**The role of pension funds in complementing**

**the social security coverage provided by PAYG first pillar:**

**Evidences from Italian data**

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**Abstract**

In this paper, we highlight the importance of strengthening the role of the second pillar in an overall balanced social security system. In particular, in countries like Italy, characterized by a considerable Pay-As-You-Go first pillar and a high demographic dependency ratio, private pension funds play a key role since they could provide a crucial supplement to benefits from the mandatory pensions. Given the declining role of public pension coverage, the assessment of function of the second pillar is a key issue to assess whether a pension system is sustainable. Using Italian data, namely the Bank of Italy SHIW, we estimate the optimal net replacement rate needed to maintain one’s standard of living in old age and in particular the level of pension coverage that should be guaranteed by private pension arrangements. Estimates are provided according to the fixed effect and the fixed effect ordered logit empirical models and display an optimal net replacement rate ranging from 85.60% to 86.02% depending if we use the former or the latter. Specifically, households’ wealth appears to be a key variable in supporting the standard of living in old age since the optimal replacement rate reduces as wealth increases.

**JEL classification:** D1, H55, J32.

**Keywords:** replacement rate, pension funds, social security, pension coverage, living standard.

1. **Introduction**

The remarkable aging process that industrialized countries are currently facing is mainly driven by declining fertility and increasing longevity. The observed increases in the median age of the population, which is estimated to continue rising over the years ahead[[1]](#footnote-1), have resulted in an increase in the old age dependency ratio[[2]](#footnote-2). In fact, according to OECD (2015), the old age dependency ratio, equal to 14 in 1950, reached the value of 28 in 2015 and it is projected to nearly double in 2075 reaching the value of 55.

In particular, the increasing old age dependency ratio should be taken carefully into account by countries with Pay-As-You-Go (PAYG) public pensions. In a PAYG system, active population finance pensions of same-period retirees based on the promise that they will receive a similar provision by future workers. Due to this transfer mechanism across generations, a decline in population growth may jeopardize the financial sustainability of the system itself and its implicit fairness among age classes[[3]](#footnote-3).

According to some prominent economists[[4]](#footnote-4) and EC (2015) the most credited solution to the sustainability problem originated by the PAYG system in an aging economy may be a partial (or fully) privatization of social security, i.e. the shift to a fully funded system where each individual builds up his/her own pension by contributing to a personal account. We instead believe that the risk of pension retirement provision is better addressed by building up a multi-pillar system, where the unfunded public pension system goes with funded private ones. It is largely acknowledged by major international organizations the importance and the key role to complement social security system with a private fully funded second pillar, since private pension schemes can provide a crucial supplement to benefits from the mandatory one.

By focusing on the Italian reality, public pensions are organized according to the PAYG notional defined contribution scheme (NDC)[[5]](#footnote-5), whose key characteristic is the provision of pension benefits that bear an actuarial relationship to individual lifetime contributions[[6]](#footnote-6). Conversely, supplementary pensions work according to the fully funded scheme (pension funds) and are built by joining one or more pension arrangements available in the system. In fact, the Italian complementary social security offers different plans that are mainly organized according to the defined contribution scheme.[[7]](#footnote-7) In particular, there are occupational (closed) pension funds that target workers who meet specific qualifications established by the funds regulations; open funds, addressing workers and non-workers; and individual pension plans mainly issued by insurance companies, where the participation is extended to all individuals irrespective on the employment status.[[8]](#footnote-8)

During the 1970s and 1980s, Italy experienced a process of strong aging population and a slowdown in growth, which led public pension expenditure to a very high and unsustainable level (Fornero and Castellino 2001). In order to provide corrections to the Italian social security system and stabilize the long-run ratio of pension expenditure to GDP, Italy has gone through several pension reforms over the last two decades. Amongst others, the gradual shift to a fully NDC scheme, the revision of the NDC transformation coefficients (which account for the increase in life expectancy), the introduction of an automatic link between life expectancy and pensionable age, the reduction in benefits for future retirees, the termination of seniority pensions scheme and the increase in the age at which people can first claim pensions. According to (OECD 2015), (EC 2015), and (MEF 2016), these measures succeeded in counteracting the increase of public pension spending in the long run. In fact, according to official estimates, pension expenditure is now forecasted to decrease slightly until 2060.[[9]](#footnote-9)

In addition to this huge first pillar, Italy is unfortunately still characterized by an insufficient complementary social security provision that according to COVIP (2016) at the end of 2015 counts 7.2 million members (almost 28% of the labour force). Particularly, when compared with other pension fund systems in OECD countries, the Italian system appears to be still not mature and fully developed.

The relevance of a robust second pillar is of particular importance when considering the replacement rate, which is the ratio of pension benefits to preretirement earnings.

The forecasted reduction in future public pension spending did not translate into an appreciable reduction in replacement rates because the process of increasing the average retirement age exerts an expansive effect on pension levels, thus contributing to an improvement in pension adequacy under the NDC scheme. Estimates provided by the Ministry of Economy and Finance (MEF 2016) confirm this process. According to such estimates, when the contribution period is kept constant over time and equal to 38 years, the gross (net) replacement rate of private sector employees in the national baseline scenario is forecasted to be equal to 68.7% (78%) in 2020, 61.3% (70.8%) in 2040, and 63.1% (72.5%) in 2060.[[10]](#footnote-10)

However, for the current generation of young workers and more in general for those with a discontinuous and fragmented working career, the NDC plan will hardly be able to grant adequate pension benefit throughout retirement. Individuals entitled to NDC pensions need to work for a long period of time in order to receive an adequate public replacement rate. If they are not able to do so, they will be forced to reduce their standards of living during retirement. Therefore, for this aim, the role of pension funds in the near futurewill be crucial in order to provide an adequate integration of the coverage supplied by the first pillar.

According to COVIP (*Delibera* 16/3/2012), the Italian pension funds supervisory authority, retirement plans have to support individuals in achieving an adequate standard of living during retirement. More specifically, COVIP encourages pension funds to set as their main target the definition of the level of social security coverage that they want to provide for their members given the replacement rate granted by the first pillar. It follows that the investment strategy must be compliant with the objective of being a source of income support in old age, i.e. giving the desired level of economic coverage of each pension fund the investment strategy needs to be defined accordingly.

Pension funds can benefit from this paper since we provide them with the crucial information regarding the optimal net replacement rate that they can use as a starting point for the definition of their investment strategies.

In this paper, we estimate the desired substitution rate from the Survey on Household Income and Wealth panel data of Bank of Italy. The aim of our exercise is to calculate what is the target of the social security coverage that pension funds should provide in order to reach an optimal fully social security coverage. Giving the current difficulties of pension funds in assessing their potential role in integrating the benefit provided by the first pillar, our empirical analysis takes into account the specific characteristics of the population under observation and provides very informative and useful results.

The paper proceeds as follows. Section 2 presents the methodology and data sources while Section 3 illustrates and discusses the results of the two empirical models used in the analysis. Finally, Section 4 provides some policy recommendations and concludes.

1. **Methodology**

In this paper, we conduct an empirical analysis where information relative to whether individuals perceive their income before and after retirement to be adequate for their needs is used to determine the optimal net replacement rate needed to maintain one’s standard of living in old age. The definition of the resources required to maintain one’s standard of living in retirement is relevant for both policy makers providing PAYG public pensions and private pension funds since they share the provision of income support in old age as their primary goal.

In our analysis, we follow the approach applied by Dudel et al. (2016) since we find their definition of a net replacement rate resulting from an empirical analysis that takes into account the specific characteristics of the population under observation very useful and appropriate.

We draw on the Survey on Household Income and Wealth (SHIW), a representative panel survey conducted by the Bank of Italy every two years with the scope of gathering information on the economic and financial behaviour of randomly selected Italian households.[[11]](#footnote-11) In particular, we conduct our analysis by relying on the survey question on how the available household income allows individuals to handle monthly economic expenses without any difficulties on a scale of 1 (lowest) to 6 (highest). [[12]](#footnote-12)

Notably, since our variable of interest is measured on a scale, by following the argumentation of Dudel et al. (2016) we can interpret it as a cardinal or ordinal variable. From this it follows that the empirical model used to estimate the optimal replacement rate is the fixed effect (FE) when the perception of own household income is intended to be a cardinal measure, and the fixed effect ordered logit (FEOL), proposed by Baetschmann, Staub, and Winkelmann (2015), when we assume the ordinal measure.[[13]](#footnote-13)

The reference model for our estimates is the following:

 (1)

Where indicate how individual at time perceives his/her household income in terms of ability to support his/her lifestyle, is the logarithm of individual net income at time , is a dummy taking the value 1 for pensioners and 0 otherwise, is a column vector of socio-demographic characteristics, represents unobserved heterogeneity of individuals, and is the error term.

As explained by Dudel et al. (2016), given the parameter estimates and , by taking two individuals and that differ in their retirement status and income level, i.e. by taking one pensioner and one non-pensioner that share the same socio-economic characteristics (), we can equate the two versions of Eq. () and solve for to obtain the optimal net replacement rate:

 (2)

In our analysis, we apply the above-mentioned empirical models, the FE and the FEOL with four main specifications all referring to respondents in six biennial SHIW waves for the years 2004-2014, i.e. a sample comprising 25,969 households corresponding to 81,856 individuals.[[14]](#footnote-14) We first conduct our analysis over the entire sample. Subsequently, we restrict the analysis only to those individuals who retired within the six waves. Finally, we add the constraint of minimum yearly income that is set at 6,000 Euros and at 8,000 Euros. In particular, the former ceiling refers to approximately the annual social pension in Italy that in 2017 corresponds to a yearly base-case benefit of 5,825 Euro. Conversely, the latter is related to the no-tax area limit for Italian employees. Notably, the definition of living standards in old age necessarily requires the introduction of a minimum income threshold. In fact, individuals entitled to very low benefits, in the example above benefits lower that the annual social pension or the no-tax are limit, are very likely to rely on other income sources or other people earnings.

Irrespective of the estimation technique and the specification, in all models we include log net individual income and a dummy variable taking the value 1 if pensioner[[15]](#footnote-15) and 0 otherwise. The regressors are age (four main classes), a dummy variable for higher educational attainment (bachelor, master and/or PhD), number of household’s members, number of income earners within each household, and net wealth (related to income).

1. **Results and discussion**

Estimates obtained with the FE and the FEOL empirical models are presented in Table I. In particular, if we consider the last sample, namely the one that includes individuals retired within the period 2004-2014 with an income above 8000 Euros, the coefficient of log income is equal to 0.587 (standard error of 0.056) and to 1.489 (standard error of 0.159) in the FE and FEOL models respectively. Moreover, the coefficients indicating the pensioner status is equal to 0.091 (standard error of 0.032) and to 0.224 (standard error of 0.079) in the FE and FEOL estimates respectively. These results yields an optimal net replacement rate that ranges between 85.60% and 86.02% depending on whether we consider the individuals’ perception of their own income to be adequate for their needs as a cardinal or ordinal variable, and thus depending on whether we apply the FE or the FEOL.

In addition to these standard results, we apply to the FE estimates the sample weights available in the six-waves SHIW survey, so to eliminate potential distortions in the distribution of the population in the sample with respect to the entire universe. Results are displayed in Table II and are perfectly in line with the ones already discussed. In this case, the net replacement rates are slightly bigger. By taking again the last sample, were we consider individuals who retired in the period 2004-2014 owning an income above 8,000 Euros, the ratio of pension benefits to preretirement earnings is 86.31%.

**Table I: Main results**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | **Optimal Net Replacement rate** | **# Ind.** | **# Obs.** |
|  | *Coeff./se* | *Coeff./se* |  |  |  |
| **FE***All sample* | 0.238\*\*\*(0.02) | 0.056\*\*(0.025) | 78.98% | 24,431 | 43,361 |
| **FEOL***All sample* | 0.729\*\*\*(0.068) | 0.152\*\*(0.064) | 81.19% | 24,431 | 43,361 |
| **FE***Retirement in 2004-2014* | 0.229\*\*\*(0.037) | 0.059\*\*(0.027) | 77.47% | 1,436 | 5,817 |
| **FEOL***Retirement in 2004-2014* | 0.809\*\*\*(0.145) | 0.161\*\*(0.069) | 81.99% | 1,436 | 5,817 |
| **FE***Retirement in 2004-2014 and income above 6,000 Euros*  | 0.565\*\*\*(0.051) | 0.079\*\*\*(0.03) | 86.94% | 1,391 | 5,316 |
| **FEOL***Retirement in 2004-2014 and income above 6,000 Euros*  | 1.415\*\*\*(0.143) | 0.194\*\*(0.076) | 87.21% | 1,391 | 5,316 |
| **FE***Retirement in 2004-2014 and income above 8,000 Euros*  | 0.587\*\*\*(0.056) | 0.091\*\*\*(0.032) | 85.60% | 1,329 | 4,968 |
| **FEOL***Retirement in 2004-2014 and income above 8,000 Euros*  | 1.489\*\*\*(0.159) | 0.224\*\*\*(0.079) | 86.02% | 1,329 | 4,968 |

\*=10%,\*\*=5%,\*\*\*=1%

**Table II: Fixed effect estimates with sample weights**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | **Optimal Net Replacement rate** | **# Obs.** |
|  | *Coeff./se* | *Coeff./se* |  |  |
| **FE:** *All sample* | 0.240\*\*\*(0.03) | 0.043(0.04) | 83.46% | 43,361 |
| **FE***Retirement in 2004-2014* | 0.243\*\*\*(0.033) | 0.052(0.033) | 80.77% | 5,817 |
| **FE***Retirement in 2004-2014 and income above 6,000 Euros*  | 0.561\*\*\*(0.065) | 0.076\*\*(0.037) | 87.38% | 5,316 |
| **FE***Retirement in 2004-2014 and income above 8,000 Euros*  | 0.584\*\*\*(0.071) | 0.086\*\*(0.039) | 86.31% | 4,968 |

\*=10%,\*\*=5%,\*\*\*=1%

By definition, the net replacement rate relates the pension to preretirement earnings, however, since the individual’s standard of living in retirement depends not only on current earnings but also on the overall resources accumulated during the entire lifetime, we study how the optimal net replacement rate varies as the individual’s wealth changes. In fact, as a further analysis, we apply the FE model to individuals retired in the sample period 2004-2014 by considering four dummies representing the different quantiles of the wealth distribution.[[16]](#footnote-16) According to the results presented in Table III, as individuals’ wealth increases the coefficient of log income is decreasing from 0.527 (standard error of 0.101) to 0.140 (standard error of 0.036). Moreover, the coefficient of the pensioner status is equal to 0.065 (standard error of 0.034). It follows that the optimal replacement rate decreases from 88.47% to 63.07% as we move from the first (poorer) to the last (richer) wealth class, i.e. the optimal net replacement rate reduces as wealth increases. The explanation is straightforward, to maintain the standard of living in retirement wealthy individuals are able to rely on different assets constituting their overall heritage, rather than the single preretirement earnings, which is the income source used to define the optimal net replacement rate.

**Table III: Fixed effect estimates with wealth classes and sample weights (retirement in 2004-2014)**

|  |  |  |
| --- | --- | --- |
|  |  | **# Obs.** |
| Income \* dummy wealth class I | Income \* dummy wealth class II | Income \* dummy wealth class III | Income \* dummy wealth class IV |  |  |
| *Coeff./se* | *Coeff./se* | *Coeff./se* | *Coeff./se* | *Coeff./se* |  |
| 0.527\*\*\*(0.101) | 0.524\*\*\*(0.102) | 0.284\*\*\*(0.09) | 0.140\*\*\*(0.036) | 0.065\*(0.034) | 5,817 |
| \*=10%,\*\*=5%,\*\*\*=1% |
| **Optimal Net Replacement rate** |
| Wealth class I(0-5.9 times income) | Wealth class II(6-11.8 times income) | Wealth class III(11.9-22.5 times income) | Wealth class IV(over 22.5 times income) |
| 88.47% | 88.41% | 79.67% | 63.07% |

1. **Conclusions and policy implications**

In this paper, by relying on the Survey of Household Income and Wealth of Bank of Italy, we conduct an empirical analysis where information relative to whether individuals perceive their income before and after retirement to be adequate for their needs is used to determine the optimal net replacement rate needed to maintain one’s standard of living in old age.

By following the approach applied by Dudel et al. (2016), our estimates are obtained with the fixed effect and the fixed effect ordered logit empirical models. The resulting optimal net replacement rate ranges from 85.60% to 86.02% depending on whether we use the former or the latter model.

The most important and significant variables are the number of household’s members and the number of income earners within each households. Moreover, households’ wealth appears to be a key variable in supporting the standard of living in old age and the optimal replacement rate reduces from 88.47% to 63.07% as wealth increases.

Our paper could be very helpful to pension funds since we are providing them with the crucial information regarding the optimal net replacement rate that they can use for the definition of their investment strategies. In this regard, official estimates of the Ministry of Economy and Finance (MEF, 2016) show an expected decrease in the net replacement rate provided by the first pillar that in the base case scenario goes from 78% in 2020 to 72.5% in 2060. If we assume constant needs of the Italian retirees in the years ahead, it becomes clear that the need of strengthening the Italian second pillar should be one of the country primary goals since it has to provide a supplementary coverage of 15%-20%.

In particular, even though the Italian private second pillar has grown significantly in the last 10 years, reaching almost the 10% of GDP, it has to be further developed, even in terms of increasing the participation rate (currently below 30% in 2015) to be in line with other OECD countries.

**Appendix**

**Table AI: Fixed effect estimates**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | **All sample**  | **Retirement in 2004-2014** | **Retirement in 2004-2014 and income above 6,000 Euros** | **Retirement in 2004-2014 and income above 8,000 Euros** |
|   | *Coeff./se* | *Coeff./se* | *Coeff./se* | *Coeff./se* |
| Net income (log) | 0.238\*\*\* | 0.229\*\*\* | 0.565\*\*\* | 0.587\*\*\* |
|  | 0.02 | 0.037 | 0.051 | 0.056 |
| Pensioner dummy | 0.056\*\* | 0.059\*\* | 0.079\*\*\* | 0.091\*\*\* |
|  | 0.025 | 0.027 | 0.03 | 0.032 |
| Age: Up to 60 | 0 | 0 | 0 | 0 |
|  | . | . | . | . |
| Age: 61-65 years | 0.031 | 0.004 | 0.017 | 0.019 |
|  | 0.027 | 0.049 | 0.05 | 0.052 |
| Age: 66-70 years | 0.001 | -0.011 | 0.018 | 0.01 |
|  | 0.039 | 0.077 | 0.08 | 0.083 |
| Age: Above 70 | -0.025 | -0.014 | 0.059 | 0.059 |
|  | 0.052 | 0.111 | 0.117 | 0.12 |
| Number of household’s members | -0.113\*\*\* | -0.120\*\*\* | -0.148\*\*\* | -0.164\*\*\* |
|  | 0.019 | 0.044 | 0.046 | 0.047 |
| Number of income earners within household | 0.216\*\*\* | 0.231\*\*\* | 0.247\*\*\* | 0.242\*\*\* |
|  | 0.017 | 0.034 | 0.035 | 0.037 |
| Higher educational attainment dummy | 0.268\* | 0.239 | 0.211 | 0.216 |
|  | 0.142 | 0.155 | 0.155 | 0.157 |
| Net wealth (related to income) | 0 | 0.000\*\*\* | 0.003\*\*\* | 0.002\* |
|  | 0 | 0 | 0.001 | 0.001 |
| Wave 2004 | 0 | 0 | 0 | 0 |
|  | . | . | . | . |
| Wave 2006 | -0.031\* | 0.003 | 0.024 | 0.016 |
|  | 0.018 | 0.037 | 0.042 | 0.043 |
| Wave 2008 | -0.028 | -0.007 | -0.035 | -0.048 |
|  | 0.022 | 0.045 | 0.049 | 0.05 |
| Wave 2010 | 0.005 | 0.054 | 0.025 | 0.007 |
|  | 0.025 | 0.054 | 0.057 | 0.059 |
| Wave 2012 | -0.130\*\*\* | -0.085 | -0.144\*\* | -0.165\*\* |
|  | 0.028 | 0.063 | 0.067 | 0.07 |
| Wave 2014 | -0.111\*\*\* | -0.107 | -0.155\* | -0.186\*\* |
|  | 0.033 | 0.075 | 0.08 | 0.083 |
| \_cons | 0.763\*\*\* | 0.840\*\* | -2.482\*\*\* | -2.613\*\*\* |
|  | 0.199 | 0.376 | 0.516 | 0.569 |
| Observations | 43361 | 5817 | 5316 | 4968 |
| Individuals | 24431 | 1436 | 1391 | 1329 |
| **Optimal net replacement rate** | **78.98%** | **77.47%** | **86.94%** | **85.60%** |

\*=10%,\*\*=5%,\*\*\*=1%

**Table AII: Fixed effect ordered logit estimates**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | **All sample**  | **Retirement in 2004-2014** | **Retirement in 2004-2014 and income above 6,000 Euros** | **Retirement in 2004-2014 and income above 8,000 Euros** |
|   | *Coeff./se* | *Coeff./se* | *Coeff./se* | *Coeff./se* |
| Net income (log) | 0.729\*\*\* | 0.809\*\*\* | 1.415\*\*\* | 1.489\*\*\* |
|  | 0.068 | 0.145 | 0.143 | 0.159 |
| Pensioner dummy | 0.152\*\* | 0.161\*\* | 0.194\*\* | 0.224\*\*\* |
|  | 0.064 | 0.069 | 0.076 | 0.079 |
| Age: Up to 60 | 0 | 0 | 0 | 0 |
|  | . | . | . | . |
| Age: 61-65 years | 0.081 | 0.005 | 0.031 | 0.039 |
|  | 0.071 | 0.123 | 0.129 | 0.134 |
| Age: 66-70 years | 0.003 | -0.014 | 0.019 | -0.01 |
|  | 0.105 | 0.194 | 0.208 | 0.219 |
| Age: Above 70 | -0.077 | -0.031 | 0.082 | 0.088 |
|  | 0.142 | 0.282 | 0.304 | 0.314 |
| Number of household’s members | -0.304\*\*\* | -0.288\*\*\* | -0.360\*\*\* | -0.392\*\*\* |
|  | 0.048 | 0.099 | 0.105 | 0.107 |
| Number of income earners within household | 0.567\*\*\* | 0.591\*\*\* | 0.639\*\*\* | 0.628\*\*\* |
|  | 0.044 | 0.088 | 0.095 | 0.099 |
| Higher educational attainment dummy | 0.764\* | 0.895\* | 0.857\* | 0.899\* |
|  | 0.444 | 0.514 | 0.495 | 0.485 |
| Net wealth (related to income) | 0 | 0.003 | 0.008\*\* | 0.005 |
|  | 0.001 | 0.003 | 0.003 | 0.003 |
| Wave 2004 | 0 | 0 | 0 | 0 |
|  | . | . | . | . |
| Wave 2006 | -0.095\* | 0.001 | 0.073 | 0.054 |
|  | 0.049 | 0.097 | 0.109 | 0.113 |
| Wave 2008 | -0.088 | -0.022 | -0.058 | -0.075 |
|  | 0.059 | 0.118 | 0.127 | 0.131 |
| Wave 2010 | 0.004 | 0.121 | 0.078 | 0.043 |
|  | 0.067 | 0.139 | 0.148 | 0.151 |
| Wave 2012 | -0.356\*\*\* | -0.213 | -0.326\* | -0.371\*\* |
|  | 0.076 | 0.161 | 0.172 | 0.18 |
| Wave 2014 | -0.307\*\*\* | -0.271 | -0.350\* | -0.412\* |
|  | 0.089 | 0.193 | 0.205 | 0.214 |
| Observations | 34790 | 8956 | 8087 | 7422 |
| Individuals | . | . | . | . |
| **Optimal net replacement rate** | **81.19%** | **81.99%** | **87.21%** | **86.02%** |

\*=10%,\*\*=5%,\*\*\*=1%

**Table AIII: Fixed effect estimates with sample weights**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | **All sample**  | **Retirement in 2004-2014** | **Retirement in 2004-2014 and income above 6,000 Euros** | **Retirement in 2004-2014 and income above 8,000 Euros** |
|   | *Coeff./se* | *Coeff./se* | *Coeff./se* | *Coeff./se* |
| Net income (log) | 0.240\*\*\* | 0.243\*\*\* | 0.561\*\*\* | 0.584\*\*\* |
|  | 0.03 | 0.033 | 0.065 | 0.071 |
| Pensioner dummy | 0.043 | 0.052 | 0.076\*\* | 0.086\*\* |
|  | 0.04 | 0.033 | 0.037 | 0.039 |
| Age: Up to 60 | 0 | 0 | 0 | 0 |
|  | . | . | . | . |
| Age: 61-65 years | 0.026 | 0.006 | 0.007 | 0.021 |
|  | 0.043 | 0.058 | 0.062 | 0.064 |
| Age: 66-70 years | -0.001 | 0.02 | 0.041 | 0.064 |
|  | 0.064 | 0.096 | 0.102 | 0.107 |
| Age: Above 70 | -0.025 | 0.061 | 0.132 | 0.185 |
|  | 0.086 | 0.139 | 0.148 | 0.152 |
| Number of household’s members | -0.076\*\* | -0.096\* | -0.125\*\* | -0.131\*\* |
|  | 0.031 | 0.051 | 0.054 | 0.056 |
| Number of income earners within household | 0.186\*\*\* | 0.189\*\*\* | 0.204\*\*\* | 0.191\*\*\* |
|  | 0.026 | 0.042 | 0.045 | 0.046 |
| Higher educational attainment dummy | 0.258 | 0.139 | 0.118 | 0.128 |
|  | 0.214 | 0.215 | 0.21 | 0.21 |
| Net wealth (related to income) | 0 | 0.000\*\* | 0.003\*\* | 0.002 |
|  | 0 | 0 | 0.001 | 0.002 |
| Wave 2004 | 0 | 0 | 0 | 0 |
|  | . | . | . | . |
| Wave 2006 | -0.021 | -0.04 | -0.01 | -0.011 |
|  | 0.032 | 0.049 | 0.054 | 0.056 |
| Wave 2008 | -0.025 | -0.01 | -0.041 | -0.046 |
|  | 0.036 | 0.057 | 0.061 | 0.064 |
| Wave 2010 | 0.025 | 0.02 | -0.008 | -0.021 |
|  | 0.042 | 0.067 | 0.072 | 0.075 |
| Wave 2012 | -0.139\*\*\* | -0.160\* | -0.219\*\* | -0.239\*\* |
|  | 0.047 | 0.082 | 0.088 | 0.093 |
| Wave 2014 | -0.119\*\* | -0.177\* | -0.229\*\* | -0.255\*\* |
|  | 0.054 | 0.099 | 0.105 | 0.11 |
| \_cons | 0.698\*\* | 0.738\*\* | -2.378\*\*\* | -2.549\*\*\* |
|  | 0.3 | 0.349 | 0.658 | 0.725 |
| Observations | 43361 | 5817 | 5316 | 4968 |
| Individuals | . | . | . | . |
| **Optimal net replacement rate** | **83.46%** | **80.77%** | **87.38%** | **86.31%** |

\*=10%,\*\*=5%,\*\*\*=1%

**Table AIV: Fixed effect with wealth classes and sample weights (retirement in 2004-2014)**

|  |  |  |  |
| --- | --- | --- | --- |
|   | *Coeff./se* |  | **Optimal net replacement rate** |
| Net income (log) \* dummy wealth class I | 0.527\*\*\* |  | Wealth class I | **88.47%** |
|  | 0.101 |  | Wealth class II | **88.41%** |
| Net income (log) \* dummy wealth class II | 0.524\*\*\* |  | Wealth class III | **79.67%** |
|  | 0.102 |  | Wealth class IV | **63.07%** |
| Net income (log) \* dummy wealth class III | 0.284\*\*\* |  |  |  |
|  | 0.09 |  |  |  |
| Net income (log) \* dummy wealth class IV | 0.140\*\*\* |  |  |  |
|  | 0.036 |  |  |  |
| Pensioner dummy | 0.065\* |  |  |  |
|  | 0.034 |  |  |  |
| Age: Up to 60 | 0 |  |  |  |
|  | . |  |  |  |
| Age: 61-65 years | 0.009 |  |  |  |
|  | 0.058 |  |  |  |
| Age: 66-70 years | 0.035 |  |  |  |
|  | 0.096 |  |  |  |
| Age: Above 70 | 0.077 |  |  |  |
|  | 0.139 |  |  |  |
| Number of household’s members | -0.097\* |  |  |  |
|  | 0.051 |  |  |  |
| Number of income earners within household | 0.199\*\*\* |  |  |  |
|  | 0.042 |  |  |  |
| Higher educational attainment dummy | 0.14 |  |  |  |
|  | 0.212 |  |  |  |
| Net wealth (related to income) | 0.000\*\* |  |  |  |
|  | 0 |  |  |  |
| Wave 2004 | 0 |  |  |  |
|  | . |  |  |  |
| Wave 2006 | -0.044 |  |  |  |
|  | 0.049 |  |  |  |
| Wave 2008 | -0.019 |  |  |  |
|  | 0.057 |  |  |  |
| Wave 2010 | 0.009 |  |  |  |
|  | 0.067 |  |  |  |
| Wave 2012 | -0.169\*\* |  |  |  |
|  | 0.082 |  |  |  |
| Wave 2014 | -0.189\* |  |  |  |
|  | 0.099 |  |  |  |
| \_cons | -0.448 |  |  |  |
|  | 0.445 |  |  |  |
| Observations | 5817 |  |  |  |
| Individuals | . |  |  |  |

\*=10%,\*\*=5%,\*\*\*=1%

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1. According to OECD (2015), the number of elderly people is projected to account for an increasing share of the total world population passing from 8% in 2015 to almost 18% by 2050, and from 16% to 27% in OECD countries. Moreover, in the OECD, the share of the population older than 75 will be similar in 2050 to the share older than 65 today. [↑](#footnote-ref-1)
2. The old age dependency ratio is the ratio of older dependents (people older than 64) to the working-age population (those aged 15-64). According to OECD (2015), in 2015, the demographically oldest OECD countries were Japan and Italy with an old age dependency ratio equal to 47 and 37 respectively. [↑](#footnote-ref-2)
3. According to Samuelson (1958), Aaron (1966), and Samuelson (1975), the PAYG system is desirable only when each generations maintain positive real rates of return on contributions, which happens so long as real earnings growth and population growth remain positive. [↑](#footnote-ref-3)
4. See among others, Feldstein (1995, 1996, 1998, 2005) and Kotlikoff (1996, 1998) and for an opposite view, Diamond (1977, 2005), Breyer (1989), Homburg (1990). [↑](#footnote-ref-4)
5. NDC pensions were fully introduced after 1/1/1996. However, pensioners with more than 18 years of contribution at 31/12/1995 are still receiving a defined benefit pension, and pensioners with less than 18 years of contribution at 12/31/1995 are still obtaining a mixed pension, i.e. a benefit computed according to both schemes, defined benefit and NDC. [↑](#footnote-ref-5)
6. See for example Holzmann and Palmer (2006). [↑](#footnote-ref-6)
7. Differently from the defined benefit funded pensions, that pre-commit to pay a defined benefit no matter on the value of assets accumulated, in defined contribution scheme, the retirement benefit, given life expectancy and the interest rate, is determined only by the amount of contributions paid into the fund. In fact, due to the solvency risk embodied in the working mechanism of defined benefit plans, in Italy subscriptions to these schemes are no more available since April 28, 1993 (Law 124/1993). [↑](#footnote-ref-7)
8. See Marè (2011). [↑](#footnote-ref-8)
9. In Italy, the recent increases in eligibility requirements for retirement should determine a reduction in the ratio between pension expenditure and GDP in the period up to 2029, when it should reach the value of 14.9%. In the following years, due to increases in the ratio of pensions to employees brought about by the aging process, the ratio rises to 15.5% in 2044. Thereafter, as a result of the full application of the NDC scheme, pension expenditure declines rapidly in terms of GDP to 13.7% in 2060 (MEF 2016). [↑](#footnote-ref-9)
10. Own estimates of the net/gross replacement rate are in line with those of MEF (2016). [↑](#footnote-ref-10)
11. https://www.bancaditalia.it/statistiche/tematiche/indagini-famiglie-imprese/bilanci-famiglie [↑](#footnote-ref-11)
12. Dudel et al. (2016) use a slightly different dependent variable, namely the satisfaction with household’s income. [↑](#footnote-ref-12)
13. We conduct several tests on the validity of the random effect model as an additional model. Results show the presence of possible unobserved heterogeneity across groups implying that the FE is preferable. [↑](#footnote-ref-13)
14. Outlier observations have been removed from the final sample in order to obtain robust coefficients’ point estimates. In total, we have detected 18 outliers (less than 1% of the total sample) among those observations that produce a very large positive and very negative impact of the covariates, respectively, above the 99th percentile and below the 1th percentile. [↑](#footnote-ref-14)
15. In our analysis, the pensioners are identified as those individuals entitled to either seniority or old-age pension. We explicitly exclude from the group of retirees the individuals entitled to benefits such as social pensions, survivor pensions, and war pensions, since they are not linked to the employment status. Moreover, we exclude from the group of pensioners individuals who receive disability allowances since they refer to too specific workers’ conditions. From this, we find reasonable to study only individuals retired in the sample period (2004-2014) that are older than 50 and younger than 80. [↑](#footnote-ref-15)
16. The four wealth classes take into account the average wealth that the same individuals earned in their entire working career. The first is 0-5.9 times the income, the second is 6-11.8 times the income, the third is 11.9-22.5 times the income, and the fourth is above 22.5 times the income. [↑](#footnote-ref-16)