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Maurizio Franzini

The Transition to NDC in Italy: Assessing Distributive and Financial Effects

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THE TRANSITION TO NDC IN ITALY: ASSESSING DISTRIBUTIVE AND FINANCIAL EFFECTS*

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October 15, 2019

Abstract

The aim of this paper is to study the distributive and financial effects of the transition to the NDC rule in the pension system in Italy. We analyse the distributive question using three different perspectives: the yearly distribution of old age pension benefits; the distribution of Replacement Rates and the distribution of the Net Present Value Ratio. We document an increase of 2 percentages points in the Gini coefficient for old age pension benefits in the period 1995-2017. Investigating the dynamic of pension benefits by deciles, we find that the lowest part of the distribution has experienced a significant worsening, while the central part of the distribution has been the more advantaged. In terms of adequacy, the system provided adequate benefits. Still the DB formula realizes a small degree of progressivity. Moving to the intertemporal dimension makes clear that the transitions' design maintains the current pension benefits' distribution far from the actuarial fairness. This has important costs on the level and the dynamic of pension liabilities.

JEL Codes: D31, H55, J11

Keywords: NDC, DB, adequacy, actuarial fairness, transition mechanism

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Sintesi non tecnica

Gli effetti distributivi e finanziari della transizione al sistema contributivo in Italia

L'introduzione della regola contributiva nel calcolo delle pensioni di vecchiaia e di invalidità operata con la L. 335/95 ha modificato in maniera radicale le caratteristiche distributive, il sistema di incentivi al pensionamento e le prospettive di sostenibilità finanziaria del sistema pensionistico italiano. La decisione di applicarla pro rata, inizialmente solo ai lavoratori con meno di 18 anni di contribuzione e successivamente con la L. 214/11 a tutta la popolazione attiva, ma solo per i versamenti successivi a quelli effettuati fino al 2011, ha definito un sentiero di convergenza tuttora poco esplorato, soprattutto per quello che riguarda l'analisi delle sue conseguenze finanziarie e distributive.

Questo progetto di ricerca si propone di utilizzare le banche dati dell'Inps, in particolare quelle sui rapporti di lavoro, sugli estratti conto e quelle del casellario dei pensionati, per analizzare gli effetti finanziari e distributivi delle scelte relative alle modalità di disegno della transizione al sistema contributivo e per esplorare possibili proposte di policy che risultino più coerenti, rispetto all'attuale assetto normativo, con la logica assicurativa introdotta nel sistema pensionistico italiano.

Utilizzando le banche dati a disposizione dell'INPS abbiamo sviluppato un'analisi sull'impatto distributivo della transizione che fa riferimento a tre differenti misure di equità, misurate rispettivamente sulla distribuzione annuale delle prestazioni di vecchiaia e anzianità; sulla distribuzione dei tassi di sostituzione delle medesime e sulla distribuzione del Net Present Value Ratio.

L'analisi mostra che il sistema pensionistico italiano nel periodo 1995-2017 ha mantenuto sostanzialmente la sua capacità di ridurre la dispersione dei redditi che si crea nel mercato del lavoro. L'analisi per decili e percentili, mostra poi che la parte bassa della distribuzione ha subito maggiori costi nella fase di transizione a vantaggio soprattutto dei decili che si trovano nella parte centrale della distribuzione. In termini di adeguatezza il giudizio sul sistema pensionistico è ampiamente positivo e l'analisi per centili mostra come la regola retributiva presenti in certo grado di progressività- Gli aspetti maggiormente problematici derivano dall'analisi intertemporale. In questo caso si mostra come, durante gli anni successivi all'introduzione della regola contributiva, la scelta conservativa rispetto al concetto di diritto acquisito, abbia allontanato sensibilmente il sistema pensionistico da una situazione di equità attuariale. Questo aspetto ha determinato anche un sensibile aumento delle passività implicite create dal sistema pensionistico.

1. INTRODUCTION

PAYGO pension systems based on a Defined Benefit mechanism have been subject to important reforms during last decades. The aims of these reforms were numerous: among them, controlling financial sustainability in the face of the ageing process expected in next decades, modernizing the social security system, and rebalancing intergenerational distribution of resources were the most significant. A first line of reform's proposals suggested changing the finance mechanism, introducing a funded component into the system (Feldstein 1997, Kotlikoff 1996). Based on the argument that the long-term internal rate of return granted by a funded system is always higher than the sustainable internal rate of return offered by a PAYGO system, such a policy would have assured higher pension benefits with the same level of contributions and/or lower contributions with the same level of the future pension benefits. Accordingly, the welfare for current workers and for future pensioners after the reform could have been higher.

Looking at the real implementation of pension reforms all over the world however, a relative small number of countries chose to follow this policy suggestion, while the large majority of them modified parameters of the public pension system (accrual rate, retirement age, indexation, etc.) without changing the PAYGO structure of the system (Oecd 2016). One possible explanation for this behaviour may have been the rather disappointing performances of financial markets, which imply lower future pension benefits and a larger variability than those initially expected through the move to a funded system (Diamond 1999, Burtless 2000). Another one, perhaps even more important is the difficulty in designing a transitional phase able to introduce the funded system without hurting at least some generations. Changing the financing mechanism implies the immediate conversion of implicit liabilities, typical of the PAYGO system, into explicit ones and/or in new taxes. Even in the case that in the long term a funded pension system could assure higher internal rates of returns than a PAYGO, such a policy carries in intergenerational redistributive effects that may make difficult the realization of the policy. Changing parameters of the pension system without modifying the finance mechanism is a more feasible policy. It is equivalent to a selective restructuring of the already existing

implicit public debt (Beltrametti 1996, Holzman 2004, Franco et. al. 2006). PAYGO pension systems are mandatory. Therefore, the implementation of such a policy allows modifications of the pension contract's internal rate of return for current workers/pensioners according to their age, date of birth, productive category and other demographic or economic characteristics. Kaier and Muller (2015) for example documents the dimension of the aggregate reduction on implicit debt of policies that revised pension rules in different countries over the last decades and show a remarkable effect on the majority of countries examined.

Italy, together with a relatively small number of countries, decided to move from a PAYGO-DB system to a PAYGO-NDC one, introducing actuarial principles into its public pension system. Such a choice belongs to the group of policies that modify parameters of the pension system and not the financing method. It also has important beneficial effects on the neutrality of the system with respect to the retirement and saving decisions of insured workers (Palmer 2006a). Moreover, the opportunity to link the internal rate of return of past and current contributions to a sustainable value dramatically reduces the tax that current generations of pensioners transfer to future generations of workers or taxpayers (Settergeen 2006; Gronchi 2006).

However, moving from a DB to an NDC system requires, as well as the case of funding the system, the design of a transitional phase. Even if the transition's effects here are much less uncertain, the policy maker must choose between different options, which in fact have different redistributive, as well as financial, outcomes (Palmer 2006b). In particular, it is crucial to decide how contributions paid by current workers under the old system, i.e. before the reform's approval, generate future pension rights. Palmer (2006b) distinguishes two opposite principles: i) acquired rights; ii) contribution principle. According to the first principle, when individuals move from work to retirement during the transitional phase, the pension system acknowledges rights acquired under the old system. As a result, future pension benefits of current workers will be, for a rather long time, a weighted average of two different formulae with weight depending on the number of years that the worker has spent in the old and in the new system. According to the second principle, contributions paid under the old system should concur, together with current and future ones to the

accumulation of the notional capital used for the computation of the pension benefit according to the NDC rule.

While the first choice preserves the nature of the contract subscribed in the past by current workers, the second allows a much more fast transition to the new principle and a more intense reduction of the net tax expected to pay by future generations, especially when the old system was based on financially unsustainable parameters.

Countries that adopted an NDC system followed different routes for their transition; each of one has advantages and costs (Palmer 2006b). The Italian design of the transition is particularly generous in the recognition of acquired rights (Franco et al. 2006). This implies a very long-lasting and expensive transitional period. A rather surprising fact is the lack of empirical studies of the distributive implications of this political choice.

In order to fill this gap the main aim of this paper is to study distributive and financial effects of the actual implementation of the transition to NDC in the Italian reform. The paper has this structure. I first describe and discuss the Italian transition mechanism to NDC. Then I introduce three different concepts of equity that are useful in the evaluation of the transition's fairness. I use different administrative data from the INPS archive in order to measure different definitions of equity on real data. In the last part of the paper I also implement a procedure to evaluate the financial costs (or the potential savings) that an alternative design of the transition to NDC could have assured to the public budget from 1995 to 2017.

2. The transition to NDC in Italy

The transitional path to the NDC system designed with the 1995 reform and only lately amended in 2012, split pensioners into three different groups:

i) workers entered in the labour market after 1995 will have their future pension computed completely according to the NDC rule;

ii) workers with less than 18 year of contributions in 1995, will have their pension computed according a pro rata formula where only contributions paid after 1995

will accrue rights according to the NDC rule, while former will be considered under the more generous DB one

iii) workers with more than 18 years of contributions in 1995 will have their pension computed according a pro rata formula where only contributions paid after 2011 will accrue rights according to the NDC rule, while former will be considered under the more generous DB one.

Even if the Italian pension system was repeatedly modified in the following years, non of the subsequent interventions changed this partition. According to Palmer's classification (Palmer 2006b) the Italian transition to NDC did not consider at all the possibility to use the contribution principle and implemented a rather generous interpretation of acquired rights, especially for those that belong to the third group. Such a political choice had important consequences: i) the speed of the transition to the new scheme is particularly slow. Only starting from the third decade of the century will all new pensioners compute their pension benefit completely under the NDC formula; ii) during the long transitional phase three different kind of formulae are expected to live together, with different weight as time passes, into the population of old age pensioners.

Figure 1, based on data of the Casellario Centrale dei Pensionati of INPS summarizes the implications of the transitional design on the composition of the population of pensioners. We split our population into four different groups:

i) those who started to receive pension benefits before 1995;

ii) those who started to receive benefits after 1995 and have them computed under the DB rule for the period 1996-2011;

iii) those who started to receive benefits after 1995 and have them computed under a mixed DB-NDC formula;

iv) those who started to work after 1995 and have their benefits computed under the NDC formula.

Here Fig. 1

The continuous decrease of pensioners belonging to the first group is not a surprise. Instead, it is interesting to notice that, at the end of the observed period in 2017, the share of mixed pensioners is still considerable low, at 9%, while the share of pensioners belonging to the fourth group, those who computed their pension benefit completely under the NDC rule, is quite negligible. Overall, the DB formula de facto still dominates the composition of current pensioners, even if the Parliament introduced the NDC system 22 years ago. This is the result of the 1995's choice to guarantee to workers with at least 18 years of contributions the maintenance of the old DB more generous formula. In fact, this part of the working population has progressively reached retirement age during the last 22 years and in 2017, it amounted to more than half of current pensioners. Simplifying one could affirm that the old DB formula still crucially influences the current distributive characteristics of the Italian old age pension system. As we will see in the rest of the paper this has important implications for any equity concept used.

3. THREE PRINCIPLES OF EQUITY

In order to better explore distributive features of the Italian pension system during the transition we will consider three different possible perspectives, which imply alternative ideas of equity. Considering only old age pensions, we will measure:

i) the yearly cross sectional distribution;
ii) the replacement rates distribution;
iii) the Net Present Value Ratio distribution.

These three perspectives embrace different principles of equity for a pension system. We think that each of them is plausible: by considering the pension's distribution from different perspectives, one can enrich the knowledge on gainers and looser within the Italian old age pension schemes.

By looking at the cross sectional distribution of old age pension benefits, we are able to test the distributional features of pension benefits in each of single year from 1995 to 2017. We can also inspect how this distribution changed during the period. Far from using

these results for judging the ability of the social security system to realize vertical equity objectives we rather use them to evaluate the form of the distribution of old pension benefits, its changes and its correlation with the distribution of earnings that generated these pension benefits.

By measuring replacement rates distribution of new pensioners in different years, we can judge the ability through time of the Italian pension system to maintain a similar level of income after retirement. We are conscious that, in order to have a complete picture of the adequacy of incomes during old age, we would have needed information both on the net of income tax measure of both earnings and pensions. Moreover, a complete analysis of adequacy would require also information on all kind of revenues that contributes to determine the individual's disposable income. Still we are conscious that, especially for those who retired in the last 20 years or so, pension benefits represents the most important component of individual income. Furthermore, the replacement rates distribution helps also in evaluating the degree of progressivity of an old age pension rule: as long as the relationship between pension benefits and past earnings is negative, given equal retirement age and seniority, then the system displays the ability to reduce the dispersion of income in the transition from work to retirement.

Finally, by measuring the Net Present Value Ratio distribution for new pensioners, we analyse the actuarial fairness for those individuals that retired during the transition. As the introduction of NDC system in Italy was motivated to the idea of having a pension system based on actuarial fairness principles, we can use the distribution of NPVRs to evaluate the distance from this principle within the current population of pensioners. Moreover, since the choice of the discount rate used to compute this index is not neutral, as it encompasses different ideas of equity and sustainability, we run a sensitivity analysis, which allows formulating different possible interpretations of the trade-off between these two dimensions during the transition.

4. DATA SET USED IN THE PAPER

We use three different sources of data in order to develop our measures of equity. Data used to compute indexes of the yearly distribution of pension benefits come from the administrative archive of the pension benefits delivered by the Italian social security system (Casellario Centrale dei Pensionati) from 1995 to 2017. Covering nearly the universe of public pension benefits, this archive allow a deep inspection of the financial and distributive implications of the transition to NDC, which started in 1996. We select from the dataset individual information on old age pension benefits. We merge the same data with those containing information on yearly earnings to compute adequacy indicators. Since in this case only information of private dependent workers are disposable, we limited our analysis to the largest pension scheme, Fondo Pensioni Lavoratori Dipendenti. Lack of information on the complete working carrier of pensioners retired during the period 1995-2017 makes even more problematic the construction of intertemporal indexes. Consequently, the large part of our intertemporal distributive analysis is concentrated on the main Italian pension scheme, the one that covers private dependent workers (FPLD). For this subsection of the pensioner's population, we also use a random extraction of the Estratti Conto of workers with at least one year of contributions paid in 1995.

5. THE YEARLY DISTRIBUTION OF OLD AGE PENSION BENEFITS

In order to analyse year-by-year distributional characteristics of the old age pension system in Italy during the transition to NDC we use information from the administrative INPS archive of old age pension benefits. Data are disposable from 1995 to 2017 and they contain information on pension benefits paid by nearly all public Italian pension schemes. We make a number of preliminary adjustment on the dataset in order to clean them from information that could distort the distributive analysis. Since our preferred dimension is the yearly benefit, we excluded pension benefits that are not paid for at least 12 month in a year because of death, or because they started to be paid during the year. We also excluded from the sample pension benefits with an amount lower than 100 yearly Euro, and supplementary old age pension benefits and other minor benefits.

Table 1 below reports a representation of the population's composition in some years of the observed period.

Here Table 1

Data in the archive allows us to distinguish between old age, anticipated and early retirement benefits. We have also information on the year of retirement, on the date of birth of pensioner, on gender, on the category and on the managing pension institution. Benefits' amount is disposable in gross of income tax value.

Some interesting trends in the composition of the population of pensioners emerges from the inspection of the table 1. Anticipated benefits nearly doubled their share. Looking at gender composition a substantial constancy emerges. An important reduction of individuals younger than 60 years is accompanied by the doubling of those older than 70. The category that increased mostly its share is self-employed. Seniority at retirement also increases its share steadily, while the average age of pensioners, consistently with other considerations, increases from 67.5 to 74.6 years.

The figure 2 displays the evolution of the average old age pension benefit from 1995 to 2017. All values are in constant 2017 prices. In real terms the average value of old age pension nearly doubled over the observed period. Its growth rate is positive, with the exception of 2001, even if in the first part of the period variations are higher. We control for different demographic and institutional characteristics of pensioners. For all the considered subgroups of pensioners, we find a positive trend in the evolution of the real average value of yearly benefit, even though some of them, notably anticipated, belonging to the public sector and in the age class under 60, display the fastest dynamic. It is important to stress the fact that the real value of pension benefits increases generally for all subgroups here examined, in a period of time when, especially after 2008, values for earnings did not have a similar trend.

Here Figure 2

The comparison of the distribution of pension benefits by centiles in 1995 and 2015 does not show strong variations. The shape of the distribution in the first and the last year is quite similar with the highest centile of the distribution owning a disproportionate share of pension income. Both in 1995 and in 2017 it is only starting from the 60th percentile that the share of benefits owned by a centile is equal or greater than 1% of total benefits.

Here Figure 3

When we move to the figure 4, which reports the evolution of the Gini index, computed on the yearly distribution of individual old age pension benefits, we note an increasing trend in the concentration of this variable. The value of Gini was 37.1% in 1995. It becomes equal to 39% 22 years later. Casarico and Lattanzio (2019) for example find that the Gini computed on earnings of private dependent workers grew, during the same period, by more than 5 percentage points.

Here Figure 4

The increase in the concentration is clearer in the first decade of the century when the Gini index grows by more than 2 percentage points. While the evolution of the Gini index proves the increased concentration of pension benefits over the years it does not specifies which part of the distribution is responsible for this trend.
Table 2 gives a detailed breakdown of pension benefits distribution by various different percentiles and by various different years. This allows a deeper inspection of distributive trends at work during the period of observation.

Here Table 2

Looking at shares of pension benefits owned by different percentiles it is noticeable the fact that the lower part of the distribution saw a reduction of the share of pension income from 9.4% in 1995 to 7.1% in 2017. On the other side of the distribution, the richest

percentiles saw also a non-negligible reduction of the share, while the following 9% had a modest increase. The most remarkable positive variation is the one of the pensioners that lie between the 25th and the 75th percentiles: their share increases from 40.4% to 42.4%. Looking at changes in the share for each centile of pension benefits distribution allows a more complete description of trends at work and confirms the increasing share devoted to the central part of the distribution at detriment of the first 20% and the last centile.

Here Figure 5

The following figure 6 shows how the average value of pension benefits at constant prices changed in different parts of the distribution. Again the negative trend for the lowest part of the distribution and the positive one for the central are remarkable. The figure indirectly confirms the "special" role played by the central part of the distribution. The percentage decrease of the pension benefit for different percentiles of the distribution is the 5th and the 10th percentiles is a remarkable one. All others centiles have positive performances and it is the 50th percentile the one that realizes the highest growth. It is in any case interesting to notice that all the right hand side of the distribution increases its pension benefits by roughly 30%.

Here figure 6

Looking at the evolution of deciles ratios, the figure 7 gives an idea of the strength in the relative position changes between three centiles of the distribution, namely the 10th, the 50th and the 90th. Again, the figure depicts the worsening for the lowest part of the distribution, and the better performance of the central centile with respect to the 90th.

Here figure 7

The inspection of data realized in the first part of the subsection shows on one side the deterioration of the relative level of pension benefits in the lowest part of the distribution

and the improvement in the central part of it. Some important normative changes introduced during this period can contribute to explain such a trend. On one side, the diffusion of pension benefits under the Gestione Separata explains the increasingly large diffusion of low benefits. On the other side, the repeated policy cares the central part of the distribution (quattordicesima etc.) can explain the remarkable performance in the central part of the distribution.

The following tables report information on the composition of different percentiles of the population of pensioners in different years.

Here table 3 and 4

An interesting alternative point of view consists in comparing pension benefits and earnings distribution for the same group of individuals. In any period old age pension distribution depends on benefits that have different effective date and therefore, even in case of equal individual progression, are correlated with different macroeconomic past performances and different indexation rules. Moreover, pension computation and category distribution changes over time, making yearly data rather complex to use in the evaluation of the distributive performances of a pension system. A feasible trick that allows bypassing, at least partially, these problems is the possibility to follow individuals that retired in the same year (t) and to compute, only for this subsample of data, a global inequality index like for example the Gini, either for pension benefits in year (t) and for earnings in year (t-1).

Here Figure 8

The figure 8 reports results of such kind of simulation for the period 1995-2017. In order to overcome discontinuity on earnings profiles and other technical problems we compute the Gini index for individuals retired in year t=1995, ….., 2017 and on the earnings distribution of the same individuals 2 years before retirement. While the trend in the Gini computed on pension benefits is similar to that computed on the yearly stock of the same

variable, the changes that occur is much higher. This can be explained by the fact that pension benefits are computed on an earnings distribution that also sees an increasing in concentration. At the same time the lower value of the Gini when computed on pension testifies the capacity of the DB pension system to reduce dispersion that derives from the dispersion in labour market incomes.

6. THE DISTRIBUTION OF REPLACEMENT RATES.

The second dimension over which we measure the distributive implication of the transition's design is the replacement rate of pensioners who retired during the period 1995-2017. The replacement rate is widely used to assess the adequacy of a pension system because it is intuitive and relatively easy to compute. Its use has however, some drawbacks that is necessary to take into account. Firstly, the replacement rate is an incomplete measure of the adequacy for pensioners and their families. Comparing the last yearly earning with the first yearly pension benefit for each individual, it furnishes only an incomplete picture of the individual's income level before and after the retirement. Not necessarily would this measure correspond to the welfare level of the pensioners' household. Moreover, being a single-period index, the replacement rate measures the adequacy in a single year, the first in retirement, while the pensioners expects to survive much longer. In fact then, the replacement rate does not say anything about the ability of the pension system to maintain adequacy over time. This lack of information on adequacy over time becomes more important the weaker is the indexation rule and the higher is the growth of the wage mass. As in Italy the indexation mechanism moved from a real to a nominal anchoring from 1995 and the wage mass growth has been quite slow during the same period, the two aspects might balance each other's, at least partially. In order to take into account of the effect of changes of adequacy over time, we use an alternative index, namely the ratio between the current pension benefit and the average value of pension benefits in the same year.

Another problem with the replacement rate is more empirical based and regards its measurement in a dataset of administrative data: earnings in the last year of work for many

individuals may not necessarily represent a reliable measure for the computation of the replacement rate. This may depend on the fact that the date of retirement occurs during the course of the year and/or on the possibility that the pensioner was unemployed and/or out of the labour force before retirement. In all this cases, yearly earning can be much lower than "normal" and consequently the measured replacement rate in these cases becomes higher. In order to overcome this shortcoming we define the replacement rate as the ratio between the first yearly annualized pension benefit and the average value of positive earnings during the five years before retirement. Even in this case a (minor) number of individuals have low or zero value at the denominator of the ratio, but for the large majority of cases the ratio conveys a more reliable value.

In what follows we describe our procedure to estimation of the replacement rate. For an individual (i) who retire in year (t), we define the replacement rate as:

$$RR_{i,t} = \frac{P_{i,t}}{W_i}$$

where:

RR_{it}: is the replacement rate of an individual (i) retiring at time t=1995, …., 2017

P_{it}: is the annualized value of the gross pension benefit of individual (i) in year (t)

W_i: is the average value of annualized gross earnings of individual (i) in the five years preceding the year of retirement

Data of pension benefits come from the administrative archive of pension benefits (Casellario Centrale dei Pensionati), where we select only individuals retiring under the main Italian pension fund, the one of Dependent Workers (FPLD). Information on the average earnings gained by individuals before retirement come from administrative data on private dependent workers for the period 1990-2017. Matching these two datasets, we are able to compute the replacement rate as defined the equation above. We decided to restrict our analysis to the main Italian pension scheme because, among the very heterogeneous and rather complex structure of the Italian social security system, FPLD covers the majority of pensioners. Moreover, among disposable data this appears as the more complete dataset, especially as far as earnings before retirement are concerned.

After controlling for data consistency and dropping pensions paid in minor schemes we end up with a sample of 3,1 million of observations. The following table reports some descriptive statistics of the selected population of pensioners.

Here table 5

The gender composition of the population does not change dramatically over the period. More significant are changes in the share of old-age versus anticipated pension, with the second group of pensioners increasing from 41% to 63%. As for the retirement age and the seniority at retirement, both variables see a substantial increase for each combination examined.

The chart below (Figure 9) gives a graphical representation of the distribution of the replacement rate for the whole population retired from 1995 to 2017. The large majority of pensioners have a replacement rate included in an interval ranging from 70% to 90%.

Here figure 9

This is a first sign of the generosity of the Italian pension system towards this subsection of the population, either with respect to expected future value of the same index (Ministero dell'Economia 2019) and in the international context (Oecd 2016).

Comparing the distribution of the replacement rate in different years makes clear that the general picture did not change substantially over the observed years. The following chart for example reports this distribution in 1995 and in 2017.

Here figure 10

A more articulated analysis for the replacement rate is the one reported in the following table. Here replacement rates for each subgroup of the retired population are the result of the ratio between the sum of pension benefits and the sum of earnings before retirement. Even if results confirm the general picture of a generous system, some differences emerge.

While controlling by year of retirement and by gender does not affect the average value of the replacement rate, major differences emerge looking at the value of the replacement rate in different retirement age. In this case, a clear inverse relation arises from the data, showing that higher replacement rates are associated with lower retirement ages. On the contrary, the average replacement rate increases with the number of years a worker contributes to the pension system. Seniority pensioners have higher replacement rates with respect to old age pensioners. Finally dividing pre-retirement earnings in deciles highlights an inverse relation between the level of earnings and the adequacy of the pension system. This relation looks more pronounced looking at the very last part of the population of pensioners, when we order them with respect to their earnings.

Here table 6

The following two charts allow a more in depth examination of this last relation, which has clear implications on the measurement of the progressivity of the DB Italian pension rule. The first of the two is a plot of replacement rates with respect to pre-retirement earnings, where the selected population share the gender and the retirement age. By controlling for these two characteristics, we are surer that "similar" individuals are in the dataset. The presence of a weak form of progressivity, in particular for earnings level above 60,000 Euro is apparent, as well as the higher level of replacement rates in the left part of the chart, where earnings are below 20,000 Euro.

Here figure 11

The figure 12 computes the average replacement rate for each centile of the earnings distribution. It is interesting to notice that, with the exception of the lowest and the highest part of the distribution, the level of the average replacement rate are substantially constant. This depicts a pension system where the progressivity is concentrated only at the two extremes of the distribution of earnings.

Here figure 12

As a final exercise, we regressed the replacement rate on the variables disposable in the dataset in order to find some more precise indications on causal relationships. The representative individual in the regression is a man with seniority at retirement less than 20 years, retired at regular age (old age pension), belonging to the first decile of the earnings distribution.

Here table 7

Results of the regression indicate a weak relation with the age. Increasing seniority up to 35 years has a positive relation with the replacement rate, while having a higher seniority reverses this relation. Anticipated pension benefits implies higher replacement rates than old age benefits. As for the earnings distribution, a clear and monotone negative relation emerges from the regression.

7. THE DISTRIBUTION OF THE NET PRESENT VALUE RATIO.

The third dimension of equity considers the actuarial fairness of the Italian pension system during the transition. The NDC philosophy rests on the idea that equity within a pension system requires a strict correspondence between contributions paid during the working period and pensions received during retirement. The measurement of the actuarial fairness during the transition id therefore a qualifying point if one wants to evaluate its consistency with the long-term structure of the pension system in Italy. In order to measure actuarial fairness in this paper we estimate the Net Present Value Ratio for individuals who reached retirement over the period 1995-2017.

In formal term,s the NPVR for an individual (i) at time (t) is defined as:

$$NPVR_{i,t} = \frac{PVP_{i,t-L}}{PVC_{i,t-L}}$$

where the numerator and the denominator are respectively the present value of pension benefits and the present value of social security contributions to be received and paid over the whole lifetime and measured at the beginning of the active life.
More precisely:

$$PVP_{i,t-L} = \sum_{t=N}^{T-1} \frac{1}{(1+r)^t} P_t$$

$$PVC_{i,t-L} = \sum_{t=0}^{N-1} \frac{1}{(1+r)^t} a_t Y_t$$

The discount rate used for the computation of the two equations above is not neutral. The term "r" in both equations defines implicitly a benchmark return for the pension system. Values for the estimated NPVR higher than 1 are a sign that the return of the pension program offers an internal rate of return higher than the benchmark. While in a steady state economy, the natural choice of the term "r" is the sustainable rate of return of a PAYGO system, i.e. the rate of growth of the wage mass; things appear more complex out of this theoretical situation. During the transition to an NDC system, the value of the discount rate applied in the formula of the NPVR encompasses an implicit value judgment, in particular when the contribution principle is applied. The discount rate can be equal to the current growth rate of the GDP and/or of the wage mass. Alternatively, it can be equal to the wage growth prevailing when contributions were paid. Finally, it can be equal to the expected value of the sustainable return of the PAYGO system expected in the future. We will return to this point in the discussion of results of the sensitivity analysis in the final subsection of the paper where we run some sensitivity analysis and a simulation of a recalculation policy.
As in the case of the computation of the replacement rate, also here, data did not allow to compute the actuarial fairness indicator for the whole population of pensioners retired between 1995 and 2017. In fact, data limitations are here even stricter. In particular, INPS archives do not allow a complete measurement of contributions paid by individuals retired

after 1995. Lack of data becomes intense before 1974 and requires some kind of imputation. In order to make our results not too much dependent on external information or on arbitrary hypotheses on lifetime earnings dynamic we restrict again our analysis on workers who retired under the FPLD pension scheme. In the computation of the NPVR, we use data from a random extraction of the Estratti Conto of the active population in 1995. A number of 162,456 individuals then compose our dataset. For each observation, we have the contribution record for the large majority of years. In last then 10% of cases, we imputed missing data using estimated parameters of a lifetime earning profiles obtained on the same dataset.

Here figure 13

The figure 13 reports results of the estimation for all individuals in the sample that retired under the FPLD. The discount rate is equal to 1,5%. The first important point to remark is that the large majority of estimated NPVR are larger than 1. In fact, when measured in term of actuarial fairness, the equity in the main scheme of the Italian pension system if far from being reached. A number of papers show that, for the NDC system, the estimated value of this index tends to 1 or even to lower values (Borella and Coda 2008; Mazzaferro, Morciano and Marano 2012). Nearly half of the population retired between 1995 and 2017 display a NPVR between 1 and 1,5, while significant part of the population has even higher values. The general picture that emerges from the figure is the one of generosity of pension system for workers that will have an important part of their pension benefit computed under the DB system, even if they retired after the introduction of the NDC rule. This also signals that pensioners retired from 1995 to 2017 determined an increase in the value of the implicit pension debt. Considering the fact that rules of computation for the other pension schemes are in many cases more generous than for the observations here examined and that contribution rate are lower in other cases, the suspect is that this is a more general result, which is not confined to individuals retired under the FPLD.

A further element that contributes to explain the large than 1 value for the estimated NPVR is the lower level of contribution rate prevailing in the past. The Parliament

introduced the still current value of 33% for the rate only in 1992. Previously the contribution rate was lower, particularly during the years before 1970. A not negligible part of contributions paid by individuals retired after 1995 were paid during periods of lower contributions rate. This could furnish additional elements of advantage in the computation of the NPVR. In order to check this hypothesis we recomputed the measure discussed hypothesizing that the contribution rate was always equal to 33%. The following figure 14 compares the distribution of NPVR's in the base simulation (the one showed in the figure 13) and in the case of constancy at 33% of the contribution rate and allow to measure the role of this difference on the index of actuarial fairness used in the paper.

Here Figure 14

As in the case of adequacy's measurement during the transition, we compute the average value of the NPVR controlling for subgroups of the population. Results of these computations are in the table 9 below.

Here table 8

While results confirm the generosity of the pension system, a more differentiated picture, within individuals retired during the transition, emerges. As time passes, the NPVR displays a decreasing trend. Starting from an average value of 1.99 it finish at an average of 1.21 for individuals retired in 2017. This result depends crucially on the different shares of pension benefits computed under the more generous DB system. Even in 2017 however, the value of the NPVR signals an advantage of 21% of pensions expected with respect to contributions paid. Retiring earlier has an important impact on actuarial fairness: the estimated average NPVR is equal to 2.03 when the retirement age is 55. It decreases continuously, reaching the average value of 1.14 when retirement age is 67. Again, the share of the DB pension benefit explains this result, since this computational rule push individuals to retire as soon as possible if the decision depends only on financial evaluations. Women report on average a higher value for the NPVR because of the higher

lifetime expectations at each age. The average NPVR increases with the number of years of contributions reaches at retirement. Anticipated pensions reach higher values with respect to old age pensions. Usually they are paid at lower age and, considering the DB component in the pension benefit, this brings an advantage to the first group of individuals. Finally controlling for the position of individuals in the distribution of permanent income, defined as the present value of lifetime earnings and estimated from the same dataset, a progressivity structure emerges. As (lifetime) earnings increase, we saw that the DB formula becomes less generous and this determines the result presented in the table. On the other side of the distribution the presence of a more transfer based component in the pension benefit (integrazione al minimo, quattordicesima mensilità) explains the higher value for the NPVR.

The figure 15 confirms the result of the negative correlation between lifetime income and the NPVR. We report here a plot of the two variables for males, retired at the age of 65, between 1995 and 2017.

Here figure 15

In order to have a complete analysis of determinant of the NPVRs in our sample we run a regression on our data. The table 8 reports results of the regression. NPVR decreases with retirement age, increases with seniority at retirement and with deciles of lifetime earnings. Looking at time dummies also a negative trend is apparent. Being female and early retired has also a positive correlation with the NPVR's value.

Here table 10

The choice of the discount rate in the computation of NPVR plays a crucial role in the definition of actuarial fairness. In order to test the sensitivity of our result to this variable the table 11 shows the distribution of NPVRs with different values of the discount rate.

Reducing the value of the discount rate increases the share of NPVR that are above 1 and in fact signals a situation of actuarial unfairness. This point is far from being neutral. Lower

discount rates are consistent with the idea that the economy, and therefore the implicit return of a "fair" pension system under NDC principles, are also lower. A discount rate of 1.5%, which is the one we used in our baseline, is consistent with the implicit growth rate that shared by policymakers in 1995. Today's values for real expected growth are sensibly below this value. This would imply, if applied to the computation of NPVRs an even stronger intergenerational unbalance that the one of our central scenario.

Here table 11

8. ESTIMATING THE FINANCIAL EFFECTS OF THE TRANSITION

Intertemporal gains for individuals retired during the period 1995-2017 have an equal dimension and an opposite effects on the implicit pension debt. As the NPVR is greater than 1, this means that an individual receives in present value benefits from the social security system more than the present value of contributions he/her pays. For the same reason and for the same individuals this means that the social security system increases its liabilities. The aim of this subsection is to present an estimate of the dimension of these gains for individuals retired from 1995 to 2017 and on its distribution. As for the former two subsections, we restrict our analysis to the main Italian pension scheme (FPLD). The idea that we follow is that pension benefits for individuals with more than 18 years of contributions in 1995 contain a DB component that is not consistent with the philosophy of the NDC reform because it accrues after the introduction of the new rule of computation into the Italian social security system. Considering only those individuals, we start from the observation that their old age pension benefit during the transition is the weighted sum of three components:

$$P_{i,t} = \alpha + \beta + \gamma$$

where

P_{it}: pension benefit for and individual (i) retired in year t=1996, …., 2017

α: DB component of the pension benefit accrued for contributions paid until 1995

β: DB component of the pension benefit accrued for contributions paid after 1995 and until 2011

γ: NDC component of the pension benefit accrued for contributions paid after 2011

In order to measure intertemporal gains for this subsection of the retired population we first use administrative data to compute terms β and γ for each individuals in the sample. While for the first term, we only need information on years of working and the respective earning after 1995; in order to estimate γ we use information on the capitalization and the conversion coefficients from INPS. After these operations, we compute a new value, γ' which differs from γ because it compute the NDC component of the mixed pension starting from 1996. Finally we compute the estimated difference in pension benefit as the difference between γ' and (γ +β). This exercise allows us to compute pension benefits for individuals with more than 18 years of contributions in 1995 according a pro-rata rule similar to those used for workers with less than 18 years of contributions in 1995.
The following table shows the estimated values of the average change in yearly pension benefits deriving from the procedure described above. We also present in the second and in the third column, the share of this change with respect to the effective pension paid and an estimation of the effect on the pension debt.

Here table 12

Financial effects of the benefits' recalculation are increasing with time, as the number of years that suffer the procedure of imputation of contributions to the NDC component increases. While at the beginning of the observed period the reduction in benefits is negligible, it increases progressively up to an average reduction of the pension benefit of nearly 25% at the end of the period, in 2017. This implies a parallel dynamic for liabilities created with the current system.

Here figure 14 a) and b)

The figure 14 a) and b) display the distribution of gains (and losses) deriving from the recalculation. Part a) of the chart shows that the large majority of changes reach an amount of less than 1,000 yearly Euros. Part b) is an estimation of the aggregate savings realized in each year. At the end of the simulation period, in 2017, they amount to 4.3 billion Euro. Summing all savings expected from a policy of this kind and taking into account lifetime expectations of individuals, we obtain a present value of roughly 43 billion Euro.

9. CONCLUSIONS

Moving from a DB to an NDC system, while maintaining the PAYGO finance rule in the pension system has significant advantages both in efficiency and in redistributive terms. In particular, it makes the transition to the new pension system less painful for current generations since they will not pay a double burden, as in the case of the transition to a funded pension system. In spite of this, the design of the transitional phase is still crucial in order to determine the speed towards the new system and the burden's distribution of the selective restructuring of the implicit pension debt associated with the introduction of an actuarially fair system. No uniform evidence comes from the international experience of countries that, during the nineties of the last century, adopted an NDC formula within their pension system.

Italian policy makers decided a particularly generous transitional rule, especially with respect to individuals with more than 18 years of contributions in 1995. This choice, which is neither consistent with the "contribution principle", nor with the "acquired rights" (Palmer 2006b), was maintained also in the following years, even if the Italian pension system has been repeatedly modified. This decision has had and will have significant distributive and financial consequences. Firstly, still in 2017 the large part of the retired population has a pension benefit computed completely with the old DB rule. This means that, looking at the yearly distribution of pension benefits one has to take into account mainly the old rule, instead of the new one.

Using administrative data from different INPS archives, this paper tests the redistributive and the financial effects of this policy decision. In this paper, I use to three different concepts of equity to study the distributive implications. Consequently, I analyse the yearly distribution of old age pension benefits, the distribution of replacement rates and the distribution of the Net Present Value Ratio. In the final part of the paper, we estimate the amount of resources that the transition's design generated.

In 2017, the DB rule defines still the large majority of current pension benefits. The shape of the distribution of pension benefits did not change dramatically during the period 1995-2017. The Gini index computed on individual pension benefits grew by two percentages points. Looking at the different parts of the distribution, we discover that the first and the second deciles have a negative dynamic, while the remaining part of the distribution saw an increase of the level of the pension benefit. By comparing the Gini index of pension benefits and earnings, computed on the same group of individuals, I found an increasing trend in both the variables. At the same time the old age pension system, maintains the capacity to reduce the dispersion generated in the earning distribution.

Moving to the adequacy of the system, the analysis show that the large majority of pension benefits have a replacement rate above 60%. The dominant DB rule has assured adequacy of treatments over the whole period. The system presents a certain degree of progressivity: dividing the population of retired individuals in 100 percentiles, I find that the average replacement rate is significantly higher in the lower part of the distribution; and it is significantly lower in the very high part of the distribution. Regression analysis shows that the replacement rate has a positive correlation with the seniority at retirement, with the anticipated pension benefits, while the correlation is negative with the retirement age and with the position in the distribution of pre-retirement earnings distribution.

The measurement of the NPVR distribution shows that the concept of equity embedded in the NDC rule is still far from being incorporated into data. Nearly all individuals who retired from 1995 to 2017 have an NPVR greater than 1, meaning that they expect to receive from the pension system more than they paid to it thorough social security contributions. In a non-negligible number of cases the value of NPVR is even higher than 1.5. Part of this results depends on lower than current tax rate paid in the past for social

security contributions. While the intertemporal advantage is common in the observed population, we find that it is higher the lower was the retirement age and the higher was the seniority at retirement. Differently from the replacement rate case, advantages increase with the year of retirement, while they decrease significantly with the distribution of permanent income.

Individuals' intertemporal gains are the other side of pension liabilities. By implementing a procedure of recalculation of pension benefits for individuals retired under the main Italian pension scheme during the period 1996-2017, which brings the pension benefits closer to an actuarial fair value, I estimate that the decision to privilege older workers in 1995 will cost 43 billion Euro of pension implicit liabilities.

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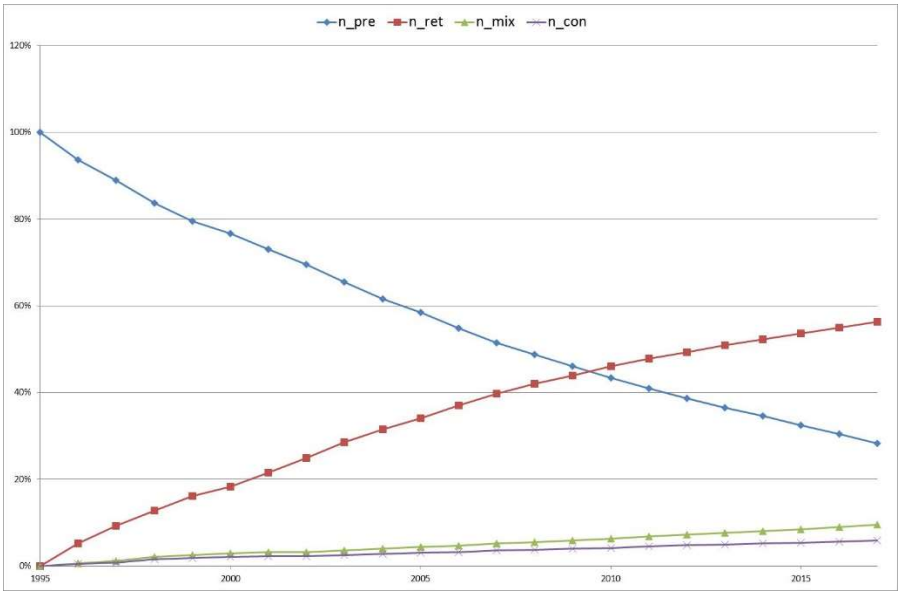
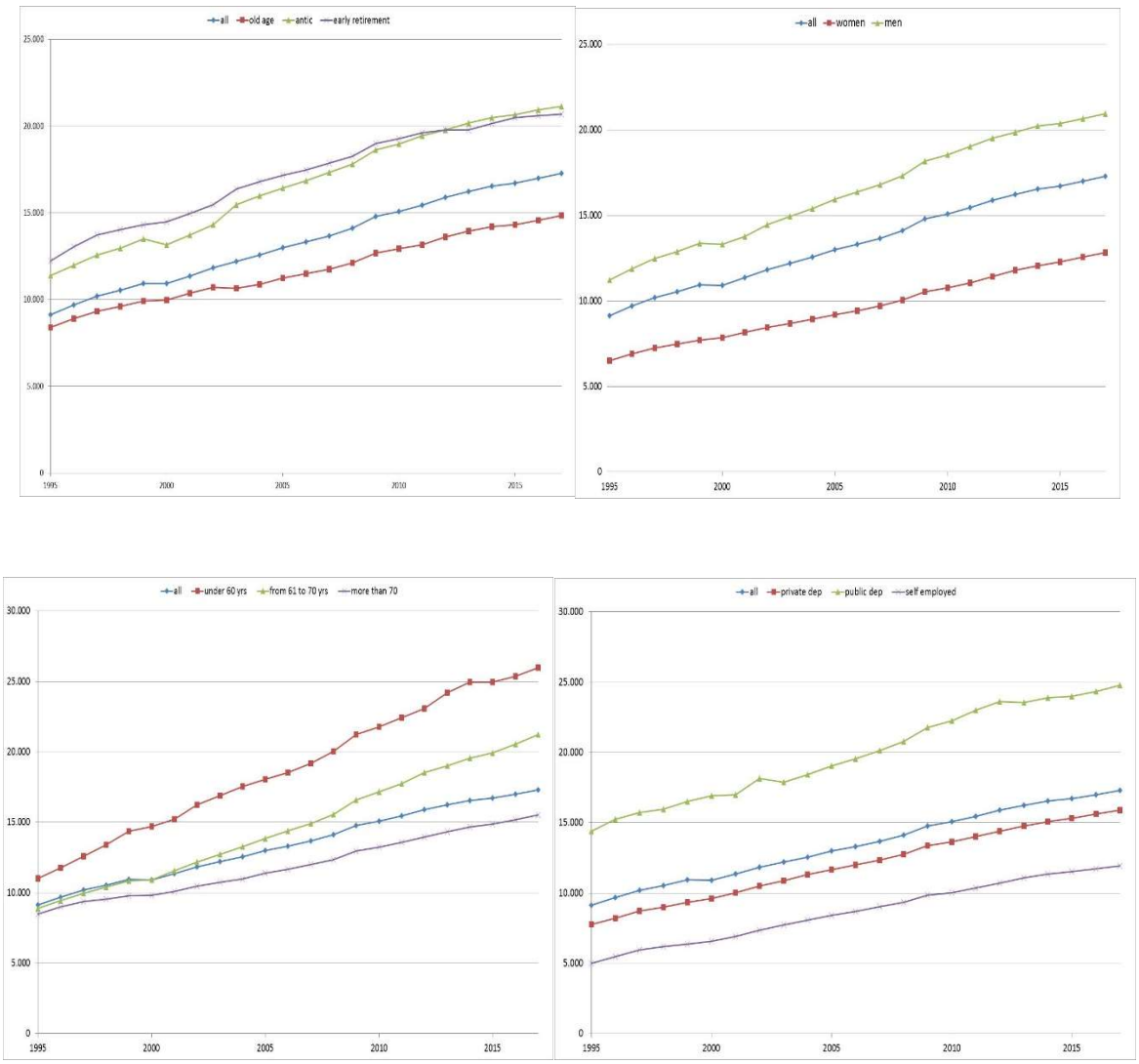
FIGURES

Figure 1
Share of pensioners according to their pension rule



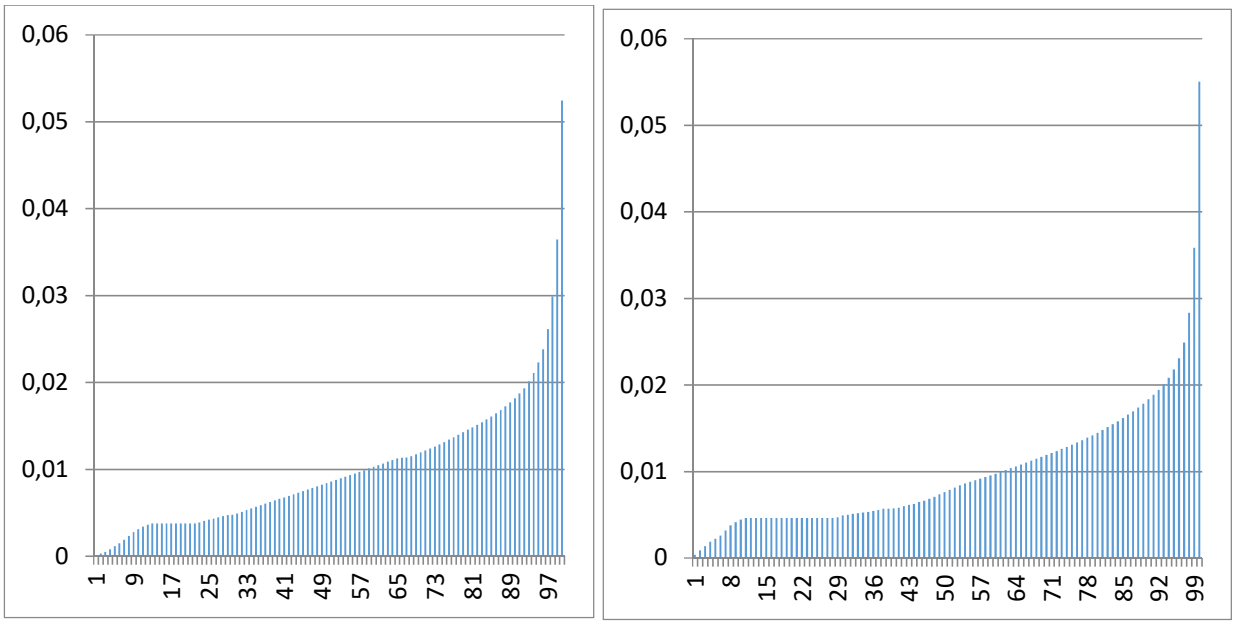
Data from Casellario Centrale dei Pensionati INPS. Only old age pensioners.
N_pre: individuals retired before 1996
N_ret: individuals with more than 18 years of contributions in 1996
N_mix: individuals with less than 18 years of contributions in 1996
N_con: individuals entered in the labour market after 1995

Figure 2
Average value of pension benefit at constant 2017 prices, by different subgroups of the population.
1995 – 2017



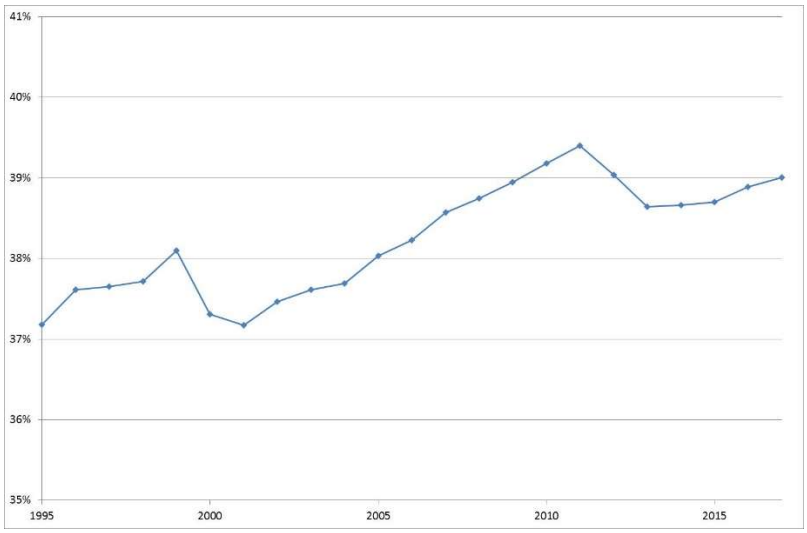
Pension benefits in constant 2017 prices. Old age pensioners in the INPS archives

Figure 3
The distribution of pension benefits by centiles in 1995 and in 2017.



Old age pension benefits divided in 100 percentiles. On the vertical axis the share of pension benefits owned by each single centile of the distribution.

Figure 4
The Gini index on old age pension benefits. 1995 – 2017



Individual values for pension benefits. Old age pensioners of all categories available in the INPS archive.

Figure 5
Changes in the share of pensions by centiles of the distribution. 2017 vs 1995

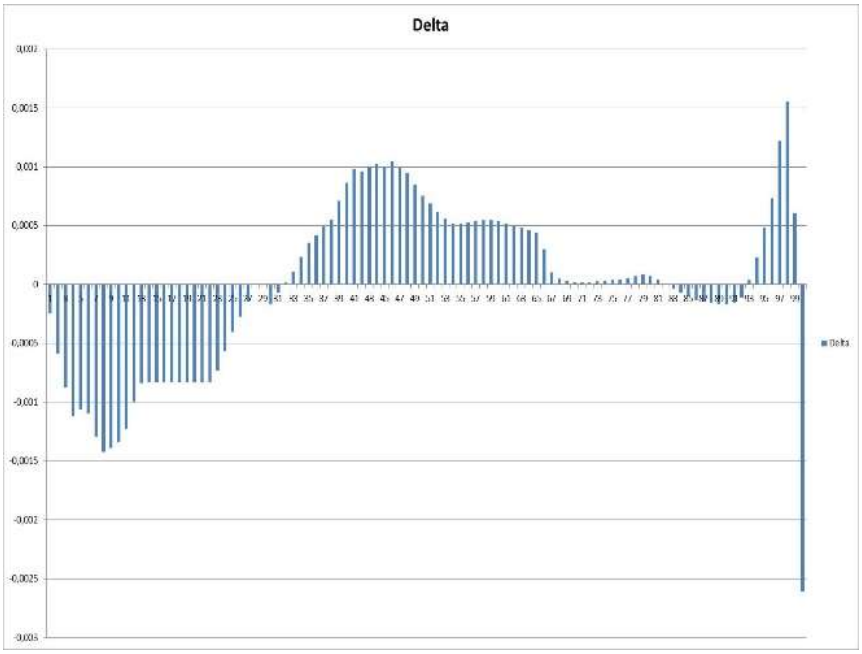


Figure 6
Percentage changes in the value of the pension benefits from 1995 to 2017, by different centiles of the distribution

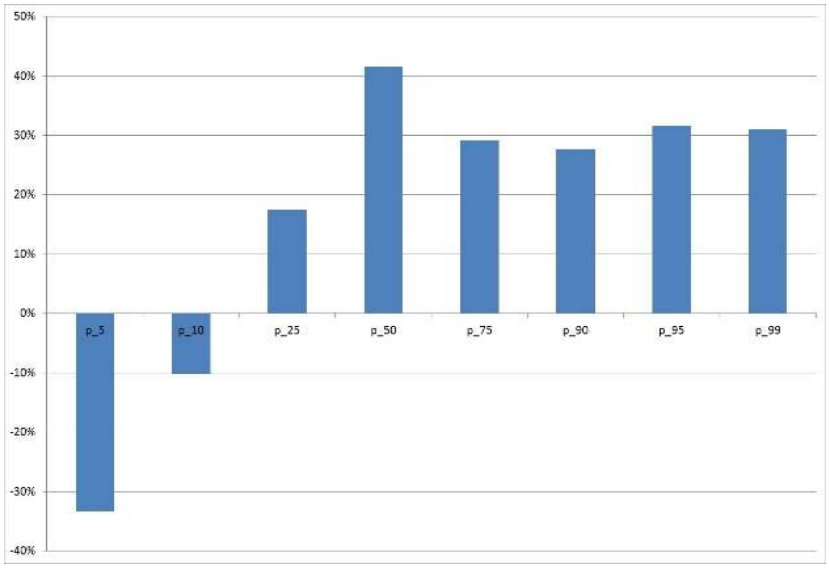


Figure 7
Deciles ratios. 1995-2017

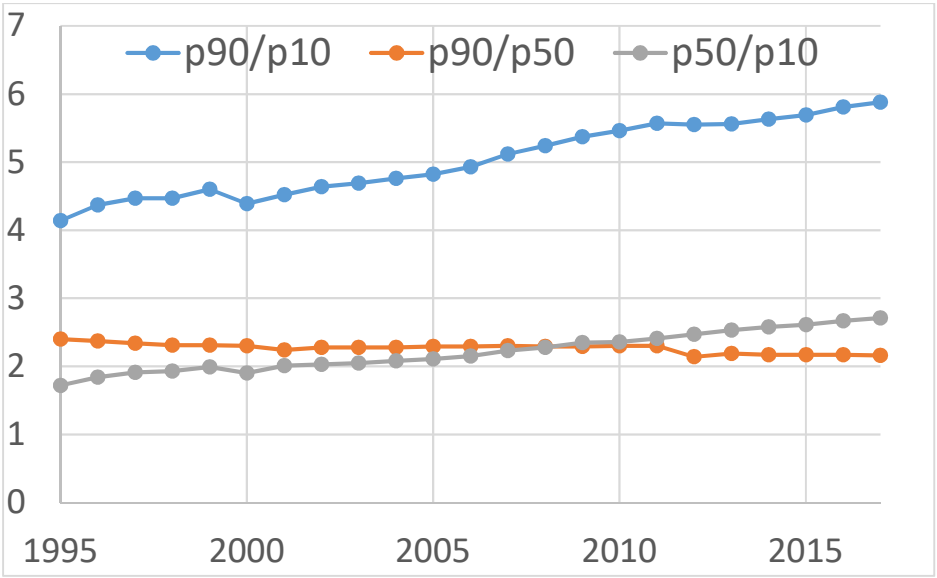
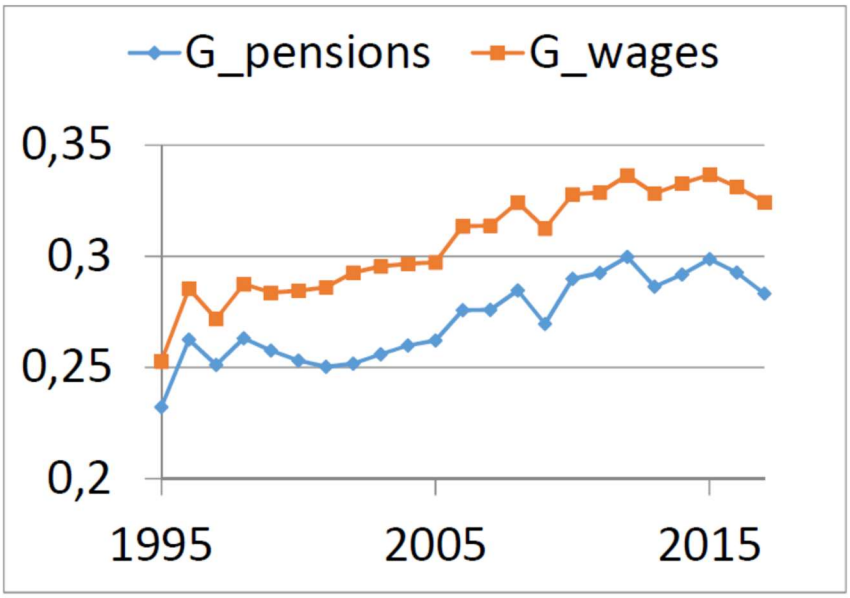
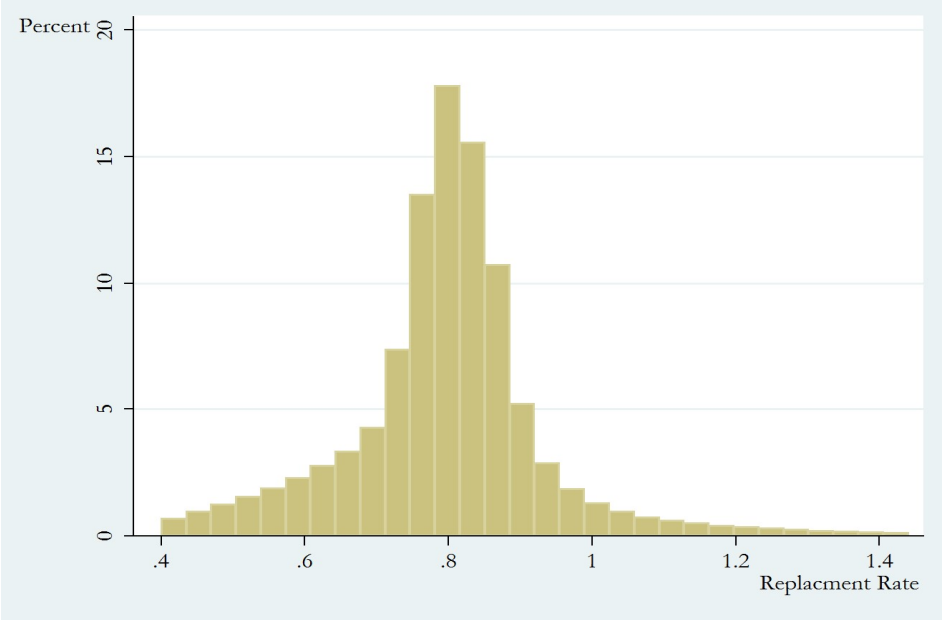


Figure 8
Gini index on new pension benefits and on earnings for same individuals



Gini index computed on individuals retiring in year (t) and on earnings of the same group of individuals in year (t-2).

Figure 9
Distribution of the replacement rate. All pensioners 1995-2017



Old age pensioners retired in FPLD from 1995 to 2017

Figure 10
Distribution of the replacement rate in 1995 and in 2017

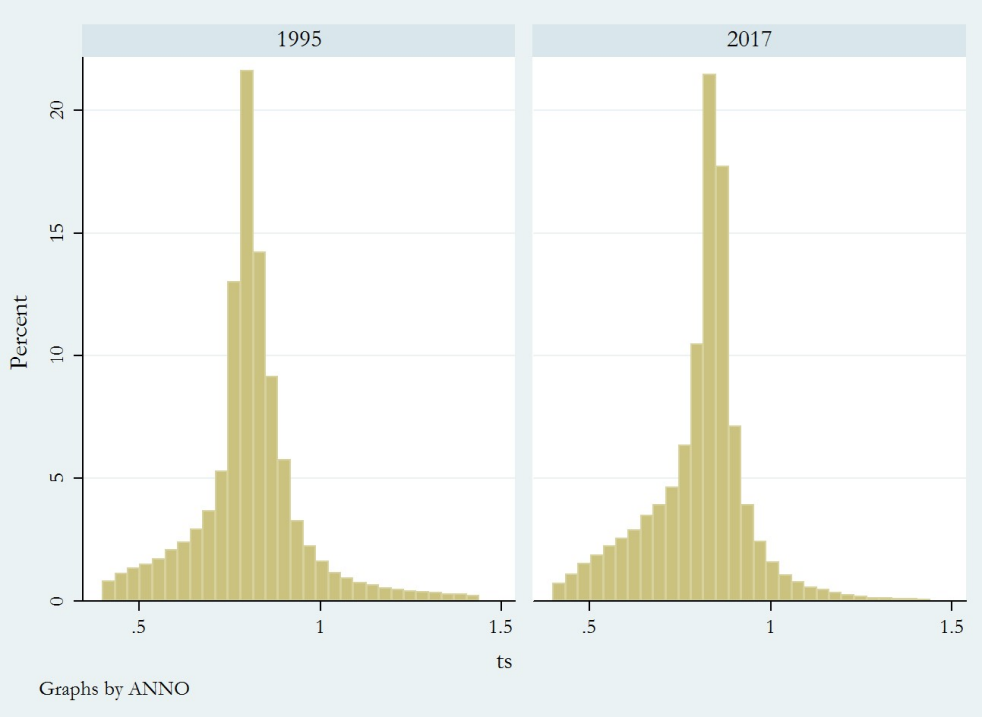


Figure 11
Plot of the replacement rate and the earning before retirement.
Men retiring at 65

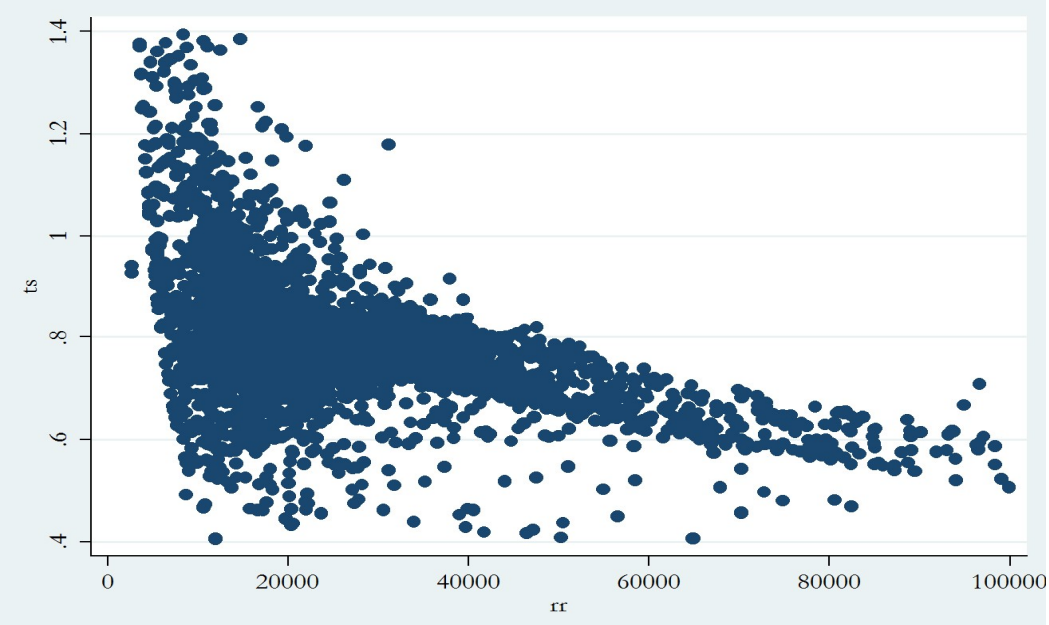


Figure 12
Average value of the replacement rate, by centiles of pre-retirement earnings.

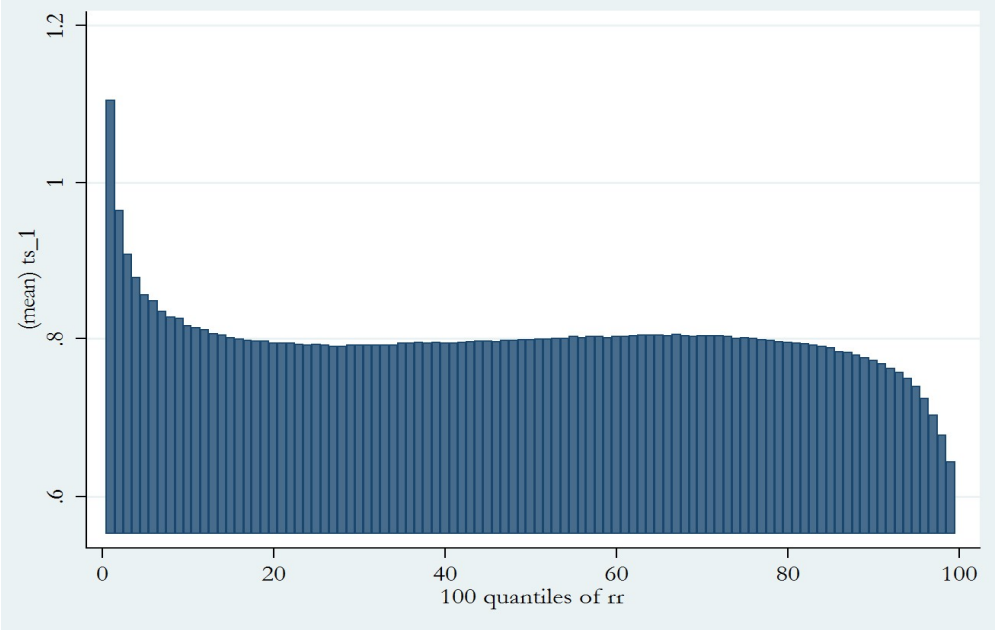


Figure 13
Distribution of individual NPVR. 1995 – 2017

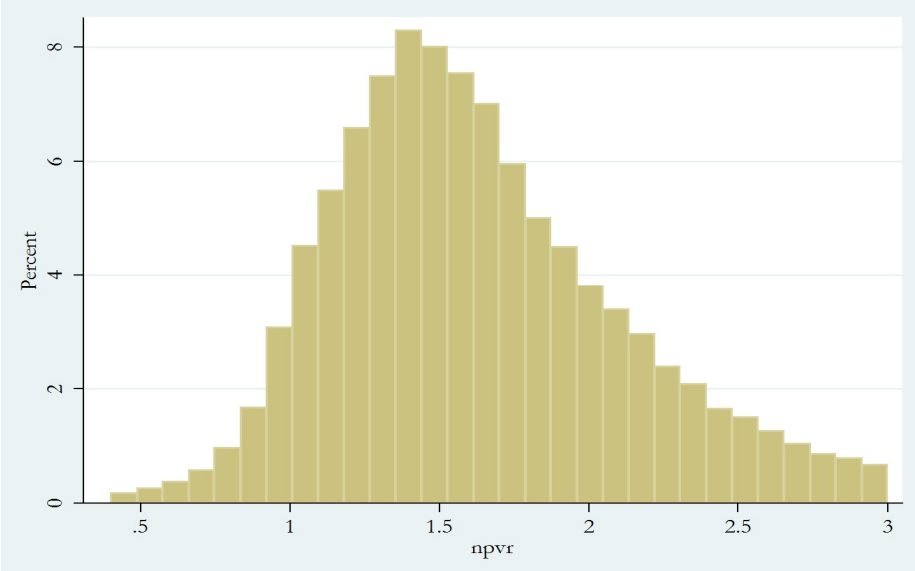


Figure 14
Average NPVR by centiles of permanent income

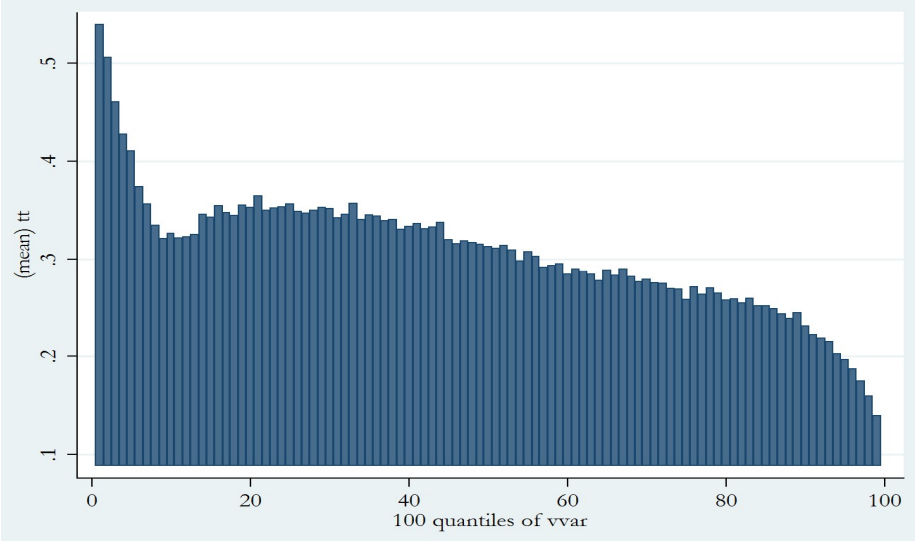


Figure 15

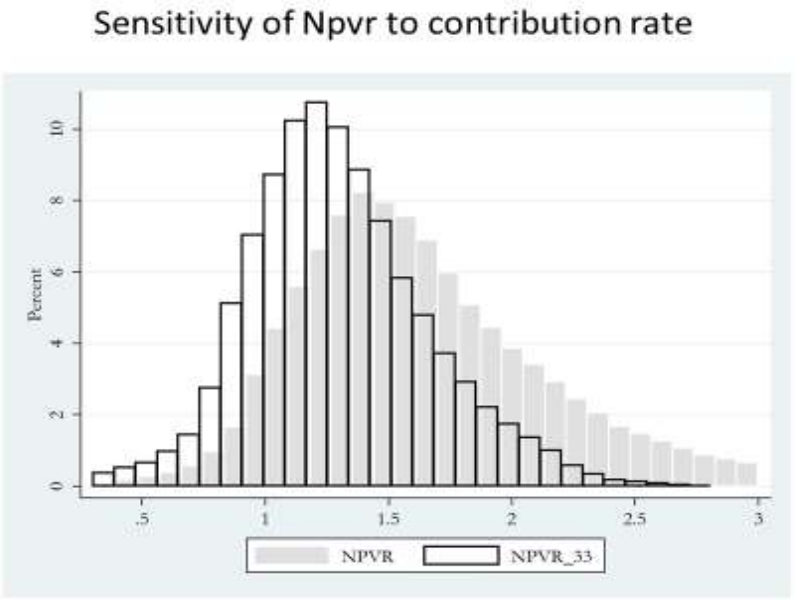


Figure 16
NPVR and permanent income

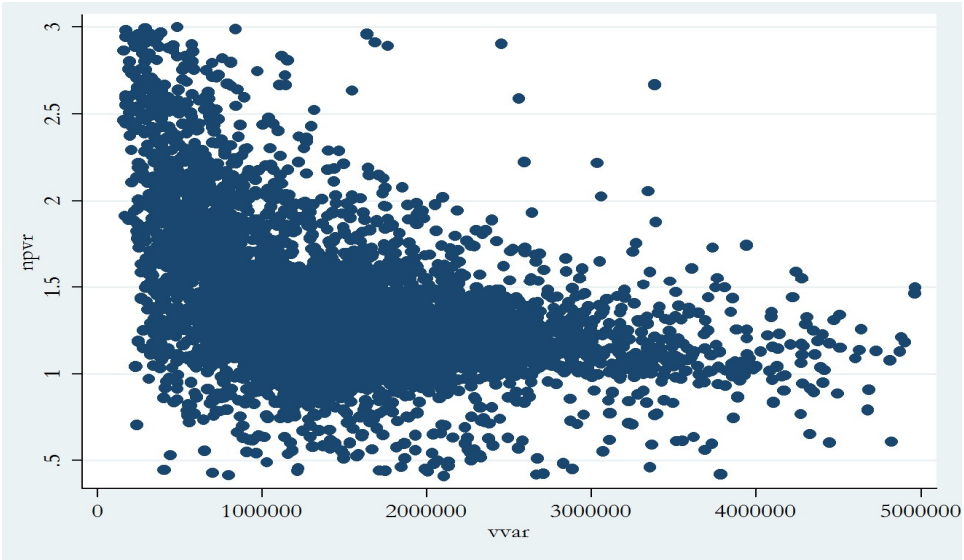


Figure 17 a
Distrinution of the change in pension benefit derived from recalculation

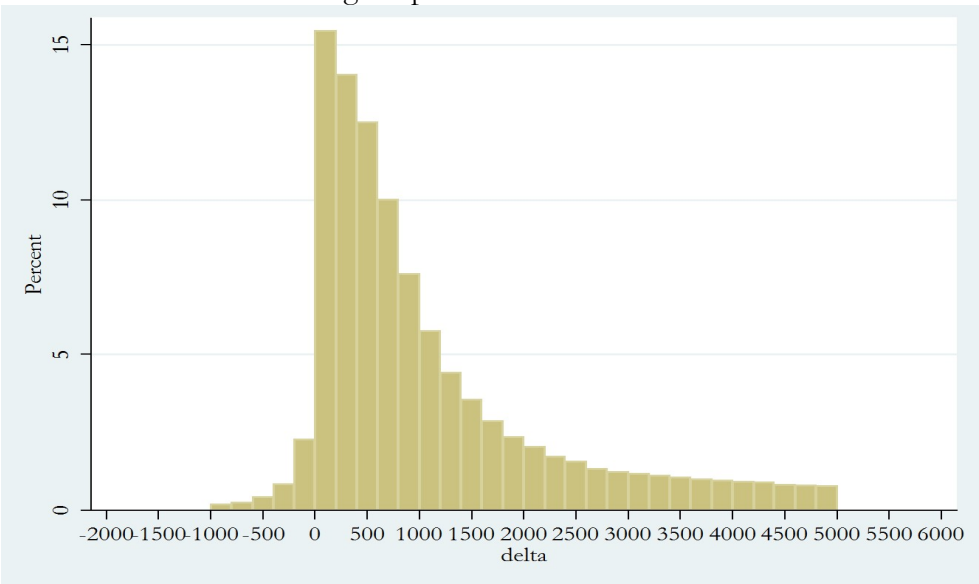
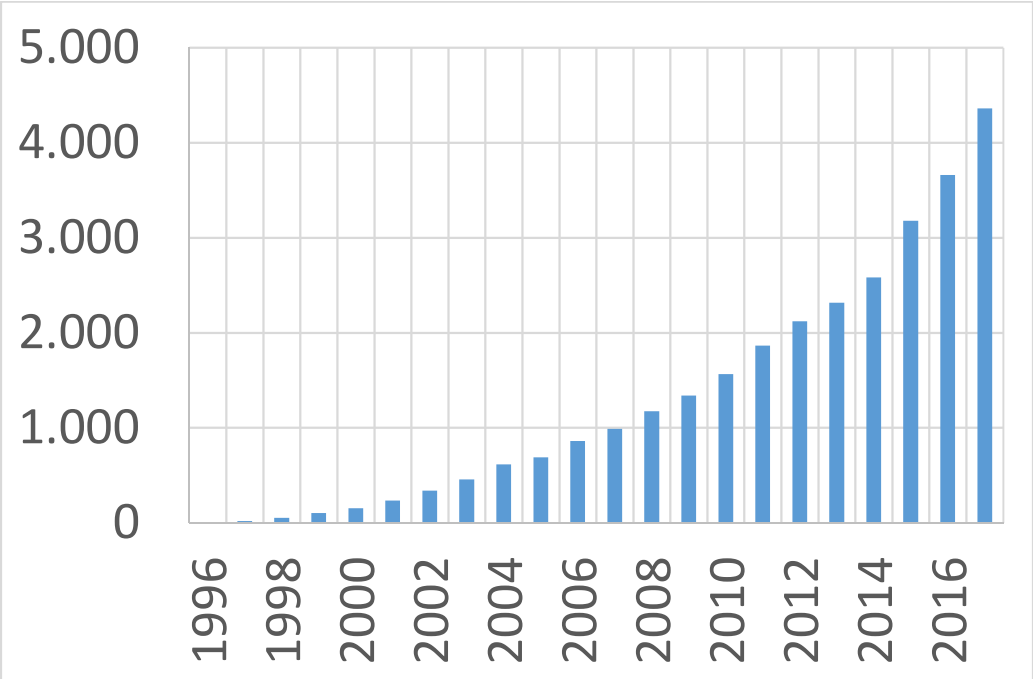


Figure 17 b
Yearly amount of saving from a recalculation of pension benefits



TABLES

Table 1
Composition of the population of pensioners in different years

Year	Old	Anticip	Early	Women	Men	< 61 yrs	61 to 70 yrs	> 70
1995	77%	19%	4%	44%	56%	22%	43%	35%
2000	72%	24%	4%	44%	56%	17%	43%	40%
2005	67%	29%	4%	44%	56%	12%	42%	46%
2010	65%	32%	3%	45%	55%	6%	41%	53%
2015	62%	35%	3%	45%	55%	3%	36%	61%
2017	61%	37%	2%	45%	55%	2%	33%	65%

Year	FPLD	Self	Others	Public	>30	21 to 30	10 to 20	< 10	Avg age
1995	56%	14%	8%	22%	41%	23%	30%	6%	67,5
2000	52%	19%	5%	23%	45%	21%	27%	7%	68,9
2005	49%	23%	7%	21%	50%	21%	24%	5%	70,4
2010	46%	25%	7%	21%	54%	20%	22%	4%	71,9
2015	44%	26%	9%	22%	56%	19%	20%	5%	73,9
2017	43%	26%	9%	22%	57%	18%	19%	6%	74,6

Data from the Archive of Pensioners (Casellario dei Pensionati), different years. Only old age pensioners with a pension benefit higher than 100 yearly Euro. Supplementary old age benefits excluded from the sample.

Table 2
The distribution of pension benefits. Share of income by centiles in different years.

Centile	share_1995	share_2000	share_2005	share_2010	share_2017	Change_95_17
Last	5,5%	5,3%	5,4%	5,3%	5,2%	-0,3%
91_99	21,3%	21,1%	21,5%	21,9%	21,8%	0,5%
76_90	23,4%	23,5%	23,4%	23,7%	23,3%	-0,1%
50_75	26,1%	26,5%	26,4%	26,5%	26,9%	0,9%
25_50	14,3%	14,8%	15,1%	15,0%	15,6%	1,3%
0_20	9,4%	8,8%	8,3%	7,6%	7,1%	-2,3%
Gini	37,1%	37,3%	38,0%	39,1%	39,0%	1,9%

Data from the Archive of Pensioners (Casellario dei Pensionati), different years. Only old age pensioners with a pension benefit higher than 100 yearly Euro. Supplementary old age benefits excluded from the sample.

Table 3
Composition of the first and the fifth decile of pension benefits. Percentage values, expect from age

Anno	age	priv	self	pub	others	old	anticip	wom	men
1995	70,7	64,6	14,9	14,4	6	96,6	3,4	51,4	48,6
2000	72,5	63,8	17	14,5	4,6	95,6	4,4	54,3	45,7
2005	73,5	59,3	19,8	12,6	8,2	94,5	5,5	57,7	42,3
2010	74,3	52,4	19,7	11,9	16	93,7	6,3	55,9	44,1
2015	76,1	46,5	18,1	13,6	21,7	93,1	6,9	53,6	46,4
2017	76,7	43,6	17,4	13,9	25	92,9	7,1	51,8	48,2
1995	66,1	66,8	16,9	15,1	1,2	75,4	24,6	41,8	48,6
2000	67,4	57,3	25,2	17	0,5	64,8	35,2	39,1	45,7
2005	69,7	52,2	31,2	16	0,6	56,8	43,2	40,1	42,3
2010	71,6	47,5	35,1	16,6	0,8	50,4	49,6	41,3	44,1
2015	73,7	43,3	35,8	18,9	2	46,7	53,3	43,1	46,4
2017	74,5	42	35	20,3	2,7	44,9	55,1	43	48,2

Data from the Archive of Pensioners (Casellario dei Pensionati), different years. Only old age pensioners belonging to the FPLD with a pension benefit higher than 100 yearly Euro. Supplementary old age benefits excluded from the sample.

Table 4
Composition of the first and the last centile of pension benefits. Percentage values, expect from age

Anno	age	priv	self	pub	others	old	anticip	wom	men
1995	69,7	65,6	3,6	27,7	3,1	96,5	3,5	29,9	48,6
2000	70,7	71,6	6,1	19,2	3,1	89,6	10,4	24,5	45,7
2005	71,3	61,6	8,4	10,1	19,9	86,3	13,7	24,6	42,3
2010	72,2	47,8	7,1	5,7	39,4	87,3	12,7	25,4	44,1
2015	74,7	39,4	6,1	4,1	50,4	87,1	12,9	26,3	46,4
2017	75,4	35,9	5,3	2,8	56	87,1	12,9	25,7	48,2
1995	65,9	8,2	0	66,1	25,7	82,6	17,4	2,8	48,6
2000	68	13,4	0	80,1	6,5	88,6	11,4	3,7	45,7
2005	69,3	11,6	0,5	54,6	33,3	64,5	35,5	4,3	42,3
2010	70,6	10,2	0,5	58,9	30,4	66,3	33,7	6	44,1
2015	72,4	10	0,5	62,4	27,1	69,7	30,3	8	46,4
2017	73	9,8	0,5	65	24,7	71,3	28,7	9,1	48,2

Data from the Archive of Pensioners (Casellario dei Pensionati), different years. Only old age pensioners belonging to the FPLD with a pension benefit higher than 100 yearly Euro. Supplementary old age benefits excluded from the sample.

Table 5
Composition of the population of individuals retired with an old age pension under FPLD. 1995 – 2017.

Year	% Men	%Wom	%Oldage	%Ant	RetAge old	RetAge anticip	Sen_old	Sen_anticip
1995	65.9	34.1	58.1	41.9	58.8	54.4	26.1	35.9
2000	66.4	33.6	23.6	76.4	61.9	56.3	26.7	35.9
2005	67.6	32.4	60.7	39.3	62.0	58.1	27.5	36.6
2010	60.4	39.6	46.8	53.2	62.1	58.3	27.7	38.7
2015	57.5	42.5	32.0	68.0	65.1	59.7	29.5	40.5
2017	62.4	37.6	36.1	63.9	65.9	60.6	30.3	41.3

Data from the Archive of Pensioners (Casellario dei Pensionati), different years. Only old age pensioners belonging to the FPLD with a pension benefit higher than 100 yearly Euro. Supplementary old age benefits excluded from the sample.

Table 6
Average value of the replacement rate by different categories of socio-economics groups

Year	**RR**	**Seniority at retirement**	**RR**
1995	78,8%	up to 15	68,4%
2000	75,5%	from 16 to 25	60,5%
2005	73,8%	from 26 to 35	74,0%
2010	77,1%	more than 35	79,5%
2015	79,0%	**Category**	
2017	78,6%	Old age	70,3%
Ret age		Anticipated	78,3%
55	80,5%	**Decile of pre-retirement income**	
60	75,3%	1	86,6%
63	74,2%	5	79,7%
65	71,5%	10	68,3%
67	67,4%	**Percentile**	
		97	70,2%
Gender		98	67,7%
Men	77,0%	99	64,4%
Women	77,1%	100	55,2%

Data from the Archive of Pensioners (Casellario dei Pensionati) and from the Archive of Private Dependent Workers. 1995-2017. Replacement rate is the ratio between the annualized pension benefit in the first year of retirement and the average of last 5 years earnings of the same individual. Each vale in the table is computed as the sum of numerator divided by the sum of the denominator of the ratio.

Table 7
Regression of the replacement rate

Variable	**Coef**	**t**
Retirement age	-.0017	-15.37
Seniority_21_25	.0393	15.17
Seniority_25_35	.2124	21.38
Seniority>_35	.2752	53.69
Anticipated	.0537	15.99
Women	.0286	13.44
decile_2	-.2617	234.67
decile_3	-.3098	243.32
decile_4	-.3290	256.71
decile_5	-.3423	233.56
decile_6	-.3514	254.98
decile_7	-.3579	219.45
decile_8	-.3655	225.81
decile_9	-.3811	249.12
decile_10	-.4625	240.32
year_1996	.0108	20.689
year_1997	.0184	32.07
year_1998	.0134	25.97
year_1999	.0032	59.04
year_2000	.0013	22.00
year_2001	.0079	14.08
year_2002	.0062	11.90
year_2003	.0088	16.30
year_2004	.0099	18.66
year_2005	.0231	36.63
year_2006	.0218	40.32
year_2007	.0278	47.33
year_2008	.0324	58.98
year_2009	.0462	73.6
year_2010	.0436	77.71
year_2011	.0447	74.91
year_2012	.0522	86.90
year_2013	.0603	87.17
year_2014	.0636	92.25
year_2015	.0575	93.24
year_2016	.0539	81.57
year_2017	.0575	92.36
_cons	.9057	37.76

Table 8
Average values for the NPVR, by different categories of socio-economic groups

Year		**Seniority at retirement**	
1995	1,99	Up to 20	1,71
2000	1,78	From 20 to 25	1,56
2005	1,53	From 26 to 35	1,62
2010	1,47	More than 35	1,62
2015	1,28	**Category**	
2017	1,21	Old age	1,51
Ret. Age		Anticipated	1,64
55	2,03	**Decile of Permanent Income**	
60	1,59	1	1,90
63	1,32	5	1,64
65	1,29	10	1,30
67	1,14	**Centile of Permanent Income**	
Gender		98	1,27
Women	1,72	99	1,22
Men	1,56	100	1,09

Data from a random extraction of active individuals in 1995 in the INPS archive (Estratti Conto). Number of observation 166,000. Discount rate is 1.5%. Permanent income is the present value of the earnings during lifetime. Only individuals from FPLD.

Table 9
Percentage of the amount of pension benefit that exceed actuarial fairness

Year	**Excess**
1996	47,2%
2000	36,2%
2005	24,8%
2010	22,5%
2015	12,9%
2017	7,8%
Old age benefits	20,2%
Anticipated benefits	28,8%
Decile lifetime earnings	
1	39,2%
5	32,3%
10	17,2%
Retirement age	
55	40,2%
60	24,3%
65	9,3%
66	3,0%
67	0,7%

Data from a random extraction of active individuals in 1995 in the INPS archive (Estratti Conto). Number of observation 166,000. Discount rate is 1.5%. Permanent income is the present value of the earnings during lifetime. Only individuals from FPLD.

Table 10
Regression of the NPVR

Variable	**Coef.**	**t**
Retirement age	-.0010	-35.89
Seniority_21_25	.0583	124.11
Seniority_25_35	.2305	565.37
Seniority>_35	.2927	663.34
Women	.0237	133.58
Anticipated	.0547	198.55
decile_2	-.2088	-603.69
decile_3	-.2544	-713.73
decile_4	-.2728	-749.62
decile_5	-.2856	-769.70
decile_6	-.2941	-779.10
decile_7	-.3003	-785.56
decile_8	-.3075	-799.02
decile_9	-.3228	-833.87
decile_10	-.4045	-1034.03
year_1996	.0128	27.54
year_1997	.0221	45.28
year_1998	.0115	24.75
year_1999	.0067	14.34
year_2000	.0038	7.33
year_2001	.0108	22.74
year_2002	.0102	21.68
year_2003	.0119	25.06
year_2004	.0131	28.32
year_2005	.0252	46.16
year_2006	.0235	49.59
year_2007	.0283	55.28
year_2008	.0348	71.71
year_2009	.0461	84.90
year_2010	.0453	91.93
year_2011	.0465	89.22

year_2012	.0536	103.07
year_2013	.0605	102.17
year_2014	.0634	107.04
year_2015	.0578	108.80
year_2016	.0544	96.35
year_2017	.0578	107.84
_cons	.7885	452.76

Table 11
Sensitivity of NPVR with respect to the discount rate

Discount rate	NPVR<= 1	1<NPVR<=2	NPVR>2
0.5%	1,50%	43,10%	55,50%
1%	2,90%	58,10%	27,50%
1.5%	6,50%	66,80%	26,60%
2%	14,00%	68,10%	11,10%

Table 12
Financial effect of recomputing pension benefits during the transition

Year	Delta	t	debt
1996	105	0,6%	1,9
2000	239	2,9%	9,8
2005	514	5,3%	21,3
2010	839	7,1%	45,6
2015	1420	19,3%	116,8
2017	1828	23,8%	135,6

Delta is in yearly Euro; debt is in thousands of Euro. Discount rate at 1.5%