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La flessibilità nell'età di pensionamento aumenta la spesa pensionistica?

Alcune evidenze empiriche e suggerimenti per il sistema italiano di sicurezza sociale

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La flessibilità nell'età di pensionamento aumenta la spesa pensionistica? Alcune evidenze empiriche e suggerimenti per il sistema italiano di sicurezza sociale

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Does a flexible retirement age increase pension expenditure? Some evidence and suggestions for the Italian social security system

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Abstract

Questo lavoro analizza la questione della relazione tra dinamica della spesa per pensioni e flessibilità nell'età di pensionamento. Nella prima parte del lavoro sono presentate una serie di evidenze empiriche, desunte dalla banca dati Visitinps, relative all'andamento dell'età media di pensionamento in Italia ed alla sua dispersione. A fronte di un aumento importante nella media, i dati evidenziano anche una compressione nella variabilità e un'importante riduzione nei pensionamenti sotto i 60 anni, soprattutto nell'ultimo decennio. Nella seconda parte del lavoro presentiamo i risultati di una serie di simulazioni stocastiche realizzate con un modello a generazioni sovrapposte che simula due regole di pensionamento di tipo DB e NDC. In particolare le simulazioni analizzano le implicazioni su due indicatori finanziari della presenza di varie forme di distribuzione e le conseguenze di politiche di riduzione permanente e temporanea nell'età media di pensionamento.

Parole chiave: flessibilità, sostenibilità, età di pensionamento, breve e lungo periodo, debito pensionistico

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Does a flexible retirement age increase pension expenditure? Some evidence and suggestions for the Italian social security system

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5th October 2021

Abstract

In defining the role of flexibility in retirement, both empirical evidence and theoretical considerations play a part. Data on past retirement choices show that a uniform age of retirement is far from representing what has happened in in Italy during the last few decades. We find that both the average and the standard deviation of the retirement age have changed significantly. In many cases, such changes have gone in the right direction as far as the sustainability of pension expenditure is concerned. In the second part of the paper, we study the budgetary impact of flexibility in retirement age by using a multi-period overlapping generation model, which we calibrate to summarise some of the characteristics of the Italian social security system. The results of a series of stochastic simulations show that flexibility of retirement does not compromise financial soundness of a PAYGO system in particular when NDC rules are used to compute benefits.

Jel codes: H55, H68, J26

Keywords: flexibility, retirement age, sustainability, short and long term, pension liabilities

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1. Introduction

Allowing for flexibility in the choice of retirement age is a partially neglected argument in the current debate on pension reform in Italy. Data on past retirement choices however show that a uniform age of retirement is far from representing what has happened in the country over the last few decades. Widespread early retirement, coupled with distortionary pension rules, have driven pension expenditure higher with worrying implications for financial sustainability. The 2010 and the 2011 pension reforms (L.122/10, L.148/11 and L.240/11) abruptly increased the legal retirement age and relative eligibility conditions. As a response, a mounting demand for flexibility emerged among Italian older workers. As is often the case, the Italian Parliament's reaction was not particularly inspired by a rational design. Rather, spot interventions have provided partial and often unbalanced answers to a genuine issue. The end of the "Quota 100" experiment, which will expire on the 31st December 2021, gives Parliament the chance to redefine a chaotic and opaque set of rules, which still regulate the exit route for mature workers from the labour market. Political parties, as well as trade unions, have recently put forward various reform proposals to public scrutiny, which aim to overcome the discontinuity that, as of January 1st 2022, will abruptly raise the retirement age by five years for a large number of workers. Most of these proposals, however, are plagued by short-sightedness and by the aim of defending the interests of particular categories. Seldom can one find proposals suggesting the use of the principle of actuarial fairness, which in fact already applies within the Italian pension system[1], as a device that could systematically contribute to defining a structural, effective and transparent route to retirement for the coming decades.

One of the aims of this paper is to show that, in a simulation model that mimics the functioning of a PAYGO system, an NDC formula allows the introduction of a flexible approach to retirement without hurting either short or long-term financial soundness. Italy has introduced such a formula for the computation of pension benefits with Law 335/95. Given the quasi-actuarial neutrality of the Italian setting, the flexibility in the choice of the

[1] Two notable exceptions are proposals of the former and of the current President of the Italian National Pension Institute.

retirement age thus appears compatible with the long-term sustainability of pension expenditure (Palmer 2006, Bosi 1997). A series of interventions, which began in 2010 and ended with Law 240/11 linked the retirement age to life expectancy at the age of 65 years, and have contributed to protecting the Italian pension system from financial pressures deriving from possible future increases in pensioners' lifespans. Other countries that have adopted computation methods similar to the Italian one, for example Sweden and Norway, have introduced age brackets for retirement in their pension systems, limiting only the possibility for early retirement when it could conflict with the adequacy of pension benefits[2] (Withehouse et al. 2017). As far as the Italian NDC system is concerned early retirement are allowed three years before the legal retirement age. Given the link between this age and the evolution of lifetime expectations, this would permit future workers to retire not before 64 years in 2020 and 67 years in 2050.

By using administrative data on the distribution of the retirement age of Italian workers who retired over the period 1995 - 2020 we document the existing heterogeneity in the retirement age of pensioners in Italy, as well as the evolution of its distribution. The complexity of Italian pension law during the transition from the old DB to the reformed NDC system makes it virtually impossible to refer to a "uniform" statutory retirement age over time, gender and categories. Data analysis can instead shed light on the evolution of retirement behaviour during the last 25 years. We find that both the average and the standard deviation of the retirement age have changed significantly. Further, the share of workers with an age at retirement below 60 decreased abruptly in the second part of the analysed period. These changes went in the right direction as far as the sustainability of pension expenditure is concerned and signal that the retirement behaviour of Italian workers underwent structural changes. In the second part of the paper, we study the budgetary impact of flexibility in retirement age by using a multi-period overlapping generation model, which we calibrate to summarise some of the characteristics of the Italian social security system. In particular, we consider two different and simplified pension rules that mimic an NDC and a DB formula, respectively. Accordingly, we

[2] In fact, the Italian NDC system already pursues such objective. In order to claim an old age pension benefit, workers should have accumulated a pension benefit, which amounts to least at 1.5 times the state pension.

develop two indicators able to measure the financial short- and long-term impact of the flexibility of retirement age, and we study their sensitivity to different retirement age distributions among the population. We then go on to analyse the comparative transitional paths of, respectively, a transitory and a permanent reduction in the average retirement age. Results of our qualitative simulations show that flexibility does not compromise financial sustainability in a NDC system. Moreover, transitory shocks in the retirement age are automatically absorbed when the NDC rule is used, while they are not under a DB formula.

2. A (very) complex set of rules

A simplifying assumption to depict the evolution of the retirement age in Italy would consider the age at which workers become eligible to receive their old age pension as a reference point. This age was, in 1992, 55 years for women and 60 years for men with permanent employment. Today it is 67 years, independent of gender and category. Moreover, the indexing of the statutory retirement age to the evolution of life expectancy at the age of 65 makes future further increases possible over the decades to come.

Unfortunately, looking only at the statutory retirement age offers an incomplete description of the very large set of exit routes within the Italian pension system, and consequently of the heterogeneity of past retirement behaviour. On the one hand, it is important to note that the statutory retirement age was not even uniform among different categories of workers[3]. Beginning in 2010, the Italian Parliament has progressively removed such differences among gender and categories.

Old age pension benefits represented, in 2020, only roughly 45% of the total pension benefits paid against a record of social security contributions. The remaining portion of pension benefits, generally named "seniority pensions", allowed workers to retire before the statutory age of retirement, according to various combinations of age and seniority. It

[3] The statutory retirement age under the DB regime, for example, was five years higher for the self-employed and freelance professionals. Significant differences were notable among other pension schemes.

is beyond the scope of this paper to analyse and discuss the evolution of eligibility conditions allowing for early retirement in Italy. What is important to stress here is the relative and growing dimension of early pension benefits in the current stock of pensions. This is large and has been continuously growing since 1995, the first year of disposable disaggregated data (Mazzaferro 2021). Many authors have investigated the effects of DB formulas coupled with early retirement. Results of previous research show that seniority pensions were costly for the pension budget and induced a regressive distribution of resources among Italian pensioners. The distributive and financial implications of this set of rules are important. Early retirement coupled with a DB rule contributes to an internal rate of returns which is higher that sustainable in a PAYGO system. Consequently, a redistribution of resources from future to current generations emerges (Castellino and Fornero 2001; Borella and Coda Moscarola 2010, Mazzaferro 2021). Moreover, workers with dynamic careers are advantaged with respect to those with more stable earning paths, receiving higher pension benefits (Niccoli 2002). The unbalanced intertemporal structure of the Italian DB pension system also created financial costs, which have been estimated in accordance with different procedures (RGS 2020, Brugiavini 2007, Mazzaferro 2021).

Complexity of rules is not only a past issue in the Italian pension landscape. Even excluding quota 100, the current pension legislation offers a large menu of (not coordinated) alternatives to the old age pension to current and future workers. For workers who retire completely under the NDC rule, an early pension is possible at the age of 64. Alternatively, for the same group of workers old age pension eligibility is reached once accrued benefits are at least equal to 1.5 times the state pension[4]. This means that 67 years of age may not be old enough to claim old age pension benefits. In fact, workers with poor contributory records and/or low wages could be forced to work until the age of 71. A seniority pension can also be reached with 42 years and 10 months of contributions (one year less for women), independently of age. Women belonging to the mixed system can also retire at the age of 58, with at least 35 years of contributions, if they accept a recompilation of their pension according to the NDC principle. Workers who entered the labour market at very young age can retire with 41 years of contributions. At

[4] In both the first and the second cases, a working seniority of at least 20 years is also required.

the age of 63 with 30 years' seniority, workers can also receive a public transfer (Ape sociale) which will be paid until the old-age pension. Physically demanding jobs allow also retirement to be brought forward with 41 years' seniority, independently of age. In summary according to the current pension law, and against a statutory retirement age of 67, which is uniform by employment category, the effective retirement age in 2021 ranges from 57 to 71 years of age.

3. Data description

During the last 25 years, the average effective retirement age has grown significantly in Italy, increasing from 58 years for workers who retired in 1995 to 64 years for those who retired in 2020. This trend brings Italy more into line with other European countries (OECD 2019). The growth in the average retirement age has affected both men and women as well as old age and seniority pensioners as Figure 1a) shows. It is the result of the progressive and continuous tightening of eligibility conditions introduced in the pension law from 1992. Interestingly, during the same time span, the dispersion of the retirement age around its mean value also underwent a significant decrease. Starting from a standard deviation of round 5 in 1995, the same indicator was just over 3 in 2020. In particular, it is important to notice that retirements below the age of 60 have decreased substantially. They represented 68% of the total in 1995, remaining at around 60% until 2008. Subsequently the reduction of the share of under 60s has been astonishing, at least in the Italian landscape. The proportion of workers who retired below the age of 60 in 2020 was equal to just 18% of the total workers retiring during this year. This figure is particularly important from a financial point of view: a DB pension benefit determines an intertemporal financial cost that is increasing as long as the age of retirement decreases. Almost eliminating very early retirement goes then in the direction of controlling pension expenditure and improving sustainability, even in a DB pension scheme like the one still prevailing in Italy in the last few decades.

FIGURE (1A-1B)

Both the increasing trend in the average value and the decreasing trend in the dispersion around the mean are uninterrupted over the examined period. This signals that, even in the absence of a complete reform design, as far as the retirement age is concerned, something structural has occurred in the retirement behaviour of Italian workers. In order to enhance the analysis, the next figure compares the distribution of retirement age in the age bracket 50-70 for the years 1995 and 2020. In the 1995 data, three peaks at the age 55, 60-61 and 65 represent more than half of the retirements occurring during this year. The first two peaks correspond to the statutory retirement age, while the second is probably a socially considered maximum age in this period. A complete different situation is depicted by the graph in 2020. Roughly, 30% of individuals who retired in this year were 67 years old. The large majority of remaining pensioners retired with a seniority benefit. Interestingly, in 2020, almost all workers retired after the age of 60, a dramatic change with respect to the 1995 situation.

FIGURE 2

The reduction in the dispersion of the retirement age over the years can also be appreciated by computing the Gini index for the variable in object. As should be clear from the following figure, a continuous reduction in the dispersion of the age distribution occurs over the whole period observed after 1995.

FIGURE 3

The next figure gives the box plot for the retirement age in the period 1995-2020. The growing median age at retirement and the reduction in the yearly box dimension are common over the examined period.

FIGURE 4

4. The mechanics of retirement age flexibility in a PAYGO system

In the economic policy debate on pension design, sometimes the idea of introducing flexibility in the retirement age in a social security system seems to cause worries about its possible negative effects on the pension budget and its financial sustainability. Two concurring facts seem to dominate this conviction: if the pension law allows individual to choose the retirement age within a bracket of possible alternatives, then a race to early retirement is likely. This in turn would lead to doubts about the financial sustainability of the pension system, reduce the countries' potential GDP and permanently increase the number of pensioners with respect to workers. This behaviour would be more worrying the less the pension rules respect actuarial equity. In this case, early retirement would also compromise the intertemporal budget constraint of the pension system by increasing its liabilities. At the same time, the idea of allowing early retirement with an actuarial adjustment faces tough political opposition. In particular, the principle to guarantee "acquired rights" to workers who started work before the introduction of the NDC rule was until now the dominating political justification not to introduce actuarial adjustment in the case of early retirement. Flexibility in retirement seems to be trapped within this cage. At the same time, however, a plethora of single and uncoordinated interventions have allowed a large number of workers to benefit from special rules that skirt the strictness of the evolution of the statutory retirement age. Is it really so dangerous to guarantee a certain degree of flexibility in the retirement age, once the adequacy of the public pension benefit is reached?

In order to evaluate the financial effects of flexibility in retirement age, it is possible to compute the difference between current pension expenditure and current social security contributions before and after its introduction and for sufficiently many years. A useful approach would be to measure the ratio between the current budget balance of the

pension system and some aggregate figure like GDP and/or the wage mass of the economy. An alternative approach would be to measure changes in total assets and liabilities of the PAYGO pension system. In this second case, the first variable is the present value of social security contributions for all individuals who belong to living generations from the time of the survey until their retirement. The second variable is the present value of current and future pension benefits for the living generations from the time of the survey until their last year of life. Again, the ratio between this indicator and GDP and/or the wage mass over time is useful to gauge the financial soundness of the system.

We develop these two indicators in an OLG model for the social security system and we perform a series of stochastic simulations. A fixed number of 1,000 individuals (i) compose each of the T generations of the model. Every individual (i) works for L_j years and is retired for R_{T-j} years, with $L_j + R_{T-j} = T$, where the term T is fixed. All individuals in the model start working at the age of 25. Consequently, L_j determines the individual retirement age. We also fix T at a value of 65, implying therefore that all individuals live until the age of 90 with certainty. At the beginning of each period (t) individuals of an age (j) receive a wage $W_{t,j,i}$ if employed or a pension $P_{t,j,i}$ if retired. $W_{t,j,i}$ is age independent, while $P_{t,j,i}$ depends on the pension formula. We analyse the performance of a mature PAYGO pension system. In particular, we compare two stylised social security systems that use a Defined Benefit and a Notional Defined Contribution formula, respectively, to compute the pension benefit. For our policy experiment, we created a set of 1,000 sample paths or stochastic trajectories. Since all individuals of the model live with certainty for a number of years T, consequently, in each period, once the system has reached maturity, T generations make up the economy. We calibrate the parameters of the pension system in such a way that the benefit computed with the DB and with the NDC formula reach the same value at an arbitrarily chosen age of retirement. In our central scenario, the DB and the NDC benefits are equal at an age of 63 years. Ignoring the time dimension, equations (1) and (2) define the DB and the NDC rule, respectively. A pension benefit for an individual (i) of age (j) is then respectively equal to:

$$P_{j,i}^{DB} = \alpha\, L_i W_{j-1,i} \qquad (1)$$

$$P_{j,i}^{NDC} = \gamma_j\, MC_{j,i} \qquad (2)$$

The amount of the DB pension benefit in equation (1) depends on an accrual factor, α, on the number of years of contributions, L_j, and on the final wage, W_{j-1}. The NDC pension benefit is the result of the product of an age-indexed conversion coefficient multiplied by the notional capital. The first term depends on life expectancy at retirement and on a discount rate, and the second is the capitalised value of contributions. The notional interest rate and the discount rate are equal to the growth rate of the wage mass generated by the model.

In order to compare NDC and DB regimes we proceed as follows. For an arbitrarily chosen retirement age value $(j)^*$, we compute the amount of the NDC pension benefit. In order to have the same value for the DB pension we must set the following:

$$\alpha = \frac{\gamma_j MC_j}{L_j W_{j-1}} \qquad (3)$$

Since the NDC system is by definition actuarially fair, the same is also true for the DB pension, but only when the retirement age is $(j)^*$. Since the DB rule does not take into account life expectancy, the condition of actuarial fairness does not apply for other ages: it follows that the DB pension benefit determines a higher (lower) value than the NDC pension benefit for lower (higher) retirement ages than age $(j)^*$.

The different age path of the pension benefit in the DB and in the NDC cases is important to understand the consequences of the introduction of retirement flexibility on the pension budget. Figure 5 below shows this relationship when we compute α in equation (3) in such a way that, with a final wage of 1, NDC and DB pension benefits are equal at the age of 63. Note that in our example, for ages lower than 63, the NDC benefit is always lower than the DB. The opposite holds true for ages higher than 63.

FIGURE (5)

In figure 6, where we have moved to an individual lifetime perspective: each age from 56 to 70 represents a possible retirement age of a representative individual. A positive (negative) bar measures an increase (decrease) in the sum of pension benefits computed on a lifetime basis with respect to the case of retirement at the age of 63. The important result with regard to the topic of this paper is the symmetry of gains and losses along the age line in the NDC case. In the DB case, this symmetry disappears. It is also important to remember that what we refer to here as individual "gains" translate into higher pension expenditure, while "losses" are lower pension expenditure in the pension budget.

FIGURE (6)

If we translate this line of reasoning from the longitudinal dimension of the representative individual to the cross-sectional dimension of the population of the model in a steady state equilibrium, we can grasp the implications of a heterogeneous distribution of retirement age with respect to the case of a uniform and statutory retirement age. Indeed, we should expect that, at least along the age/time dimensions, gains and losses tend to balance out in the NDC case. The same should not be true in the DB case. Considering the cross-sectional dimension, then we would expect the NDC system to always being in equilibrium. As with the DB system, the sum of over-expenditure in the left part of the age distribution should be more than balanced by the lower level of expenditure in the right part of the age distribution.

We use two indicators to gauge the role of flexibility of retirement on the budgetary status of a PAYGO system. The first is the ratio between the current budget of the pension system and the GDP[5].

$$F_t = \frac{aW_tN_t - P_tR_t}{Gdp_t} \qquad (4)$$

The terms W_t and P_t are the average value of wages and pensions computed respectively for the population of workers and pensioners defined respectively by the terms N_t and R_t.

[5] In order to compute the GDP value, we start from the hypothesis that the wage mass of the model is equal to a constant share of the GDP. More specifically, we consider such a share to be equal to 0.56.

The second indicator requires calculation of the difference between the total amount of pension benefits accrued by living generations at time (t) and the total amount of future social security contributions of living working generations. It is a possible measure of the liabilities created at a time (t) by a PAYGO system as a share of the GDP as:

$$D_t = \frac{PVP_t - PVC_t}{Gdp_t} \quad (5)$$

PVP_t and PVC_t are, respectively, the total amount of pension benefits and social security contributions that all living generations expect to receive and pay. Both values are in present value terms[6]. We set retirement for each individual in the sample in accordance with a random extraction. In what follows we propose different forms of statistical distributions. The results for the two indicators computed for the NDC as well as the DB case are presented in table 1 below. In particular, we contrast the values obtained in the case of a uniform retirement age with those deriving from different form of statistical distributions. The rows from the second to the fourth test the sensitivity of our results to heterogeneity in retirement age. The three normal distributions have the same central value but different standard deviations, while the fourth row represents an asymmetric distribution again around the same central value as the former.

By definition, the value of F_t is equal to zero in the fixed retirement age scenario for both the NDC and the DB case. The two systems also have the same amount of liabilities. It is noticeable that, in the NDC case, both the value of F_t and the value of D_t remain very close to the level reached in the fixed retirement age scenario. This result crucially depends on the property of actuarial fairness of the NDC system and on its transposition to the cross sectional age distribution of the population. Unlike the NDC system, in the DB case the pension budget is no longer in equilibrium once heterogeneity in retirement is introduced. As long as a normal distribution is considered, a positive value for the budget emerges. This is a consequence of the characteristics of the DB system shown in figure 2. In fact, extra expenditure of those retiring earlier is more than compensated by lower expenditure of those retiring later. The extent of the deviations from the equilibrium value

[6] For a generic individual the term D_t is equal to $\sum_{k=t+j}^{t+j+R} P_{i,k} \left(\frac{1}{1+s}\right)^{t-k} - \sum_{k=t}^{t+j} a\, W_{i,k} \left(\frac{1}{1+s}\right)^{t-k}$

have an inverse relationship with the standard deviation of the distribution: the more they are dispersed around the central value of the distribution, the more the asymmetry of the DB system determines a departure from the equilibrium value of the fixed retirement age scenario. Similar results apply in the case of the second indicator that computes the sum of liabilities net of assets of a PAYGO pension system.

TABLE (1)

In order to better evaluate the results, the following figure contains in black (a sample of) single stochastic trajectories, and in red the trajectory of the average value of the same indicator computed over the 1,000 simulations in the NDC case. In the right part of the Figure, the path of three individual simulations is shown.

FIGURE (7)

Two main points emerge as relevant from these steady state simulations. Once a central retirement age has been chosen, allowing heterogeneity in the retirement age does not significantly modify the financial position of the system. Paradoxically, a DB system presents advantages from this point of view because the costs associated with earlier retirement are lower than savings deriving from delays in the retirement age. On the other hand, the fact that actuarial fairness does not depend on the retirement age in the NDC system seems a decisive advantage for this computational rule once we move to distributions that are more realistic and out of the steady state.

5. A transitory and a permanent lowering of the retirement age

From an economic policy point of view, the results of the preceding subsection are interesting because they show that, at least in a simplified set of external conditions and in

a steady state of the economy, allowing flexibility in the retirement age does not compromise the long-term financial soundness of the pension system. In the NDC case, the actuarial fairness of the rule ensures the substantial irrelevance of the age distribution of retirement in a population when the model is a steady state situation. Even in a DB system, deviations from the equilibrium do not appear particularly significant.

Moving out of the steady state, even maintaining the simplified-parameters configuration of the economy from the last subsection, adds significant results, both from the point of view of the relative advantage of the two computational methods and from the implications of the time span that are necessary to absorb the financial effects of shocks in retirement age.

We offer two different exercises here. In the first, we study the financial implications of a permanent reduction in the average retirement age. We then move on to analyse a policy of temporary reduction in the same variable over a finite number of cohorts.

We still take 63 years as the initial central retirement age. In the permanent case, we reduce this age to 60. In the temporary case, the reduction is the same, but it affects only three successive cohorts of workers, and afterwards the central retirement age returns to its initial value. In both the permanent and the transitory case, we maintain the hypothesis of a heterogeneous retirement distribution. In particular, while the mean value of the normal distribution of retirement moves from 63 years to 60 years, the standard deviation remains constant at a value of 4.

Figure 3 shows the behaviour of the indicator F_t in the two exercises. Each of the lines represent the deviation of the indicator with respect to its long-term steady state equilibrium value. Negative numbers therefore represent a deficit in the current pension budget as a share of GDP, while positive numbers are surpluses. The first interesting result regards the length of the financial effects deriving from a shock in the retirement age. In both the permanent and in the transitory case, three decades are required to absorb the shock. In the NDC case, the system returns to its long-term equilibrium. In the DB case, a permanent deficit emerges in the new equilibrium, while the net effect of deviations turns out to be more expensive than in the NDC system both in the permanent and in the transitory shock.

Lowering the retirement age does represent a cost for the pension budget, if the reduction is permanent. Over the analysed period the cost, expressed as the sum of all deficits net of surpluses, amounts to 48% and 109% of GDP respectively in the NDC and the DB case. As for the transitory reduction in the retirement age of the second exercise, the cost is nil in the NDC case and it is equal to 5.9% of GDP in the DB case. The absence of financial costs of the temporary shock in the case of the NDC system is illustrative of the automatic adjustment mechanism property of this rule. In fact, allowing a certain number of workers to retire earlier ends up in a reallocation of expenditures and revenues for the pension budget over time with a net effect of zero, if we consider a sufficiently long period. Qualitatively, the financial consequences of this policy is similar in the DB case. However, the net final implications are negative for the pension budget.

FIGURE (8)

In order to understand the forces at work in the pension system during both the permanent and the transitory shock, it will be useful to refer to the next figure. This shows the evolution over time of two fundamental ratios that explain the behaviour of a pension budget: the economic ratio (average yearly pension payments over average yearly wages) and the demographic ratio (number of pensioners over number of workers). A shock in the retirement age has immediate effects on the demographic ratio. The number of pensioners over the number of workers increases in both the permanent and in the temporary shock. In the second case, however, the ratio returns to its initial value once all individuals of cohorts interested by the policy are disappeared from the model. Therefore, the demographic ratio pushes the pension budget toward a deficit if the economic ratio does not change. However, without an immediate reduction in the stock of current pension benefits, time will be required for the economic ratio to reach a value that completely counterbalances the adverse demographic shock. In other terms, pension benefits paid to workers who retire after the shock should decrease in amount. This in turn depends on the lower seniority of new pensioners and, only for the NDC case, on

the longer life expectancy at retirement that reduces the value of the transformation coefficient. The reason for the delay in the adjustment of the economic ratio depends on the fact that existing pension benefits, i.e. those pensions that have begun to be paid before the shock occurred and are still being paid after the shock, remain untouched in their amount. A point worth noticing is that in the NDC case, the reaction in the economic ratio is always stronger than in the DB case. Moreover, since the NDC rule respects actuarial equity for any retirement age, the system always returns to its long-term equilibrium.

FIGURE (9)

The last figure represents the financial effects of the reduction in retirement age on total liabilities (net of assets). Once again, the left part of the figure shows analysis of the permanent shock, while the right refers to the transitory shock. Consistently with effects on the current budget, a permanent shock leads to a permanent increase in the level of pension liabilities in the DB case. The effects in the NDC case are completely different, with liabilities above the steady state value for three decades and end up with a lower equilibrium value. This last results depend on the lower level of social security wealth associated to the lower level of the retirement age. As for the transitory shock it is interesting to notice that the growth of liabilites is always higher in the DB case and the reduction phase is more intense in the NDC case. This is consistent with results of the transitory shock on the current pension budget and again it depends on the higher sensitivity of pension benefits level to the retirement age in the NDC case with respect to the DB one.

FIGURE (10)

6. Policy considerations

In defining the role of the flexibility in retirement for the next decades, both empirical evidence and theoretical considerations play a role. Looking at past retirement behaviour the first part of the paper showed that, together with a sensible increase in the average age of retirement, a significant reduction in the dispersion around the mean value occurred over the years and notably during the last decade. Importantly also the share of workers who retired early i.e. before 60 years abruptly decreased over time. Since very early retirement coupled with a DB mechanism are two signs of an unbalanced and costly pension system these are good news for the Italian social security system.

Allowing flexibility in retirement can have important positive effects on individual welfare. The possibility to decide, at least in a bracket of reasonable ages able to preserve the adequacy of the pension benefit, when to leave the labour market and moving to retirement can better accommodate individual decision according to individual's preferences and/or to familiar priorities. At the same time, international authorities and national policy makers appear often worried about the negative impact that flexibility could exert on pension's budget sustainability. We show that in an OLG model that simulate two simple pension systems that mimic respectively a DB and a NDC rule, flexibility alone does not determine important deviations from the steady state equilibrium value both of the current pension budget and of the total liabilities expressed as a ratio with the Gdp. This result holds for both a NDC and a DB system and in a number of different retirement age distributions. The intuition behind these results is that, once a central retirement age is chosen in such a way that it results financially sustainable, the extra lifetime expenditure of those who retire earlier are balanced by lower expenditure of those retiring later. While in an NDC system, this result does not depend on the retirement age, the same is not true for a DB one.

Moving out of the steady state illustrates better the advantage of NDC over DB. While in the first, both a temporary and a permanent shock in the retirement age do not affect the long term equilibrium property of the system, the same does not hold for the DB system. Therefore, financial costs are always higher in the DB system.

Economic policy consequences are straightforward: once a central age of retirement able to guarantee the adequacy of the public pension system is chosen, an NDC system is

compatible with flexibility in the choice of the effective age of exit from the labour market. Moreover policies that are designed to give flexibility by decreasing the age of retirement (permanently or even temporary) are costly for the pension budget in a DB system, while the automatic adjustment properties of the NDC system allow such policies to be implemented with less negative impacts.

The possibility to issue temporary public deficits during a recession was an important lesson learnt by policy makers around the world during the last two years. This idea can also be translated to the management of a PAYGO system: as far as positive balances follow deficits, the financial long term sustainability of the system would not be compromised. At the same time, allowing flexibility in the choice of retirement age can substantially improve welfare of workers.

References

Brugiavini, A. and F. Peracchi, (2007), "Fiscal Implications of Pension Reforms in Italy", in *Social Security Programs and Retirement around the World: Fiscal Implications of Reform,* Gruber J. and J. Poterba, (ed.), Chicago University Press.

Borella, M. and Coda Moscarola, F. (2010) Microsimulation of pension reforms: behavioural versus nonbehavioural approach, in *The Journal of Pension Economics and Finance*, 9(04): 583–607.

Bosi, P. (1997), Aumentare l'età pensionabile fa diminuire la spesa pensionistica? Ancora sulle caratteristiche di lungo periodo della riforma Dini, in *Politica Economica*, Vol. 2, pp. 295-304.

Castellino, O. e E. Fornero, (2001), *La riforma del sistema previdenziale italiano*, Il Mulino, Bologna

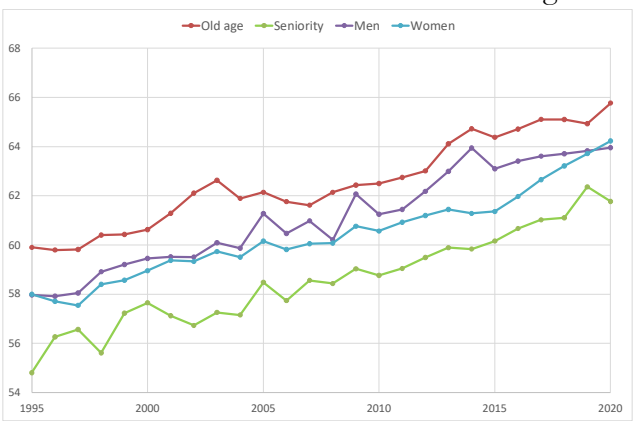
Mazzaferro, C. (2021), The transition to NDC in Italy: assessing distributive and financial effects, *The Journal of Pension Economics and Finance*, doi 10.1017/S1474747221000329

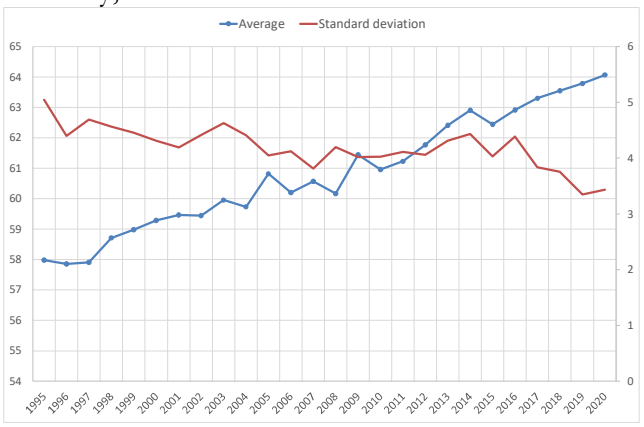
Niccoli, A. (1991), INPS, pensioni e tassi d'interesse: quali proposte sono efficaci, eque e coerenti? in *Moneta e Credito*, Vol. 44, 4, p. 455-47.

Palmer, E. (2006), What Is NDC?, in Holzman, R. and E. Palmer, (eds.), *Issues and Prospects for Non-Financial Defined Contribution Schemes*, The World Bank Press.

Ragioneria Generale dello Stato, (2020), *Le tendenze di medio-lungo periodo del sistema pensionistico e socio-sanitario*, Rapporto n. 21, Ministero dell'Economia, Roma

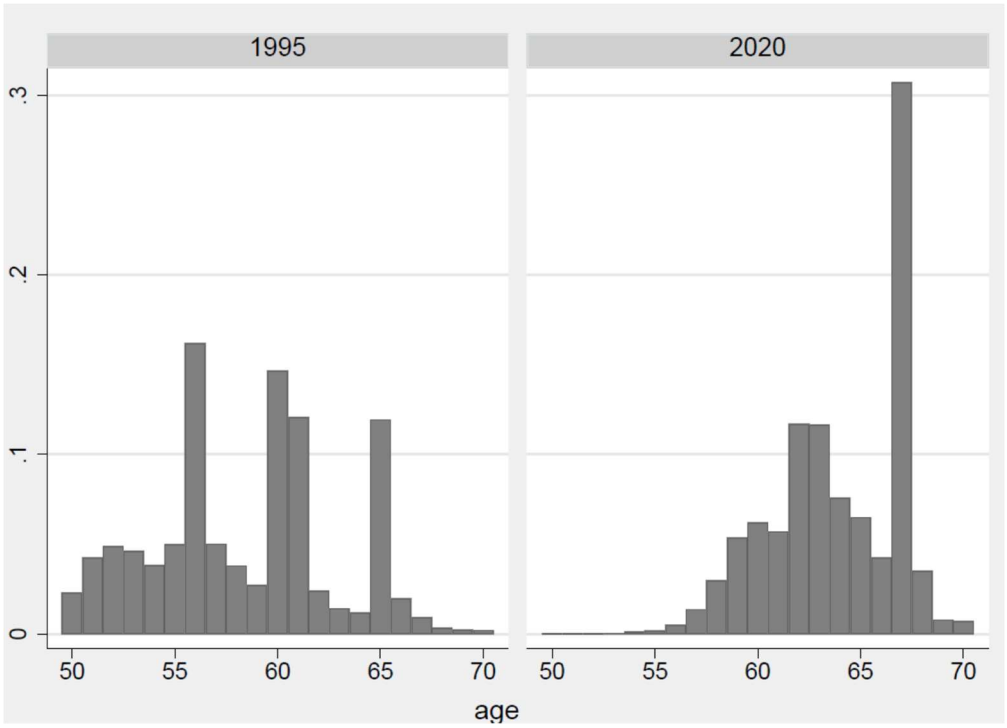
Figure 1 a), 1 b)
Retirement age trends in Italy, 1995-2020





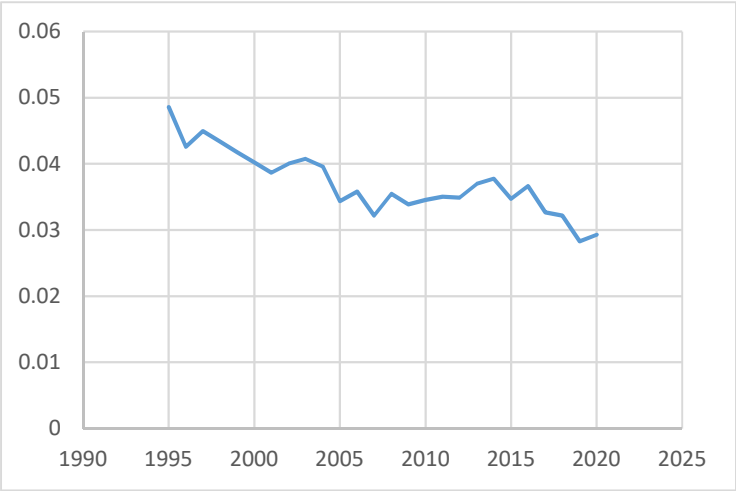
Source: Visitinps data

Figure 2
Distribution of retirement by age in 1995 and in 2020.



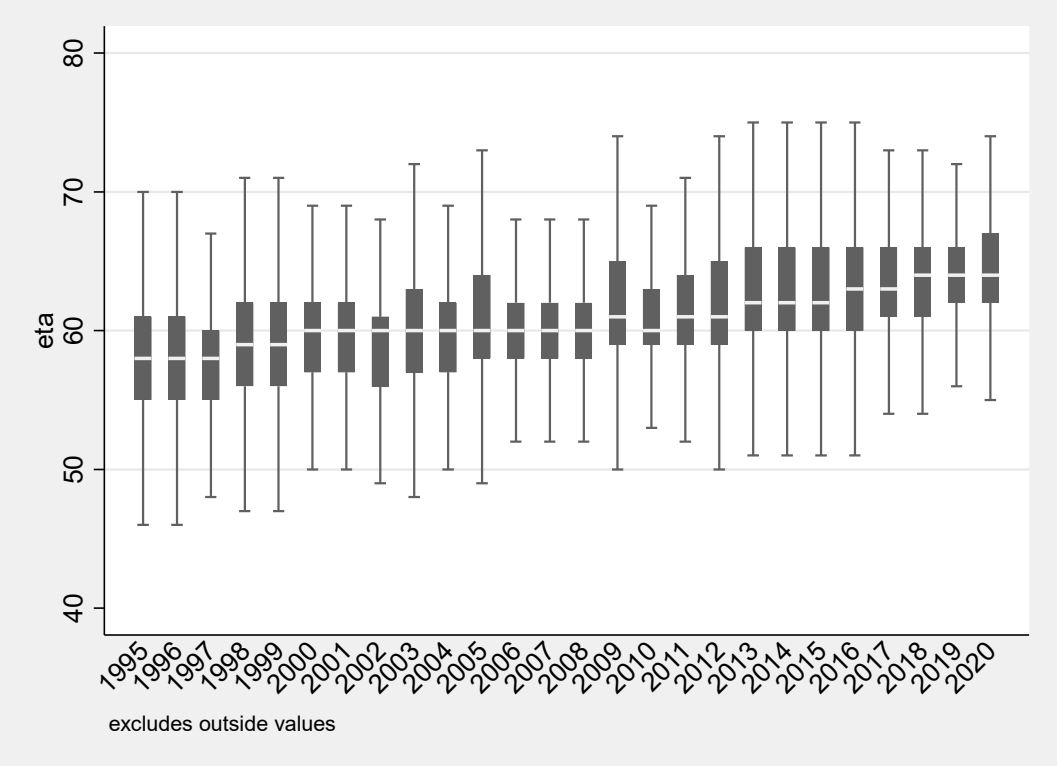
Source: Visitinps data

Figure 3
Gini index of the retirement age, 1995-2020



Source: Visitinps data

Figure 4
Boxplot of retirement age, 1995-2020



Source: Visitinps data

Figure 5
Pension benefits and age in an NDC (pc) and a DB (pr) system
when the two produce the same pension benefit at the age of 63

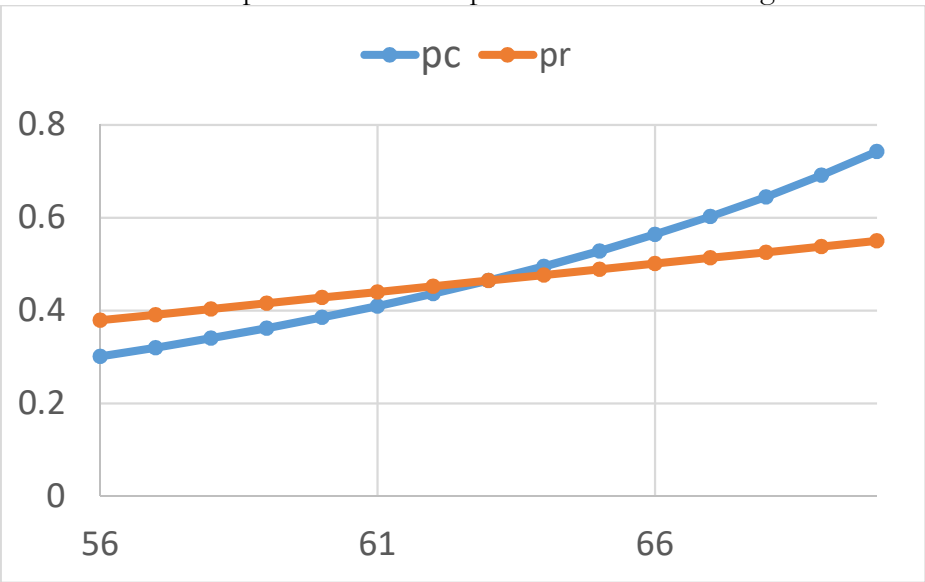


Figure 6
Individual gains and losses in lifetime pension benefits from bringing forward and delaying the retirement age

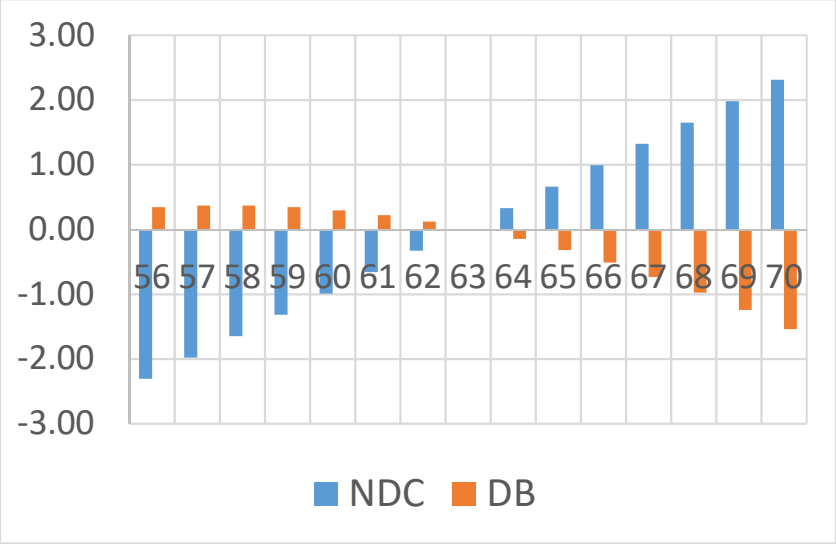


Figure 7
Current budget of the NDC system over GDP (left) in the stochastic simulation (right) and three individual trajectories.

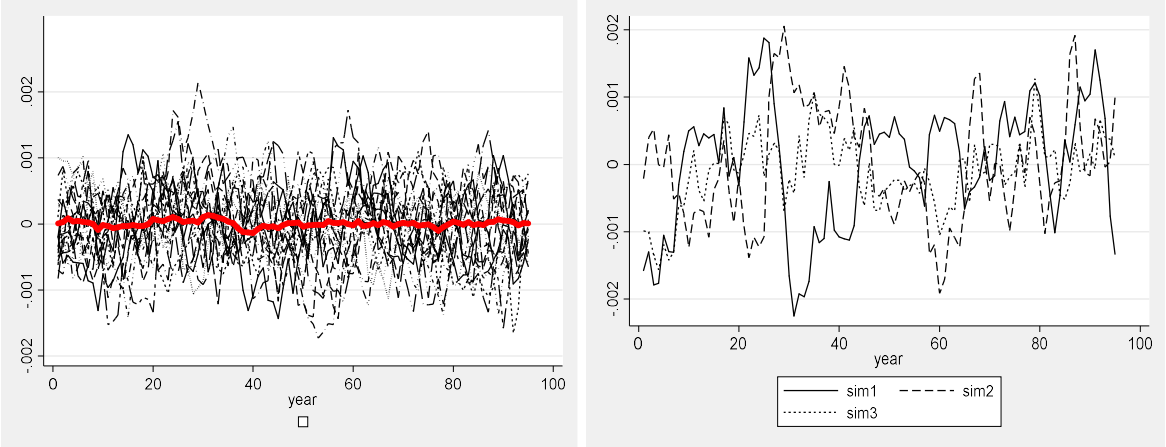
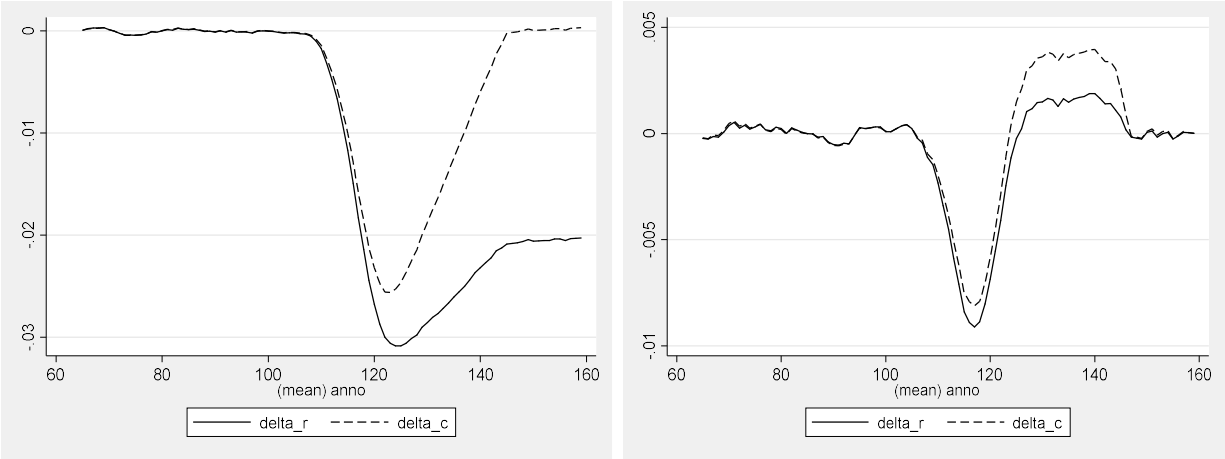


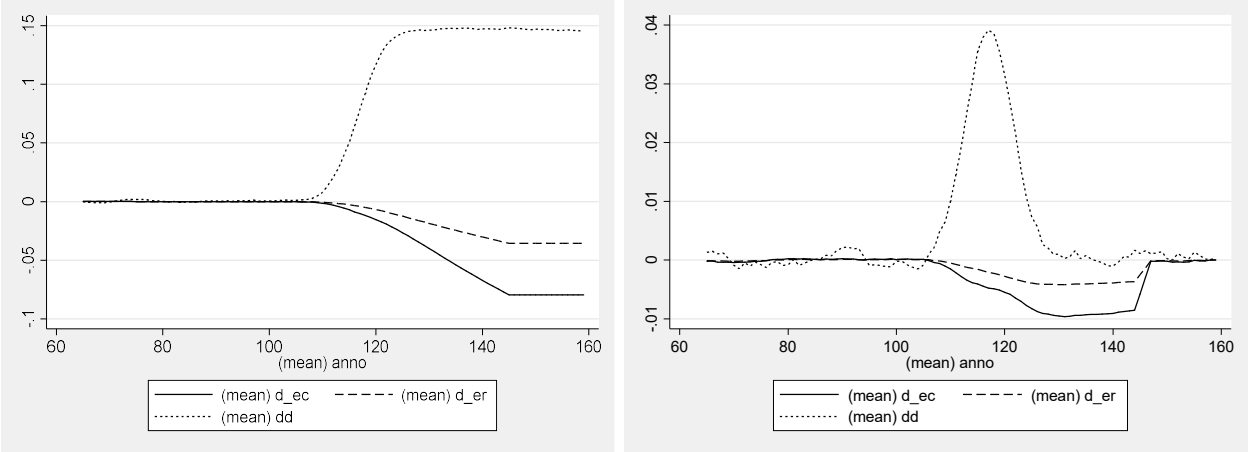
Figure 8

Deviation from the steady-state value of the current pension budget as a share of GDP following a permanent (left) and a transitory (right) lowering of the average retirement age.



Results from 1000 simulations of the model

Figure 9
Deviations of the economic and the demographic ratio in the permanent and the transitory shock from their steady-state values.

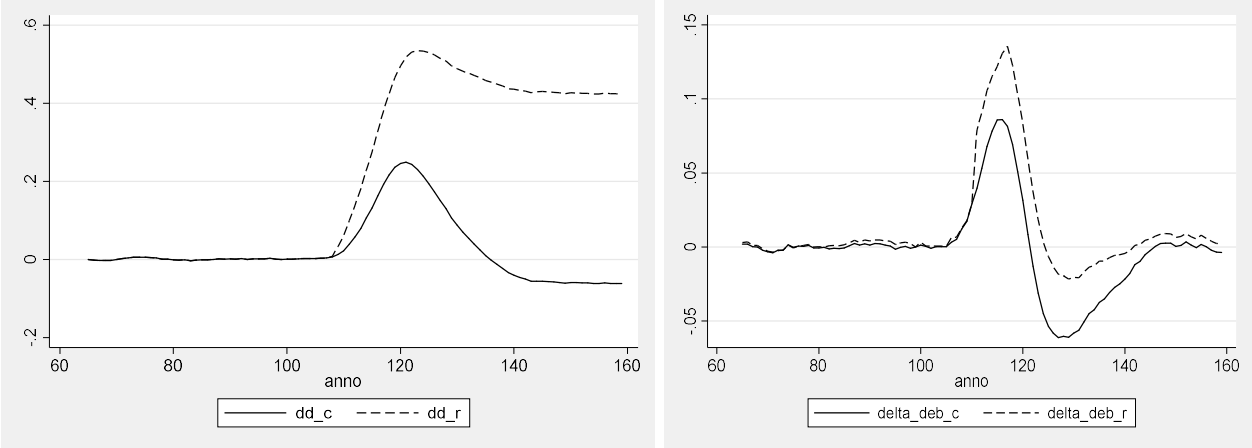


d_ec and d_er measure the economic ratio in the NDC and the DB case; dd is the demographic ratio

Results from 1000 simulations of the model

Figure 10

Deviation from the steadystate value of the liabilities of the pension system as a share of Gdp following a permanent (left) and a transitory (right) lowering in the average retirement age.



Results from 1000 simulations of the model

Table 1

Financial indicators (as a share of GDP) with different theoretical distribution of the retirement age. Mean values and standard deviation (in parentheses); 1000 simulations.

Distribution of retirement age	F_{NDC}	F_{DB}	D_{NDC}	D_{DB}
Fixed	0.0000 (0.000)	0.0000 (0.000)	6.11 (0.000)	6.11 (0.000)
Normal (63.4)	-0.00003 (0.0016)	0.002 (0.0015)	6.12 (0.017)	5.94 (0.024)
Normal (63.2)	0.000062 (0.0012)	0.00065 (0.0012)	6.11 (0.014)	6.07 (0.017)
Normal (63.6)	0.000013 (0.0023)	0.0056 (0.0019)	6.13 (0.022)	5.71 (0.034)
Beta()	0.00004 (0.0010)	0.0004 (0.001)	6.11 (0.0177)	6.09 (0.014)