

Measuring intragenerational and intergenerational redistribution in the reformed Italian social security system

Carlo Mazzaferro¹ *University of Bologna and CAPP*
Marcello Morciano *University of East Anglia, ISER and CAPP*

May 2009

Abstract

Reforms of the Italian social security system, carried out between 1992 and 2007, will change dramatically its structure in the long run. The empirical research has paid more attention at the evaluation of macroeconomic and financial implications of such reforms. Up to now we do not know about any effort to describe and discuss the long run intergenerational and intragenerational redistributive implications of such a big change in the main component of the Italian social protection system.

The main aim of this paper is to set out this line of research. We will use CAPP_DYN, a dynamic microsimulation model of the Italian population. The model simulates stochastically the socio-demographic and economic evolution of a representative sample of the Italian population over the period 2005-2050. Sample members (about 170.000 in the base year) are involved in a number of demographic and economic events such as birth, education, marriage, work, retirement, death. Taking into account as much as possible of the rather complex phasing in of the Notional Defined Contribution system introduced after 1995 the model is able to produce a set of indexes (net present value ratio, Gini, replacement rates, etc) that allow us to evaluate the distributive properties of the reformed system in each of the simulated years as well as in a life-time/cohort perspective. In particular we will pay attention to the slow transitional phase that appears to be critical since the cohabitation of three different regimes of computation of pension benefits.

¹ Address for correspondence: Carlo Mazzaferro, email: carlo.mazzaferro@unibo.it

1. Introduction

This paper empirically analyzes the long term distributive trends in the main part of the Italian social security system after the reform process began in 1992 and not finished yet. Our simulations are carried out using CAPP_DYN, a closed, discrete time-based dynamic population model developed at the CAPP (Centro di Analisi delle Politiche Pubbliche²), since 2004. The model is based on a representative sample of the Italian population and stochastically projects them forward through time to 2050. It allows scholars to analyse both the intragenerational and the intergenerational effects of the reforms occurred in the pension system, paying attention on the distributional implication of the very slow transition phase from the old earnings related formula to the new notional defined contribution system. Having started the process, the change will be gradually phased-in over the following 3 decades. In that period, important socio-demographic changes have been expected and three different computation rules of the pension benefit will coexist. Besides the absence of indexation to the real growth of wages will impoverish pension benefits as long as time passes, adding complexities at the distributive outlook of the Italian pension system.

A model based on a heterogeneous population, like CAPP_DYN, offers a comparative advantage in capturing some of the intertemporal distributive effects described above, with respect to other classes of agent-based macro or microsimulation models.

The paper is organized as follows. Subsection 2 describes the general structure of the model whereas section 3 is devoted in presenting our results. The analysis is restricted to old age pension benefits provided within the main Italian pension schemes (applied to the private and public dependent workers and the majority of self employed). The intra and intergenerational distributive trends of the Italian reformed pensions system are analyzed with the aid of different synthetic indicators. The gross replacement rate between the first year pension benefit and the last year wage/earning, the Gini index

²www.capp.unimo.it

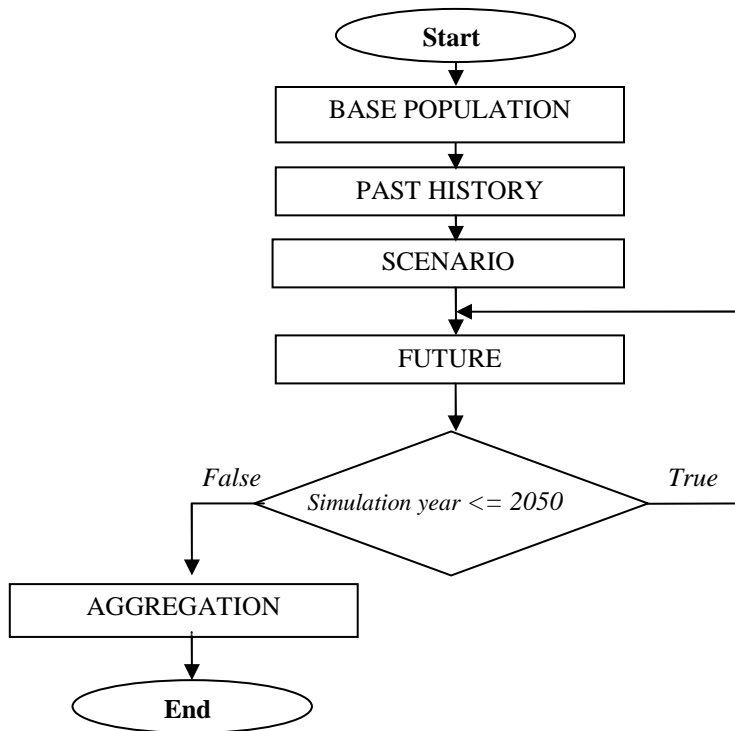
computed on the annual distribution of old age pension benefits and finally a poverty index computed among pensioners and among the whole population as well. Money's worth measure (Net Present Value Ratio) is finally computed in order to capture the intergenerational distribution of resources.

2. *CAPP_DYN: the structure of the model*

All the simulations presented in this paper are run using CAPP_DYN. A detailed description of the model is beyond the scope of this paper and we refer to Mazzaferro and Morciano (2008) for technicalities. The model takes a cross-section representative of the Italian population in a certain year and, applying dynamic ageing processes, simulates the life course for each individual in this initial population up to 2050. New sample members are added in each of the simulated year as result of the flow of new birth and new immigrants, according official demographic scenarios whereas others will be removed due to the simulation of the annual death.

Fig. 1 shows the general structure of the model: starting from the initial base population (`BASE POPULATION`), a second block retrospectively simulates past working careers of the active population in the base year (`PAST HISTORY`). When the past individual's working careers are available for all sample members we get on to a block where the exogenous parameters are setted (`SCENARIO`), a simulation cycle where the evolution of the population is projected (`FUTURE`), and finally we apply a module where all cross-sections are aggregated into a single panel (`AGGREGATION`).

Figure 1
The structure of the CAPP_DYN model

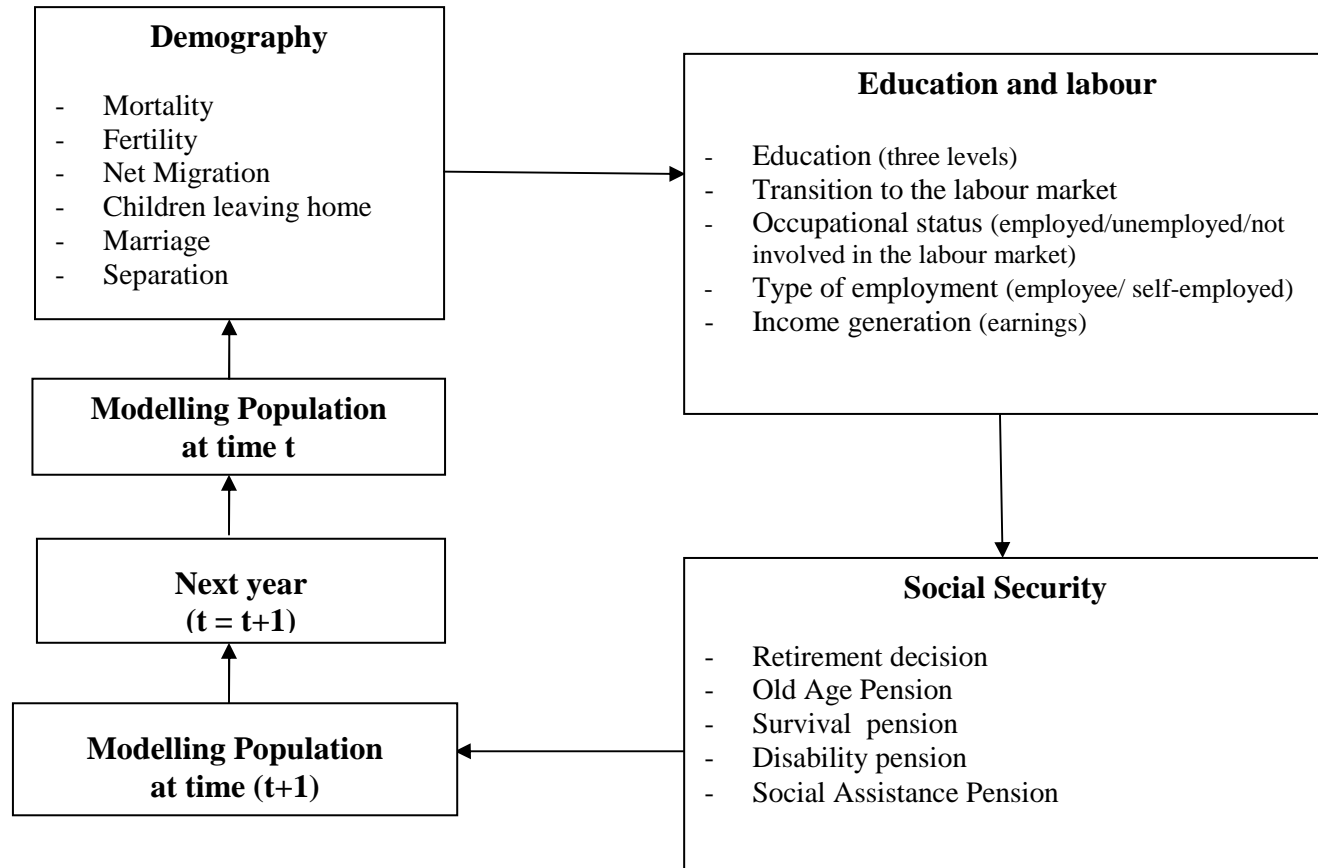


The initial population is taken from the 2002 wave of the Bank of Italy Survey of Households Income and Wealth (SHIW_02), a dataset comprising 8001 households and 21,400 individuals, which has been resampled and inflated, in line with official socio-demographic figures. Simulations presented here are run using an initial sample of 107,000 households and 270,000 individuals.

While the unit of simulation is the individual, we nevertheless keep information on the family structure, tracking its change over time. All individuals in the sample are involved in a considerable number of demographic and economic events, such as birth, education, marriage, work, retirement and death. Economic and demographic transitions among states are simulated using Monte Carlo processes. A set of matrices and econometric models are employed in order to obtain conditional transition probabilities which in turn are used for generate the individual's lifetime pattern of education, working career and personal income and so on.

The CAPP_DYN future block has a recursive structure consisting in a set of modules executed in a predetermined order. Each module is devoted in simulating a particular event. The events are simulated in discrete time (calendar year) using finite-state Markov's chains. The order of these modules is shown in Fig. 2. The simulation starts with a set of demographic modules (mortality, fertility, net migration, household structure, (re-)marriage and divorce). Afterwards individual's educational choices and completion of the educational careers are modelled for the youngest sample members. The next module deals with individual's job decisions. Each individual may change his/her occupational status (assumed to be characterized in the finite sets of possibilities: full time, part-time, out of the labour market, unemployed) according a set of time-variant and time-invariant observables. For those in inpaid work an earning equation based on a Mincerian model allows the estimation of earnings. Finally, each individual, on the basis of the current pension rules, and of his/her accrued seniority and the legal retirement age, moves towards retirement. Individual income comes from employment or from the social security system. For employed people, earning dynamics are simulated using a simple variance component approach. For retired individuals we compute deterministically occupational, survival and social-flat rate benefits. We have done our best to take into account the rather complex nature of the Italian pension system.

Figure 2. The modules of CAPP_DYN



3. The reform in the Italian pension system and its distributive effects

The reform process in the Italian social security system started in 1992 with the Amato reform, a standard parametric reform which: i) increased progressively legal retirement age, ii) cut accrual factors in the earnings related pension formula, iii) modified indexation of pension benefits linking their growth to inflation instead of to earnings. Three years later, the 1995 reform introduced a Notional Defined Contribution (NDC) system which linked more closely individual's contributions with pension benefits and crediting future benefits a sustainable rate of return. Finally, the 1997 reform further reduced the heterogeneity of treatments between private and public employees and it restricted the possibility to retire before the legal retirement age. Nevertheless, the legislative scenario has been modified again in recent years further reducing possibilities of early retirements.

According to a number of studies (see among others Franco 2002; Castellino and Fornero 2001), the change from a defined benefit to a (notional) defined contribution scheme resulting from the 1995 reform, should have made the system more equitable by linking closely contributions and pension benefits at the individual level. Contributions are (fictitiously) accumulated in an individual fund and are revalued in line with a moving average of GDP growth. Pension benefits are calculated as a product of this revaluation and a coefficient conditional on life expectancies at retirement. Such coefficient, uniform by sex and dynamically updated in order to take into account projections on the life expectancies of new and future cohorts, roughly allows the system to be on average actuarially fair among cohorts. Indeed the NDC system provides a homogeneous internal rate of return across pensioners. More complex is the situation in terms of the adequacy of the system: in order to assure financial sustainability the NDC system has reduced prospective replacement rates. This effect is only partially counterbalanced by the increase in the average retirement age.

The very slow transitional path from the earnings related formula existing before 1995 to the reformed one (a contributions related formula) complicates the picture. In fact, all individuals with at least 18 years of contributions in 1995 remained under the old earnings related scheme, while workers with less than 18 years of contributions will retire with a weighted mixture of pre and post reform benefits. A summary of the differences in the rules of computation of the pension benefit for the three groups is provided in the appendix.

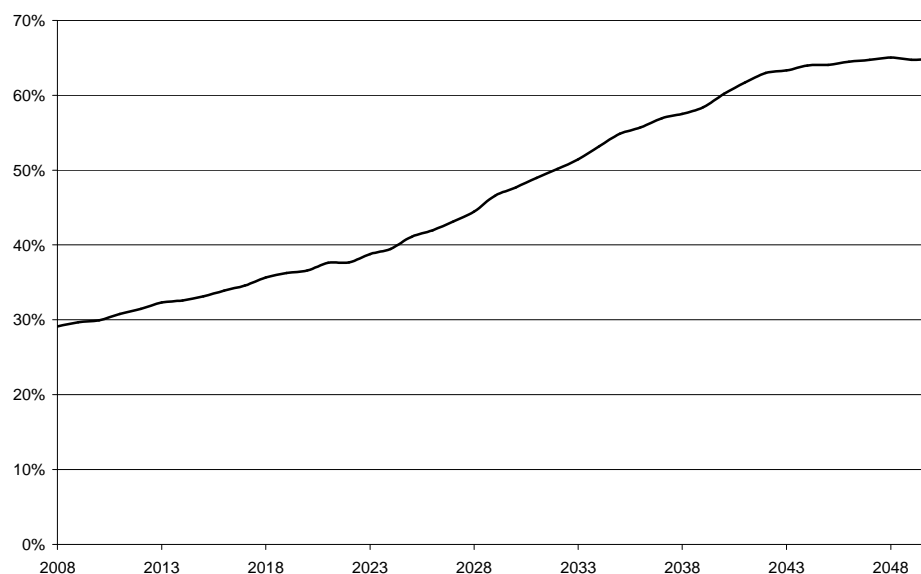
Moreover, the decision, already made in 1992, to abandon the indexation of pension benefits to real earnings will result in the gradual impoverishment of existing pensioners compared with new

pensioners and workers. Therefore, for the next decades the Italian social security system will pay pension benefits computed under three different set of rules. Furthermore, because of the price-indexation public pension benefits will decrease their relative value depending on their maturity.

4 *Empirical results*

In this section we present the results of our simulations. Before going through the presentation of the distribution of pensioners' incomes projected for the next decades, it is important to note that the Italian population is currently experiencing one of the most rapid ageing processes in the world. The most used index for studying such process, the old age dependency ratio – the number of people of people aged 65 and over as a percentage of the working age population (16-64) is forecast to rise dramatically in the next decades.

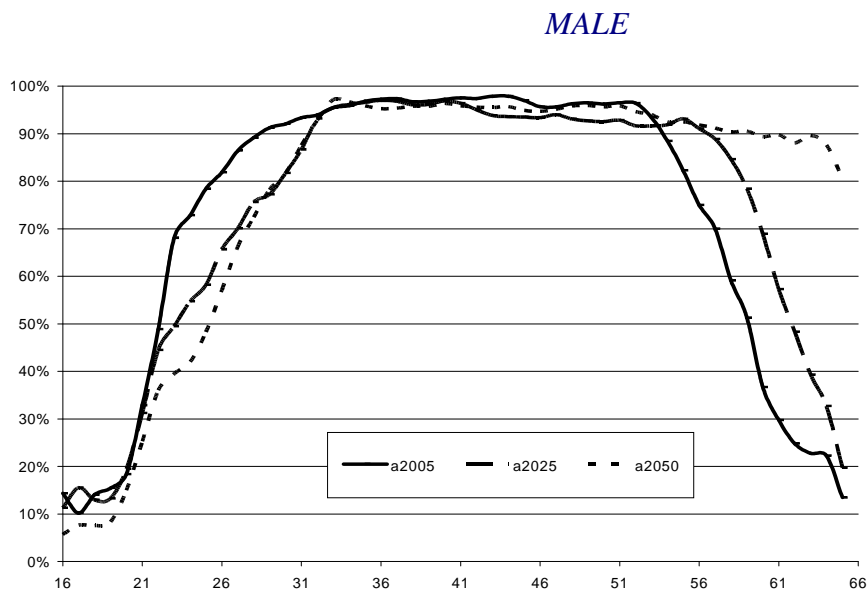
Figure 3. Old age dependency ratio



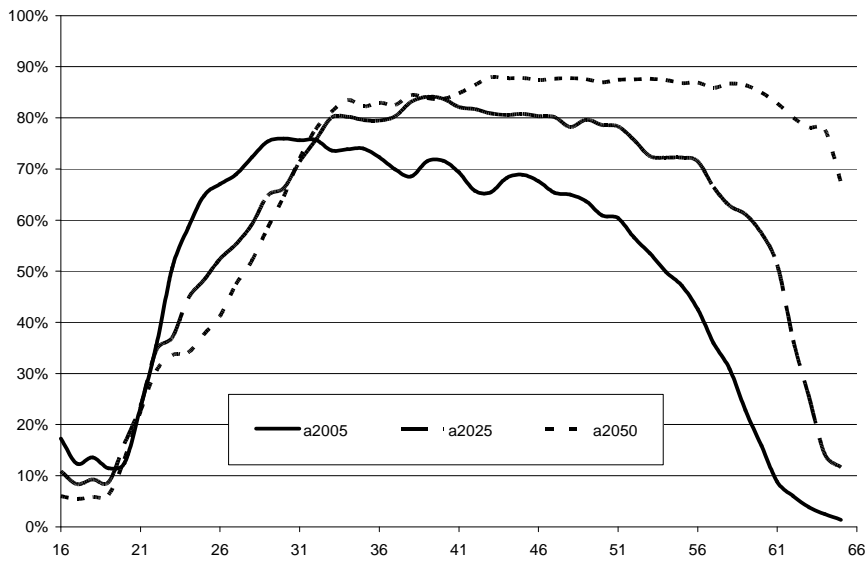
The ageing of the baby boom generation and the increase in life expectancy expected for the future decades are not the only factors that may produce effects on the pension projections. Changing in marital status and fertility decisions are, amongst others, important socio-demographic processes which explain the gradual reduction in the family size. These changes might, in turn, have significant effects in determining work participation decisions and, of course, level and composition of the family disposable income. The increased level of educational of the younger Italian cohorts,

the increase of female participation into the labour market and the tendency of postponing the retirement age are other important processes which are likely to affect structure and composition of the Italian labour market. Fig. 4 reports the participation rate by age estimated by CAPP_DYN in 2009, 2025 and 2050. Some effects are worth to note. Moving from 2005 to 2050 the participation rate at younger ages will decrease for both men and women, given the tendency to remain longer at school of younger cohorts. At the same time the participation rate increases for women in the central part of their active lifetime as a result of a trend registered in Italy since the middle of the nineties and expected to continue in the future. Finally the participation rate increases also in the final part of active lifetimes because legal retirement age increases and because we assume that individuals in the model will respond to the reduction in the replacement rate expected from the pension system working longer.

Figure 4. Participation rate by age and gender, years 2009, 2025 and 2050

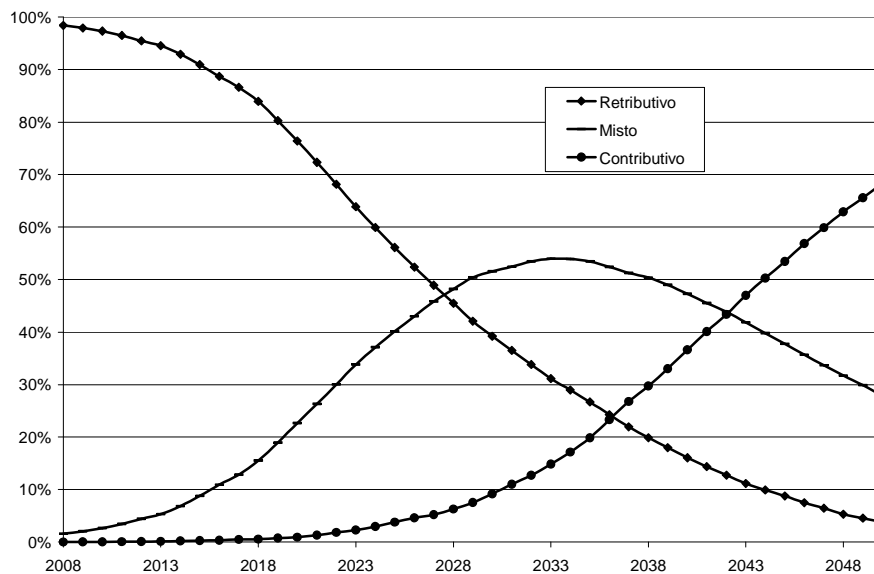


FEMALE



Preliminarily to the presentation of our distributive results on pensioners' incomes it is interesting to notice how the shares of the three groups of pensioners (earnings related, mixed system and contribution related) is expected to evolve during the period under examination. Figure 5 shows that only at the beginning and at the end of the observed period a clear superiority of one of the three groups of pensioners emerges. In the middle of the period of analysis all three groups of pensioners will be present at the same time implying an increase in the heterogeneity observed in the level of pension benefits received.

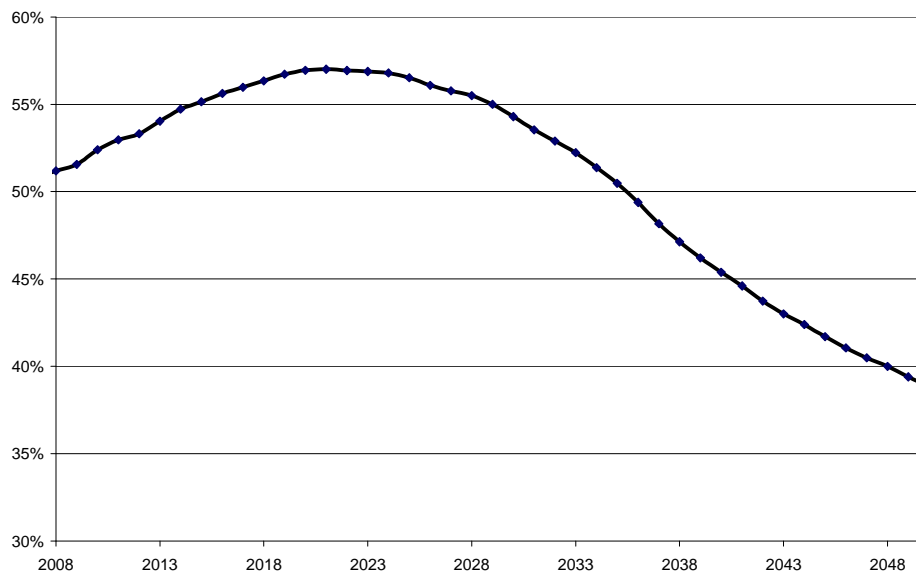
Figure 5
Share of living pensioners according to the pension rule



Source: CAPP_DYN

Another important point that is worthwhile stressing regards the evolution of the average level of pension benefits with respect to the average level of earnings. From Figure 6 we can see that the ratio increases up to year 2023 and decreases afterwards. Two forces are jointly at work in explaining the evolution depicted in Figure 6. On one hand the absence of an indexation of pension benefits to real wages tends to reduce the relative value of of the former with respect to the latter. On the other hand the slow transition towards the more restrictive NDC system has a more ambiguous effect since it explains both the initial rise and the reduction of the ratio in the second part of the period under observation. More generally, Figure 6 draws a scenario where the average risk of poverty for the older part of the population is expected to rise in the next decades, stressed by the huge gain of life expectancy projected for the new cohorts. However, a full judgement of the implication of the reformed pension system on poverty would require detailed information about the disposable household income distribution.

Figure 6
Ratio between average old age pension and average earning. 2008-2050



Source: CAPP_DYN

Turning on the distributive analysis of pension benefits, Table 1 reports, for a number of representative years, the mean and standard deviation of the pension benefits expected for the whole stock of recipients and for each of the three pensioners subgroups³.

Table 1
The distribution of old age pension

Year	Share	Average value	Standard deviation	Coefficient of variation	p90/p10
All pensions					
2008	100%	12,912	7,238	0.31	3.93
2015	100%	15,505	9,070	0.34	4.20
2020	100%	17,303	9,999	0.33	4.27
2025	100%	18,809	11,172	0.35	4.49
2030	100%	19,795	11,939	0.36	4.42
2040	100%	20,171	12,019	0.36	4.01
2050	100%	21,159	12,143	0.33	3.84
Earnings related					
2008	98.4%	12,950	7,261	0.31	3.98
2015	90.9%	15,636	9,046	0.33	4.12
2020	76.4%	17,008	9,554	0.32	4.17
2025	56.1%	17,950	9,690	0.29	4.16
2030	39.2%	18,850	9,769	0.27	3.93
2040	16.1%	20,944	9,853	0.22	3.55
2050	3.8%	22,032	9,758	0.20	3.31
Mixed					
2008	1.6%	10,579	5,096	0.23	3.28
2015	8.8%	14,376	9,281	0.42	4.78
2020	22.7%	18,663	11,312	0.37	5.16
2025	40.1%	20,852	12,894	0.38	5.06
2030	51.6%	21,929	13,514	0.38	5.23
2040	47.3%	22,578	13,933	0.38	5.16
2050	27.9%	22,875	14,003	0.37	5.00
Contribution related					
2015	0.3%	8,273	2,301	0.08	1.87
2020	0.9%	8,385	1,766	0.04	1.56
2025	3.8%	9,917	3,198	0.10	1.92
2030	9.2%	11,854	5,133	0.19	2.28
2040	36.6%	16,726	9,029	0.29	3.19
2050	68.4%	20,411	11,347	0.31	3.60

Source: CAPP_DYN. All monetary values (gross) are expressed in the base year prices (Euro 2008).

³ Only individuals receiving an old age pension benefit are included in statistics presented in Table 1.

In the last two columns of that table we add two measures of social distance: the coefficient of variation and the percentile ratio (the ratio of the income of the person at the 90th percentile (p90) to the person at the 10th percentile (p10)). The evolution of the average amount of pension benefits presented in Table 1 indirectly confirms the progressive reduction of the relative value of the benefits as time passes.

Results presented in the right side of the table suggest an increase in the dispersion of the distribution of pension benefits in the central part of the simulation period. The overall effect is mainly driven by the gradual application of the contribution related formula in computing pension benefits. Let's consider for example the coefficient of variation: its peak value occurs in the year 2035. Afterwards the coefficient of variation slowly decreases. Interesting is also the analysis of the interquartile ratio: if we evaluate it over the whole stock of benefits its dynamic is very similar to that of the coefficient of variation; it is much higher for the mixed and the contribution related pension.

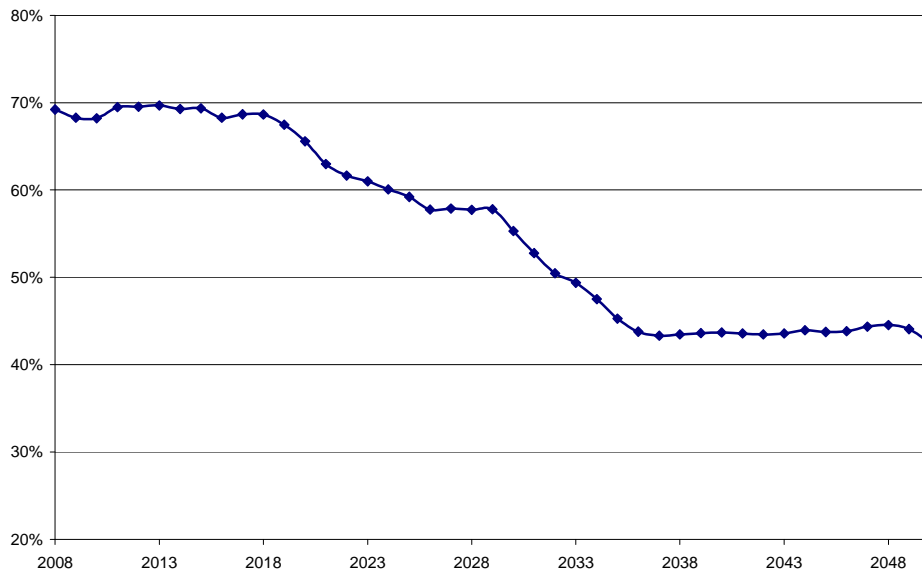
In the remaining part of this section we provide a picture of the intragenerational distributional effects of the reforms. We focus on the relative patterns of inequality and poverty, using some of the widespread indicators used in the pension literature: the replacement rate, the Gini index and the HeadCount Ratio (HCR).

The replacement ratio even if it does not describe completely the characteristics of a pension system is widely used because it offers a direct picture of the adequacy of a pension system. The Gini index synthesizes the evaluation of the dispersion of pension benefits distribution whereas HCR gives a summary indication on the poverty risk among pensioners.

3.1 *Replacement rates*

The time trend of the average value of the gross replacement rate, computed as the ratio of the accrued pension in the first year of retirement to the last earning is reported in Fig. 7 for the whole population of new pensioners. Although this index does not give a full image of all the distributive characteristics of a pension system, it has the appeal of providing a first idea of the degree of adequacy of a pension system.

Figure 7
Gross replacement ratio for new pensioners. 2008-2050



Source: CAPP_DYN

Fig. 7 highlights the deep reduction of this index, especially in the second part of the period when the NDC system will be completely phased in. The average replacement rate, roughly equal to 70% at the beginning of the estimated period decreases dramatically to about 45% at the end of it.

Table 2 analyzes the distribution of replacement rates in some representative years. It is interesting to notice that, in spite of the expected reduction of the mean value of this indicator its variability, analyzed here using the coefficient of variation, gradually increases⁴.

Particularly worrying is the drop in the value of the replacement rate for the 10th percentile, from 45% to 25% at the end of the period as well as the increase in the distance between the 90th and the 10th percentiles.

⁴ The evolution of the replacement rate depends on the dynamics of earnings as well. Here for brevity we do not present the result of this indicator. For the goal of this paper it is important to note that the growth rate is linked with Italian official projection whereas earning distribution amongst workers is mainly explained by the estimated coefficient used earning module and the evolution of the time-variant covariates over the simulation period. See Mazzaferro and Morciano (2008) and Morciano (2007) for details.

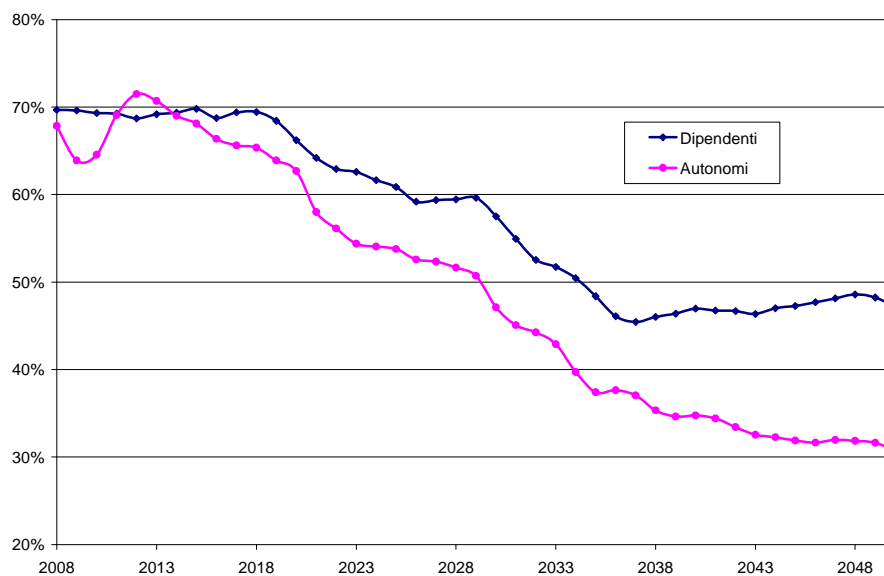
Table 2
Distribution of the gross replacement ratio
in some representative years.

<i>Year</i>	<i>Average value</i>	<i>Coeff.of variation</i>	<i>p10</i>	<i>p90</i>	<i>p90 – p10</i>	<i>p90 / p10</i>
2008	69.2%	0.04	0.45	0.73	1.63	0.28
2015	69.0%	0.04	0.47	0.80	1.69	0.33
2025	58.1%	0.10	0.31	0.75	2.40	0.44
2035	43.2%	0.11	0.26	0.61	2.36	0.35
2050	41.2%	0.14	0.25	0.56	2.28	0.31

Source: CAPP_DYN

Looking now at some subgroups of the whole population may help to identify who will be the looser in the reform process of the pension system. Figure 8 shows that, related to their pre-retirement earnings, self employed workers expect a greater penalization by the introduction of the NDC system. This result is the consequence of the lower contribution rate that this category of workers pays to the pension system (20%) with respect to the contribution rate applied to dependent workers (33%). Changing the computation rule from an earning related to a contribution related formula reduces therefore more deeply the level of the benefit for the self-employed, *ceteris paribus*.

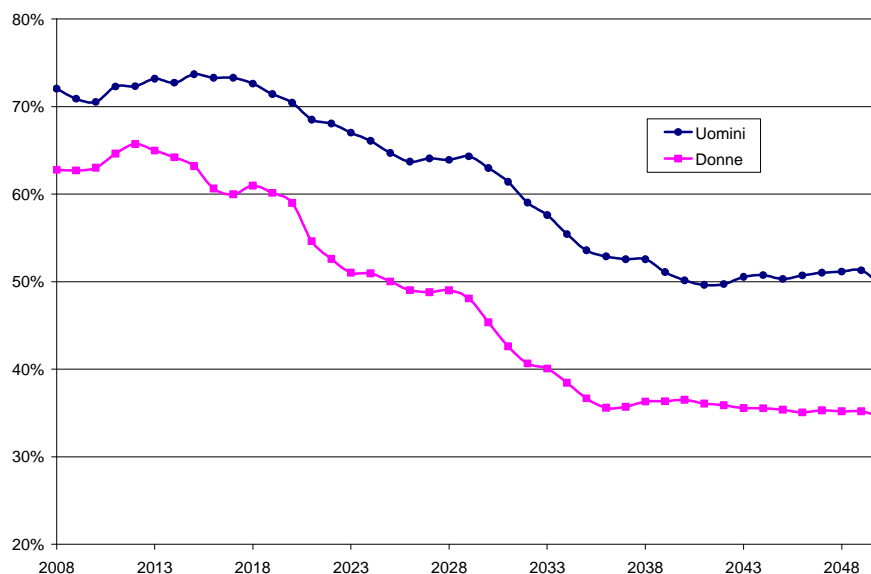
Figure 8
Gross replacement rate for self-employed and dependent workers
2008 - 2050



Source: CAPP_DYN

Figure 9 finally distinguishes by gender. The gap between men and women, still present at the beginning of the simulation increases through time. The main explanation of this increasing difference is the role that the 5 years gap between the legal retirement age of male (65) and female (60) has in the expected pensions computed on a NDC system. Furthermore, the difference by gender on the legal retirement age that hardly finds a justification from an economic perspective, increases the poverty risk for women.

Figure 9
Gross replacement rate by sex
2008-2050



Source: CAPP_DYN

The only analysis of the replacement rate may give a distorted picture of the whole effects of pension reforms enacted. Computing the ratio between pension benefits provided since a certain year and the average value of earnings (or total pension stock) after a time interval of 5, 10, 15 and 20 years, is a useful exercise to evaluate the ability of the social security system to be adequate for pensioners even some year after retirement. Table 3 reports those ratios for old age pensions that are provided firstly in year 2008, 2015, 2025 and 2035. Results prove that the indexation mechanism chosen in 1995 causes a progressive and intense reduction of the real value of pension benefits⁵. This reduction increases with time and reaches troubling values: for example average (new) pension benefits paid in 2035 are worth 44% of the average value of earnings at the same year, but the same benefits will be equal to only 20% of average earnings if measured 20 years later. At the same time, looking data by columns we can have a measure of the progressive reduction of the value of pensions as long as time passes and the introduction of the NDC system is phased in. Finally the second part of the table shows that there is also a distributive problem within the population of pensioners. In fact, those who are expected to live longer will have to face a rather important reduction of their pension benefit with respect to younger pensioners.

⁵ Of course, the magnitude of this reduction is influenced by the assumption regarding the growth rate. We assume that earnings in CAPP_DYN grow in line with official projection of RGS (in average 1.8% in real term over the period 2009-2050).

Table 3
Ratio between the averagnpension benefit provided in year t and average earning (r_*) and average pension benefit (t_*)in the current year (r_1 e t_1)and after 5, 10, 15 e 20 years.

Pension provided in year:	r_1	r_5	r_{10}	r_{15}	r_{20}
2008	82%	78%	73%	67%	60%
2015	71%	68%	62%	57%	51%
2025	63%	59%	54%	48%	43%
2035	44%	41%	38%	33%	20%

Pension provided in year:	t_1	t_5	t_{10}	t_{15}	t_{20}
2008	163%	151%	134%	120%	109%
2015	130%	121%	112%	106%	103%
2025	114%	109%	108%	106%	104%
2035	91%	90%	88%	86%	ND

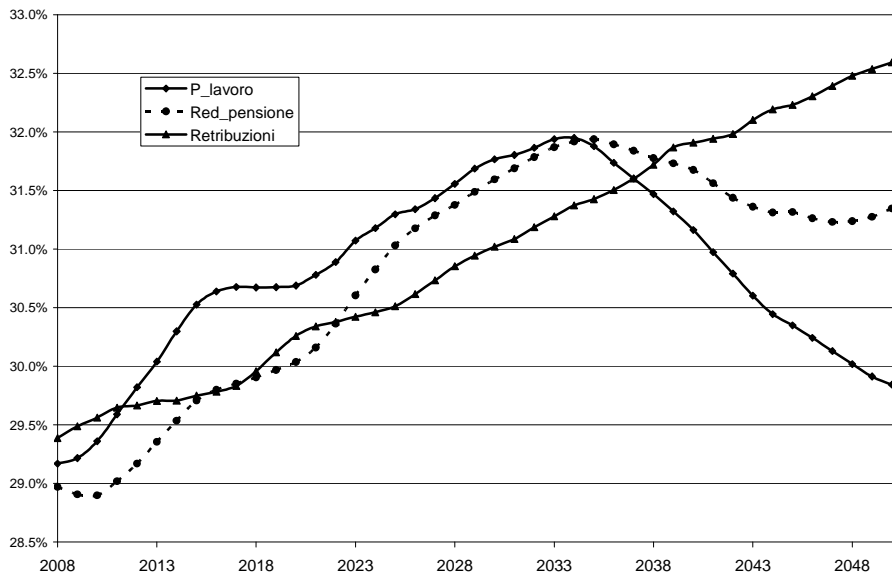
Source: CAPP_DYN

3.2 *Gini index and quintile analysis*

Figure 10 compares the evolution of three Gini indexes: the first is computed on old age pension benefits, the second on the sum of all pension benefits (i.e. including social assistance, survivors and invalidity benefits) and the third on earnings. All values are gross of income taxes. Starting from earnings one can see that the time trend of the Gini index is continuously increasing from 29.5% in 2008 to 32.5% in 2050. Two factors mainly contribute to the explanation of such a trend: the increasing participation rate of women and the increasing share of high educated workers in the second part of the simulation. Both the first and the second factors boost the dispersion of earnings. The trend of Gini indexes on pensions is more related to the evolution of reforms enacted in the nineties. Firstly it is worth noticing that until 2030 the dispersion is greater when computed on old age pensions: this result is counter intuitive. In the broader definition of pension we use, benefits such as social allowances and survivor pensions are included. Since these benefits are normally lower than the mean value of old age pensions, their inclusion push up the value of the

Gini index. Of course, the heterogeneity caused in the computation of old age pensions by the slow transition phase to the NDC system has a stronger impact on the Gini index since its value increases in the central part of the simulation, decreasing thereafter when the share of the NDC benefits becomes prevalent (see Figure 1)

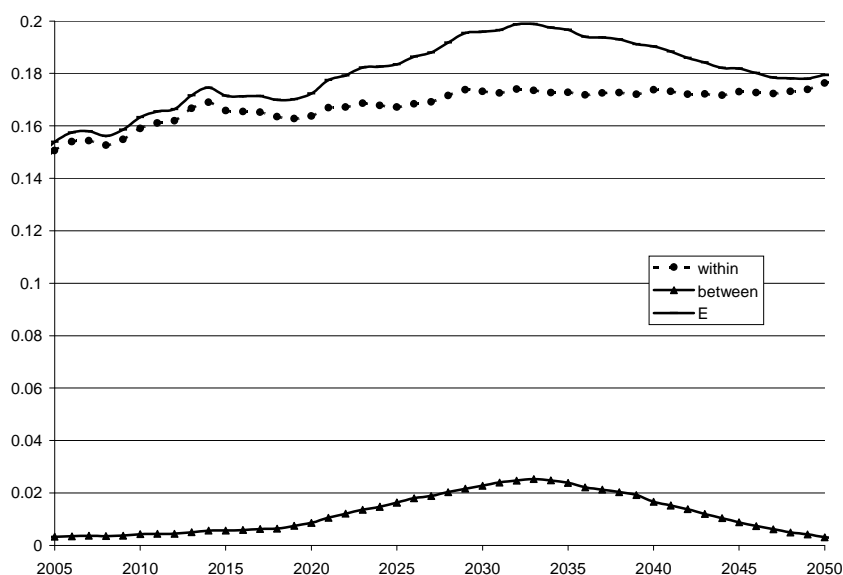
Figure 10
Gini index on earnings and pension benefits.
2008-2050



Fonte: CAPP_DYN

In other terms the dispersion in the old age pension distribution reaches its maximum in the central period of our simulation (2020-2035) when the heterogeneity in the composition of pensioners according to the rule of computation of their benefits is the largest (see again Figure 1). In order to test this hypothesis Figure 11 computes an index defined as the half of the coefficient of variation that, differently from the Gini index, has the advantage to be completely additively decomposable by subgroup into within and between group inequality components. Figure 11 shows that between-group inequality explains a non negligible part of the dispersion in the interval 2025-2040, roughly the same time period that sees the maximum value of the Gini index.

Figure 11
Between and within inequality in old age pensions.
 2008 - 2050

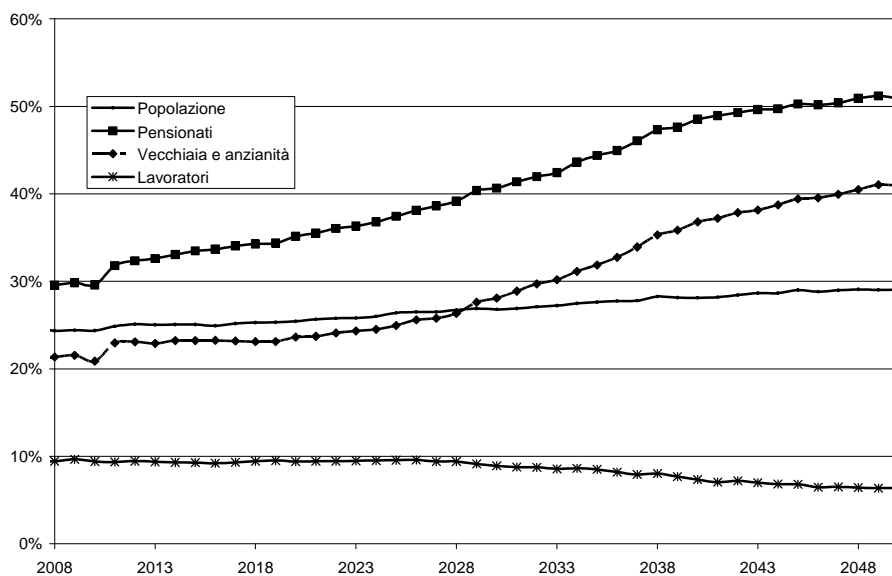


Source: CAPP_DYN

A further step in to the evaluation of distributive characteristics of the Italian NDC system is made in the last part of this subsection where we report the estimation of the time trend of the Head Count Ratio and we study the composition of pensioners by quintile of equivalent income.

Figure 12 describes the dynamic of the Head Count Ratio (HCR) for some representative categories of individuals. Some important things should be noticed. First, we note significant differences in the path of the HCR computed among pensioners and workers. Poverty risk, defined as the situation where the equivalent income is below the 60% of the median value of its distribution, increases fractionally for the whole population. The same measure stays roughly constant until 2040 for dependent workers and self employed, decreasing then in the last ten years of the observed period. Important differences from the latter trend are depicted for pensioners. In particular at the end of the observed period 50% of the pensioners and 40% of old age pensioners fall below the poverty line. This result is the direct consequence of the drop in the gross replacement ratio and in the ratio between average pension benefits and average earnings documented in the first part of this subsection.

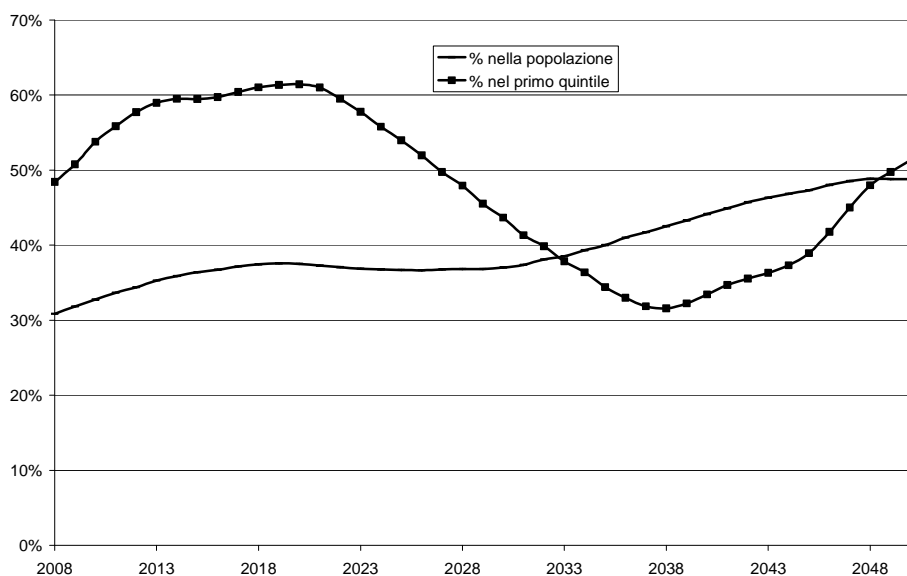
Figure 12
Head count ratio for different groups of the population
2008 - 2050



Source: CAPP_DYN

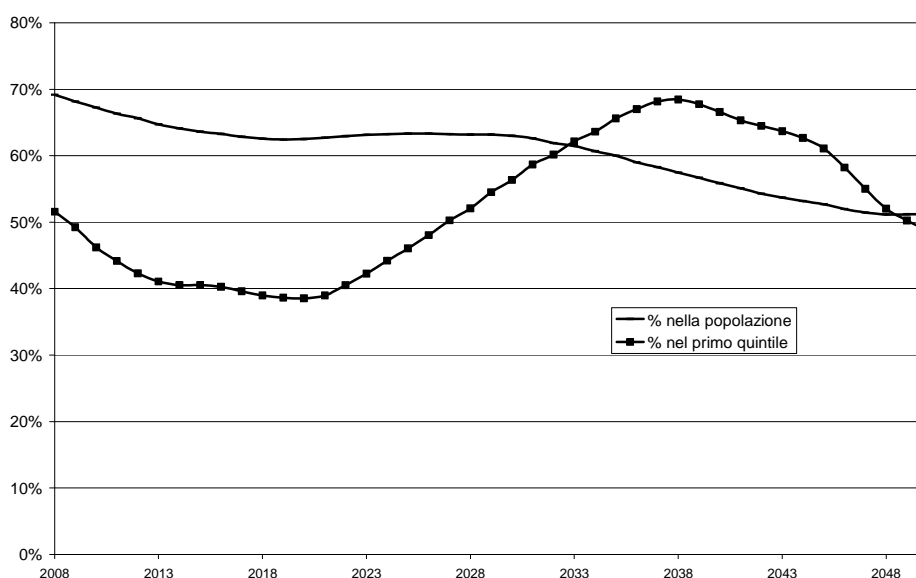
In order to better understand what happens within the retired population we look now at the composition of the first quintile of income.

Figure 12a
Share of pensioners with more than 75 years in the first quintile of income
and in the retired population



Source: CAPP_DYN

Figure 12b
Share of pensioners with less than 75 years in the first quintile of income and in the retired population



Fonte: CAPP_DYN

In figures 12a and 12b we distinguish pensioners that are in the poorest quintile of income distribution according to their age (more or less than 75 years).

First it is interesting to note that, given the expected ageing of the population “older” pensioners (individuals with more than 75 years) will be a growing share of the retired population, passing from 30% in 2008 to 50% in 2050.

The share of older pensioners in the first quintile is expected to increase until 2023, decreasing from 2023 to 2038 and then increasing afterwards until the end of the simulated period. Many different factors are at work to explain such a complicate dynamic. In the first part of the simulation the loss of real indexation of pension benefits prevails, making older pensioners poorer. Moreover in the first part of the simulation new benefits paid to “young” pensioners are still earnings related, having therefore a relative high replacement rate. After 2020 the share of the NDC system starts to grow either in the mixed pensions and by itself. This explains the fact that older pensioners in the central period do not lose their relative position in the distribution of income. In the final part of the simulation the “indexation” effect described above tends again to prevail and at the end of the observed period the 70% of older pensioner are more than 75 years old.

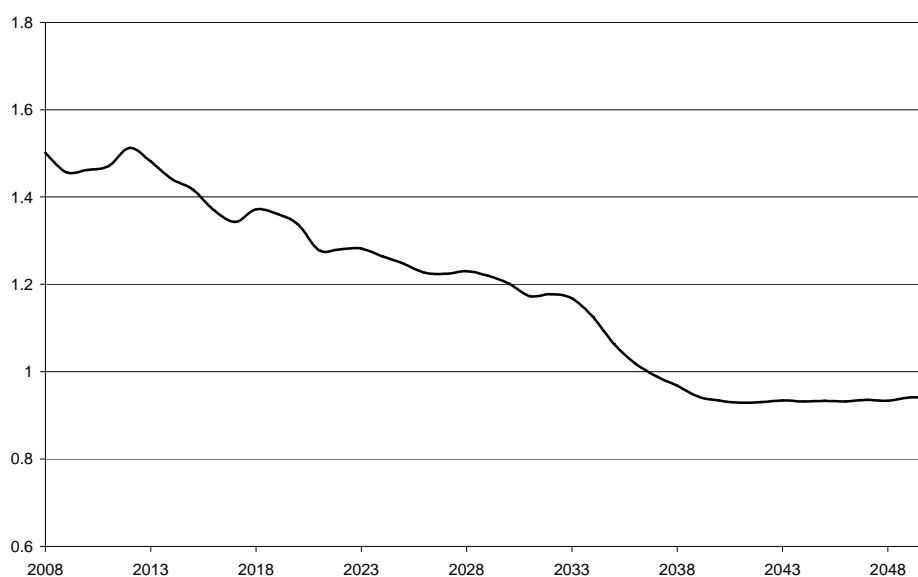
4. *Intergenerational/lifetime redistribution*

A completely different picture of the distributive effects of the reform process emerges if we consider the lifetime perspective. From this point of view results are much less troubling. As expected, transition to the NDC system brings down the NPVR, defined as the ratio of the present value of individual's benefits received to the present value of contributions paid during the individual's lifetime. Benefits and contributions are evaluated at the retirement year.

Figure 13 shows that after 2030 the NPVR will be lower than one, meaning that in actuarial terms a new pensioner in the model expects to receive a smaller amount of money that he/she has paid in as social security contributions. This result depends on the fact that the accrual coefficient used in the NDC system is computed in a way in which it takes into account life expectancy of the partner (if any)

Looking at the time trend of the NPVR its reduction appears quite important and it is completely explained by the fact that the earnings related formula, prevailing in the first part of the simulation, is far from being equal from an actuarial point of view.

Figure 13
Net Present Value Ratio for new pensioners. 2008 – 2050.



The fulfilment of the actuarial equity is an important result of the reform process of the Italian social security. However actuarial equity and adequacy of the system are not always overlapping. On the opposite the two aims can be conflicting.

References

- Ando, A. e Nicoletti Altimari S. (2004), A Micro Simulation Model of Demographic Development and Households' Economic Behavior in Italy, *Temi di discussione della Banca d'Italia* n. 533.
- Borella, M. e Coda Moscarola, F. (2005), Redistribution in the Italian Pension System, *Annali di Economia e Giornale degli Economisti*
- Leonbruni R. e M. Richiardi, (2006), Labor-Sim: an Agent Based Microsimulation of Labour Supply. An Application to Italy, Labour Working Paper, n. 46.
- Mazzaferro C. and M. Morciano, (2008), CAPP_DYN: A Dynamic Microsimulation Model for the Italian Social Security System, CAPPaper n. 48, disponibile sul sito www.capp.unimo.it
- Ministero del Lavoro e delle Politiche Sociali, (2005), Aspetti distributivi del sistema pensionistico nella prospettiva del passaggio al sistema contributivo, Roma disponibile sul sito <http://www.welfare.gov.it> e sul sito www.capp.unimo.it.
- Ragioneria generale dello Stato (2008), Le tendenze di medio-lungo periodo del sistema pensionistico e sanitario, Rapporto n. 10, Roma.
- Vagliasindi, P. (2004) Effetti redistributivi dell'intervento pubblico: esperimenti di microsimulazione per l'Italia, Torino, Giappichelli.
- Zaidi, A. and Rake, K. (2002), Dynamic microsimulation models: a review and some lessons for SAGE, Sage discussion paper n. 2, London.

APPENDIX

5. The social security module

Individual retirement choices and the computation of old age, seniority and survivors pension benefits, as well as of social allowances, social assistance increases (*maggiorazioni sociali*) and supplements (*integrazioni al minimo*) are simulated in this module.

The individual pension transfer depends on the following variables:

- the life-cycle profile of labour incomes;
- the seniority of social security contribution at the moment of retirement;
- the contribution rate during working life;
- the – exogenous - macroeconomic growth during the period of pension contribution;
- the pension scheme;
- the retirement age.

The first four variables depend on the results provided by the previous “demographic” and “education and labour market” modules. In particular, the life-cycle profile of labour incomes depends on the evolution of characteristics controlled for in the regressions reported in table 2.2.9. The seniority at the moment of retirement depends on the total amount of years the individual received a positive labour incomes according to the model. Due to the chance of transitions among different employment statuses during the working life, a share of simulated individuals may show periods with no contributions.

The model simulates the following pension benefits:

1. Old age and seniority pensions,
2. Survivors and indirect pensions,
3. INPS disability pensions,
4. Civil disability pensions,
5. Social allowances,
6. Supplements to the minimum (*integrazioni al minimo*)
7. Social assistance supplements (*maggiorazioni sociali*).

The benefit amount is held constant in real terms for the whole retirement period, accordingly to the general pension indexation system introduced by the 1992 reform⁶. Minimum pension amount, contribution caps and minimum and maximum thresholds for determining the benefit

⁶ The model does not allow for inflation.

according to different pension schemes increase with time following the real GDP growth forecasts selected in the “scenario”⁷.

5.1 The decision to retire

The selection of the new retirees is implemented each year of the simulation following a two stage procedure. In the first stage all individuals fulfilling the necessary conditions (in terms of age and contributory seniority) for old age and/or seniority pension are identified. The identification is implemented according to the law in force, in particular by law n. 243/2004 and law n. 247/2007⁸.

The first chance for retirement occurs when an individual achieves age requirements for the earlier retirement (compared with the statutory age), which is nowadays fixed at 60 years for women and 65 for men⁹. In this case the model checks whether the exit from the labour market is inter-temporally advantageous. In practice, it compares two options: keep working one more year or exit immediately. If the net social security wealth is greater under the second option, then the retirement choice is effectively simulated if the replacement rate exceeds a certain threshold, set at 60%.

Therefore, the model allows for two relevant aspects in the retirement choice: the first is an evaluation of inter-temporal convenience and the second relates to the adequacy of the pension benefit provided by the social security system¹⁰.

The second way for retirement is the achievement of the statutory age conditioned to the minimum requirements of social security contribution seniority, amounting to 20 years for individuals subjected to the defined benefit (DB) or the mixed system and 5 years for those in the defined contribution (DC) system. In the latter case, the exit rule and the provision of the (old age) pension benefit depends on the gender of the worker. It is worth reminding the regulation in force determines a different retirement age for males and females (65 for the men, 60 for ladies). Once

⁷ The path of real GDP growth is exogenous to the model. The implemented procedure differs from the pension scheme provisions being in force, which allows the pensions and the social allowances minimum amount adjustments through legislative action. However, we consider the option of keeping the minimum pensions constant to the base year values as being unrealistic as well as forcing discrete adjustments in certain years is quite arbitrary.

⁸ The increases in requirements for an early retirement are revised with respect to age 65 for men and 60 for women, according to the law n. 243/2004. In particular, according to the provisions of the law, an increase to 58 of the age requirements for seniority retirement is provided in 2008, being unchanged to 35 the seniority requirement. From 2009 a system of quotas is introduced: the early retirement will be allowed if the sum of worker’s age and contributory seniority will be higher than 95 (until the end of 2010), 96 (until the end of 2012) and 97 (after 2013), with the age requirement however increasing from 59 in 2009 to 61 in 2013. Requirements for self employed are one year higher.

⁹ This chance will remain also with the DC system for the workers with a seniority of 40 years, apart from age.

¹⁰ The choice of the particular threshold value adopted is clearly sensitive with respect the determination of the actual mean age of retirement. The choice of 60% seems to be a “reasonable” option which in practice restricts the seniority retirements just in the first part of the simulation period.

they are 65 and the minimum contributory requirements have been fulfilled, then men are supposed to retire, independently of the evaluation in terms of inter-temporal convenience and adequacy of the pension benefit. For women, a different rule has been adopted in order to avoid a substantial flow of pensioners receiving very low replacement rates, especially in the period when the DC system will be at work. We feel the hypothesis of an exit at 60 unrealistic for individuals which, especially in the later part of the simulation, will be more educated on average – therefore entering the labour market later – and in the same time will define their pension according to the DC rule which tends to penalize an early exit from the labour market.

In order to avoid the formation of a stock of young pensioners receiving very low pensions we calibrate the model so that the actual retirement age progressively increases every ten year up to 65 in 2050.

5.2 The computation of old age and seniority pensions

In the following, the computation formulas used for the estimation of the amount of the first pension transfer according to the three pension schemes, (the defined benefit, the mixed one and the defined contribution) are shown. In general, computing the pension benefit is not an easy task due to the joint consideration of both individual and household income criteria in the provision of social transfers such as supplements to the minimum (*integrazioni al minimo*) and social assistance supplements (*maggiorazioni sociali*). When possible, in the imputation procedure concerning these types of social benefits, the socio-economic features of the individuals are allowed for as well as their temporal evolution.

- The defined benefit regime

Individuals who have achieved at least 18 years contribution seniority at the end 1995 are under the DB regime. The calculation rule of pension benefit is synthesized by the formula:

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

where r is the pension rate of return, N_1 and N_2 represent the year of contribution before and after 1992 respectively, W_1 and W_2 represent the pensionable earnings useful for pension estimation, for contributions paid before and after 1992 respectively.

The terms in the DB formula are not constant for all workers as they depend on the pension scheme and on the pensionable wage level. In particular, W_1 is equal to the last wage for employees in the public sector and to the five and ten years average for employees in the private sector and self-employed workers respectively. W_2 is the mean over ten years wage for public and private sector employees and over 15 years for self-employed workers. The rate of return r is equal to 2% for the pensionable earnings bracket between 0 and 36,980 Euros in 2002 and it decrease with earnings level down to 1.1% for the pensionable earnings bracket over 49,156 Euros.

Pensioners who have paid at least 20 annuities of contribution, but did not reach the minimum pension amount, are supplemented up to the minimum level.

- The mixed regime

This regime is applied to workers with less than 18 years of social security contribution seniority in 1995. In this case the old age/seniority pension benefit is determined as the sum of two components; the first component is P_A and it is computed according to the DB formula on the contribution paid before 1995, while the second, P_B , is computed according to a DC rule on the after 1995 contributions. In formula:

$$P_{mixed}=P_A+P_B$$

where the general rule for determining P_A is similar to the formula used in the DB regime. Nevertheless, in the “mixed” regime the pensionable wage for the contributions paid between 1992 and 1995 is determined differently, being computed as the mean wage over the years after 1992 indexed to 1% yearly rate according to a simple compounding rule. The P_B term of the mixed pension is figured according to a DC rule.

Pensioners which have paid at least 20 annuities of contribution but did not reach the minimum pension amount are topped up to the minimum level.

- The defined contribution regime

This regime involves people entered into the labour market after 1995, for which the amount of pension is defined as:

$$P_{DC}=k*MC$$

where k is the transformation coefficient that varies with retirement age so as to guarantee a quasi-actuarial equity between the present value of paid contribution and the present value of expected pension benefits. In order to allow for the expected evolution of mortality accounted for in the model by ISTAT official forecasts, the coefficients computed by RGS in its forecast model adjusting pension amounts according to varying demographic conditions every ten years have been employed.

MC is the “*montante contributivo*” i.e. the total of contributions accrued during the whole working life capitalized at the rate of growth of nominal GDP, defined by the sum of the contribution paid compounded at the GDP growth rate. The yearly contribution is computed as a share of the gross wage for employees and gross income for self-employed. The contribution rate is set at 33% for employees and 20% for self-employed workers. A contributory cap is set at 82,404 Euros. In order to benefit of minimum pension at least five annuities of contribution have to be paid. Finally, the amount of the pension cannot exceed the amount of social allowance increased by 20%. In the opposite case, pension will not be paid if the requirement is achieved before the statutory age of retirement which is set at 60 for women and 65 for men. For the pensions provided under the DC scheme no supplement up to the minimum is allowed, while a supplement up to the level of social allowance is provided if the income requirements are fulfilled.

- Survivors and indirect pensions

The death of a pensioner or of an insured entitles the survivors to benefit of survivors and indirect pension respectively.

The model allows the payments of indirect pensions if the dead had achieved at least 5 years contributions. When the total amount due to the survivor has been determined, the shares are assigned to every single components of the household accounting for their economic conditions¹¹.

In particular, the model distributes the total amount among the survivors assigning:

- 60% to the spouse
- 20% to each child in case the spouse is alive
- 40% to each child in case the spouse is not alive.

The sum of the share cannot exceed the 100% of the pension the retired would be entitled for.

¹¹ Current regulations can be found by consulting the INPS website in the section “*la pensione ai superstiti*”.

If one child is entitled only, the share is set at 70%. The amount of survivor pension depends on economic conditions of the beneficiary. The allowance is reduced by 20%, 40%, and 50% in case the income earned by the beneficiary exceed by 5, 4, 3 times respectively the amount of the minimum pension benefit. The last rule is not applied in case underage students or disable children are co-entitled.

5.3 Civil and INPS disability pensions

The social security module selects beneficiaries of disability allowances, disability and civil inability pensions.

The disability allowance amount is determined according to the standard system of old-age pension computation depending on the pensionable earnings and on the contributory seniority of the insured.

If the allowance amount is lower than the minimum benefit, it can be supplemented up to this limit.

The disability pension amount consists of two components: one share is determined according to the pensionable earnings and to the contributive seniority as for the inability allowance, while the remaining part, named "*maggiorazione*", is determined by the difference between the inability allowance and the pension she/he could benefit should she/he had accrued a seniority increased by a period amounting to the difference between the year the inability allowance started to operate and the pensionable age (set at 60 years for men and 55 years for women with a dispensation to disabled persons at least for the 80%). No seniority above the 40 years will be considered.

In order to determine the amount of disability pension with the DC system, the sum of contributions accrued is added to a share of contributions for the gap period between the pension starting year and the 60th birthday. Again, seniority cannot exceed 40 years.

The amounts of civil disability pension are in line with the values which are provided by the current law and are updated according to the GDP growth from the second year of simulation.

The module providing the entitled individuals with the civil disability pension benefit checks whether the yearly income requirements are fulfilled or not.

5.4 The social allowances

Over 65 persons which have an individual/household income under the statutory limit are supplied with the social allowance. In fact, the Italian regulations provide the social allowance can be paid out when certain beneficiary or her/his spouse's economic conditions occur. In order to allow – at least partially - for these conditions, the model sums up each year labour and pension incomes of the spouses. The benefits are then paid out when the total income is lower than the statutory thresholds, which are yearly revalued according to the real GDP growth rate. In general, the allowance amount is designed as to raise the overall income up to the legal threshold.

So for instance, in 2007 the monthly allowance amount is equal to 389.36 Euros. It implies the yearly amount in the same year is 5,061.68 Euros (389.36 x 13 monthly installments) corresponding also to the income limit for an applicant which is not married, the yearly limit being $5,061.68 \times 2 = 10,123.36$ whether the applicant is married. In general, the yearly allowance is equal to the gap between the current yearly social allowance and the effective overall income earned by the applicant – in case summed to the income of the spouse -¹². Unlike the social pension¹³, the social allowance - or a share of it - is paid to the applicant even if he/she has a personal income above the individual legal threshold, as long as the overall income of the spouses is lower than the legal threshold for the couple.

¹² So for instance, if the applicant is married and the yearly total income is 9,000 Euros, the allowance amount is reduced to 1,123.36 Euros (the difference between 10,123.36, current annual income threshold for a married applicant, and 9,000 Euros).

¹³ From January the 1st 1996 the social allowance replaced the social pension, which however keeps on being payed out to those individuals which, being entitled for, applied within 31st of December 1995.

5.5 Supplements to the minimum (integrazioni al minimo) and social assistance supplements (maggiorazioni)

As already mentioned, when the supplied pension benefit is below the minimum legal amount the model provides the pensioner with a supplement or a social assistance increase, allowing for personal and household income as well as the pensioner age¹⁴.

¹⁴ The computation of the minimum treatments is carried out according to the provisions reported into the INPS website in the section “*il trattamento minimo*”.