	61.2%	34.4%	65.6%	16.5%	83.5%
2004	40.1%	59.9%	36.0%	64.1%	13.6%	86.4%
2006	43.4%	56.6%	37.4%	62.6%	15.0%	85.0%
2008	39.2%	60.8%	39.9%	60.2%	11.2%	88.8%
2010	39.8%	60.2%	39.4%	60.6%	43.4%	56.6%
2012	42.4%	57.6%	51.7%	48.3%	63.5%	36.5%

In order to estimate the social and economic factors that contribute to determine the degree of comprehension of the pension system we run three probit regressions testing the probability of estimating correctly the future level of the pension benefit, the probability of overestimating the future pension benefits and the ability to correctly predict the retirement age. As explanatory variables we consider quintiles of (individual) income, the seniority at work approximated by the number of years an individual has contributed to his/her pension scheme, gender, occupational status (divided in private, public employee and self-employed), geographical area (north, centre, south), educational level (three degrees), a proxy of the pension regime to which each worker belongs (Defined Benfit, Mixed system and Notional Defined Contribution system) and a set of time dummies.

The following table 10 reports results of the estimation in terms of marginal effects.

Table 10
Probit regressions on the three variables measuring the degree of understanding of the pension system.

VARIABLES	Correctly understand pension benefit	Overestimate pension benefit	Correctly understand retirement age
dquint2	0.028***	0.075***	0.006
	(-0.009)	(-0.009)	(-0.007)
dquint3	0.032***	0.095***	0.005
	(-0.01)	(-0.01)	(-0.007)
dquint4	0.047***	0.126***	-0.021***
	(-0.01)	(-0.01)	(-0.008)
dquint5	0.030***	0.118***	-0.33***
	(-0.011)	(-0.011)	(-0.009)
Seniority	0.006***	-0.002***	0.002***
	(-0.001)	(-0.001)	(-0.001)
Male	0.055***	-0.086***	-0.021***
	(-0.006)	(-0.007)	(-0.005)
Public employee	-0.028***	0.146***	-0.043***
	(-0.007)	(-0.008)	(-0.007)
Self employed	-0.190***	0.054***	0.055***
	(-0.006)	(-0.009)	(-0.006)
North	0.054***	-0.125***	0.0003
	(-0.007)	(-0.008)	(-0.006)
Centre	0.017*	-0.017*	-0.017**
	(-0.009)	(-0.01)	(-0.007)
Diploma	0.003	0.043***	0.011**
	(-0.007)	(-0.008)	(-0.006)
Degree	-0.071***	0.100***	0.035***
	(-0.009)	(-0.011)	(-0.008)
Mixed	-0.188***	0.147***	0.106***
	(-0.011)	(-0.013)	(-0.009)
NDC	-0.178***	0.173***	0.122***
	(-0.016)	(-0.02)	(-0.013)
2002	0.032***	-0.048***	0.033***
	(-0.01)	(-0.011)	(-0.007)
2004	0.024**	-0.075***	0.055***
	(-0.01)	(-0.011)	(-0.007)
2006	0.020**	-0.118***	0.011
	(-0.01)	(-0.012)	(-0.008)
2008	0.044***	-0.124***	0.076***
	(-0.012)	(-0.013)	(-0.008)
2010	0.059***	-0.228***	-0.279***
	(-0.014)	(-0.015)	(-0.012)
2012	-0.02	-0.393***	-0.481***
	(-0.016)	(-0.014)	(-0.012)

Observations	30,070	30,070	39,499
Pseudo R-squared	0.106	0.0851	0.122

Omitted variables: 1st quintile of income distribution, private employee, living in the north, first level degree, defined benefit, year 2000.

The position in the income distribution has a positive relation with the probability to both rightly estimate the future level of the pension benefit and to the probability of overestimating it. As individuals increase their seniority at work they improve their ability in predicting both the level of the pension benefit and the retirement age. They also reduce their optimism. Men are better than women in predict the level of the pension benefit. They also tend to underestimate it. As for the occupational status, private dependent workers are better in estimating their future pension, whereas self-employed seem better in predict correctly their retirement age. Public dependent workers are more optimist about their future level of the pension benefit. As the educational level increases workers tend to overestimate their future pension benefit, to be less able to predict it correctly and to be better in judge their retirement age. Belonging to the NDC scheme (and being therefore younger) decreases the probability to compute correctly the pension benefit but increases the ability to predict retirement age. Finally, time seems to play an important role. In particular, as time passes individuals become more and more pessimist about the future level of the pension benefit and less and less (in particular after 2010) able to correctly predict their retirement age. The increase in pessimism on future pensions may be due to the presence of the great recession, which could reduce expectations on living standards, and is consistent with the lower ability to predict the retirement age: many seem unaware that they will be obliged to retire later and, just for this fact, with a pension which will be greater than in the case of an earlier retirement.

4. Private wealth and social security wealth based on expected pension benefits: is there an offsetting effect?

The value of annuities expected from the (public) pension system constitutes a major part of total household wealth in Italy [Mazzaferro and Toso 2009]. Any analysis of the accumulation and distribution of wealth, and of its evolution over time, would therefore be misleading without its inclusion. In this paper we define social security wealth as the discounted sum of all expected future pension benefits. For each employed individual *i* observed at time *t* social security wealth is defined as:

$$SSWN_{t,i} = (1+r)^{(t-p)} \sum_{k=p}^{p+d}(1+r)^{(P-k)} \; P\_ex_i \quad (4)$$

where:

r is the discount/interest rate

P_ex_i is the pension benefit expected by individual *i* upon retirement

Yi is the gross income of individual i

p is the expected year of retirement of individual *i*,

d is the life expectancy at retirement of individual *i*, *r* is the discount rate,

m_k is the group specific real growth rate of earnings

In our simulation r is equal to 1.5%; d is taken from the ISTAT dynamic population projection to 2060. The specific past earnings rate of growth are reported in the following table. Future yearly growth of earnings is fixed at 1%.

Table 12
Specific growth rate of earnings.

	Men	women
first	0.0049	0.053
second	0.0153	0.0115
third	0.028	0.017

Table 13 reports the average value of the expected and the statutory social security wealth computed according to equation (4) as well as the net worth from 2000 to 2012.

Table 13
Average value of the expected and the statutory social security wealth, and of net worth.
Households with at least one employed individual. Thousands of Euro at 2012 prices

Year	Expected SSW	Statutory SSW	w
2000	587,458	467,153	259,585
2002	599,376	479,188	259,774
2004	597,662	487,447	291,050
2006	591,787	483,584	317,101
2008	453,016	390,336	299,324
2010	406,610	350,148	312,570
2012	350,717	320,920	287,904

The time evolution of the SSW variable is strongly influenced by the reform process of the last 12 years and from the nearly flat dynamics of labour income during the same period. On average, SSW decreased from 587 thousand of Euro in 2000 to 350 thousand of Euro in 2012. During the same period important facts modified also the level and the composition of the net worth of Italian workers, defined as the sum of real and financial

wealth, net of any debts. Differently from the SSW, the net worth of households with at least a worker did not decrease in the observed period. Starting from an average value of 255 thousand Euro in 2000, it was equal to 285 thusand of Euro in 2012. It reached a maximum of 310 thousand of Euro in 2010.

The next step is be an estimation of the degree of substitution between social security wealth and net worth during the observed period.

Table 14: The substitutability between net worth and SSW.

	Total sample	Informed	Uninformed
SSW / Y	-0.335***	-0.384***	-0.292***
	(-22.89)	(-22.30)	(-10.82)
Age	0.184***	0.201***	0.135
	(4.69)	(4.56)	(1.83)
Age squared	-0.00148***	-0.00178***	-0.000825
	(-3.53)	(-3.83)	(-1.04)
Woman	0.0876	0.0614	0.108
	(0.86)	(0.56)	(0.54)
Public employee	0.693***	0.647***	0.755**
	(5.93)	(5.50)	(2.92)
Self-employed	3.087***	3.091***	3.072***
	(26.94)	(23.13)	(14.47)
High School	1.233***	1.149***	1.410***
	(12.42)	(11.12)	(6.88)
Degree	1.480***	1.535***	1.453***
	(10.14)	(9.45)	(5.31)
Mixed regime	-1.129***	-1.388***	-0.926***
	(-9.11)	(-10.21)	(-3.54)
NDC regime	-2.675***	-3.286***	-2.202***
	(-13.88)	(-13.99)	(-6.30)
Centre	0.830***	1.045***	0.448
	(7.24)	(8.68)	(1.92)
South	0.385***	0.269*	0.554**
	(3.56)	(2.34)	(2.58)
Year 2002	0.284	0.304	0.318
	(1.90)	(1.94)	(1.04)
Year 2004	0.911***	1.202***	0.529
	(6.10)	(7.52)	(1.79)

Year 2006	1.135***	1.384***	0.881**
	(7.37)	(8.33)	(2.92)
Year 2008	1.081***	1.203***	1.001**
	(6.49)	(6.90)	(2.87)
Year 2010	1.080***	1.145***	1.119**
	(6.16)	(6.22)	(3.07)
Year 2012	0.870***	1.108***	0.713
	(4.10)	(4.51)	(1.86)
Income	0.0000117***	0.0000124***	0.0000108***
	(8.28)	(7.45)	(4.40)
Constant	0.784	1.148	1.219
	(0.86)	(1.10)	(0.73)
N	15905	10005	5900
R^2	0.156	0.200	0.120

Table 14 presents OLS estimation of the relationship between private wealth and SSW for households in the sample. We drop from the sample all households where the head was not able to predict correctly his/her retirement age. The dependent variable is the wealth / income ratio. We estimate the substitutability between the dependent variable and the SSW / income ratio, controlling for age, age squared, gender , employment dummies, pension regime dummies, education and regional dummies and time dummies.

In the total sample the degree of substitutability between private wealth and SSW is estimated at -0.335 with statistical significance at 1%. This result is consistent with findings of Bottazzi et al. [2006] who found a displacing effect of -0.28 in a regression where SHIW data in the period 1989-1991 were compared with data coming from the 2000-2002 SHIW surveys. There is therefore a substitution between these two forms of wealth, but the rate Is significantly lower than 1. Increase in the expected retirement age might be an explanation of this result, since working longer implies, ceteris paribus, a reduction in saving for retirement. Wealth accumulation is positively related to age. It is also higher for public employees and for the self-employed, as well as for middle and highly educated individuals. A negative relationship with the dependent variable is displayed for individuals in the mixed and in the NDC system.

We finally split the sample between informed and uninformed, defined respectively as those households where the head has a pension error smaller or higher than | 25% |. As the table shows, the offsetting effect between private wealth and SSW is larger for the informed (-0.392) then for the uninformed (-0.296). This result displays the crucial importance of knowledge in pension policies. Individuals that are informed both on retirement age and on their future pension benefit's level seem more prepared to respond to changes in the future arrangement of the public pension system.

Conclusions

The Italian pension system experienced in the last 20 years a long series of reforms. Most of them were aimed at reducing the generosity of the system and at guaranteeing its internal sustainability, but some actually went in the opposite direction, i.e. reducing the severity of previous reforms for at least part of the population of workers. The frequency and sometimes also the sign of these reforms made the whole process somewhat confusing for many workers, but the general message that was transmitted was one of a reduction in the level of future pension benefits. Workers consequently adapted their expectations, but with delays and in an incomplete and confusing fashion: there has been a shift from a general overestimation of the generosity of the future pension towards a greater tendency to underestimate it, particularly because many do not realize that the retirement age will continuously be posponed with increasing life expectancy. At the end of a turbulent period of reforms, many workers still are not able to correctly predict the level of the pension benefit or their correct retirement age, in particular in the last few years, also due to the effect of the economic crisis. The expected level of social security wealth markedly decreased in the last decade as well, with private wealth still showing a significant degree of substitutability with it.

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Appendix A: Computation rules for the pension benefit

Below we describe the different rules prevailing under the DB, the mixed and the NDC schemes. The population in the model has been divided into three groups according to seniority in 1995: DB, mixed and NDC.

The computation rule for pension benefit of those workers who are under the DB system is summarized by the formula:

$$P_{DB} = r^*(N_1W_1 + N_2W_2) \qquad (1)$$

where r is an accrual rate, N_1 and N_2 represent the years of contribution before and after 1992 respectively, W_1 and W_2 represent the pensionable earnings used for computing pension installment, for the contributions paid before and after 1992 respectively.

The terms r and W in the DB formula vary according to pension scheme and to the amount of pensionable earnings. In particular, W_1 is equal to the last yearly-earning for employees in the public sector; the average of the last five or ten pensionable yearly-earnings for those employed in the private sector and self-employed workers respectively. W_2 is the mean computed over the last ten years of positive earnings for public and private sector employees and over the last 15 years for self-employed workers. The accrual rate r is equal to 2% for the pensionable earnings bracket between 0 and 42,111 Euros (2009 prices) and it decreases with earnings level down progressively to a value of 1.1% for the pensionable earnings bracket over 55,976 Euros (2009 prices).

For workers under the mixed regime, the old age pension benefit is determined as the sum of two components:

$$P_{mixed} = P_A + P_B \qquad (2)$$

where the general rule for determining P_A is similar to the formula used in the DB regime for the contribution paid before 1995, while the second, P_B is computed according to a NDC rule on the contributions paid after 1995. Nevertheless, in the "mixed" regime the pensionable earnings for the contributions paid between 1992 and 1995 is determined differently, as the average yearly earnings indexed to 1% yearly rate according to a simple compounding rule. The P_B term of the mixed pension is figured according to the NDC rule of equation (3).

Old-age pension in the NDC system is computed as:

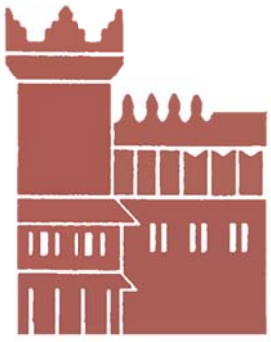
$$P_{NDC} = D_x * MC \qquad (3)$$

where D_X is a conversion factor that varies with retirement age (x) so as to guarantee a quasi-actuarial equity between the present value of paid contributions and the present value of expected pension benefits[2]. *MC* is the total of contributions accrued during the whole working life in proportion to gross earnings (33% for employees and 24% for self-employed), capitalized at the rate of growth of nominal GDP. The yearly contribution is computed as a share of the gross wage for employees and gross income for the self-employed. The contribution rate is set at 33% for employees and 24% for self-employed workers. A contributory cap is set at 91,507 Euros (2009 prices). At least five years of contributions are required to claim an old age pension if the corresponding pension installment exceeds the amount of social allowance increased by 20%. The latter condition is not applied for those who will retire after the statutory retirement age.

[2] The conversion factor has been computed as the result of the following simplified formula:

$$D_X = \sum_{t=0}^{w-x-1} \frac{l^v_{x+t}}{l_x}(1+i)^{-t} + \beta \sum_{t=0}^{w-x-1} \left(\frac{l^v_{x+t}}{l_x} q^v_{x+t} a^F_{x+t+1} (1+i)^{-(t+1)} \right)$$

found in Caselli et al (2003) where w is the maximum life span (set equal to 100 years); $\frac{l^v_{x+t}}{l_x}$ is the pensioner's probability at age x of being alive at age $x + t$; i is the annual real discount rate (set equal to 1.5 per cent, assumed to be equal to the long-run annual growth rate of Gross Domestic Product in real terms); β (set equal to 0.54 for a male pensioner and 0.42 for a female one) is the fraction of the pension paid out the surviving spouse (if there is any); q^v_{x+t} is the probability of dying between age $x + t$ and age $x + t + 1$; a^F_{x+t+1} is the expected present value of a real annuity of one dollar paid to the surviving spouse (if there is any) after the pensioner's death at age $x + t + 1$.



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