Working Paper 2/00

SOCIAL SECURITY TRANSITION IN ITALY: COSTS, DISTORTIONS AND (SOME) POSSIBLE CORRECTIONS

PIER MARCO FERRARESI - ELSA FORNERO[♣]

[♠] University of Turin
Faculty of Economics
Corso Unione Sovietica 218 bis
10143 – Turin
Tel. +39-011-6706074 (Ferraresi) e.m: Ferraresi@econ.unito.it
Tel +39-011-6706076 (Fornero) e.m: Elsa.Fornero@unito.it

Abstract

This paper focuses on alternative money's worth measures of the Italian (public) pension system for representative cohorts, considering both the present transition and the future steady state envisaged by recent reforms. Micro-based calculations of the aggregate budget effects induced by further possible policy changes are also presented.
The main results of the simulation exercise are:
i. young and future generations face a steady and strong reduction of their social security's worth mainly due to the 1992 and 1995 reforms and accentuated the discontinuities characterising the reforms;
ii. throughout most of the transition period, the increase in benefits for an additional year of work, after reaching seniority pension requirements, does not offset the financial costs generated by additional contributions and shorter expected retirement. The implied loss still represents a strong incentive to early retirement;
iii. the extension, from the year 2000, of the pro rata mechanism to all new pensioners would generate a non-negligible smoothing effect on microeconomic distortions, but a comparatively small reduction in pension expenditure;
iv. a much larger reduction can be obtained if seniority pensions are determined according to actuarial fairness: i.e., by taking into account life expectancy at retirement;
v) considering the introduction of an opting out clause, all generations hit by recent reforms have an incentive to quit; the younger the cohort, the stronger the incentive.
The paper finally highlights aspects of the social security problem which deserve to be addressed in a more complete analysis, such as risk adjustments, welfare implications and general equilibrium feedback effects.
Even without these extensions, we think our conclusions are quite robust, and may help policy discussion.

JEL classification codes: H55, J26, E27

• This is a revised version of a paper already published in: Politica Economica. No. 1, 2000.
The authors wish to thank Onorato Castellino and Carlo Mazzaferro for useful comments, and Emiliano Mandrone for his help in analysing data from the Bank of Italy 1995 Survey of Households' Income and Wealth. Financial support from MURST is gratefully acknowledged.

1. Aims and motivations

The reform of a social security system cannot be reduced to a mere technical problem. It triggers consent and dissent, polemic and emotion - often voiced in over-heated tones. It modifies expectations and disappoints hopes. 'Social security' represents, in other words, an unsolved and increasingly sensitive conundrum for a country like Italy and, in general, for all 'mature' societies.

In Italy, the Nineties have marked a period of intense, although incomplete, reform (Brugiavini, Fornero 1999). Despite the 1992 (Amato) and 1995 (Dini) reforms, imbalances in the pension system will continue to be high for the next 3-4 decades (3,5 - 4,5 per cent of GDP).

These imbalances contribute to overall public deficit, thereby diverting resources from alternative uses, through which it could be possible to boost the efficiency and also, arguably, the equity of public spending. They also affect intergenerational distribution, directly or indirectly depriving young people of resources. Aggregate concerns, however, are not the sole ones. In fact, pension determination rules distort labour market incentives, causing the exit of workers at among the lowest ages anywhere in the world and, for the double convenience of employees and employers, favour the expansion of black activities[1].

An issue so dense in political, social and generational implications deserves to be addressed in a detached way, deprived of the ideological elements that have so far characterised the political debate. This paper aims at providing a rigorous calculation base for alternative reform paths, including partial privatisation.

Of course, economic calculations are hardly totally value-free, and ours are no exception. We present and discuss in some detail the simulation model and the sensitivity analysis, but also the main shortcomings of the exercise, due to the lack of uncertainty and feedback effects in the model.

Within this perspective, the paper has two aims:

[1]Despite the emphasis on financial imbalances, it would be wrong to forget that the Italian pension system has performed important tasks, especially with regard to the prevention of poverty among the elderly and the bridging of the income gap between retired and active generations (Brugiavini and Fornero, 1999)

i. to describe the transition in progress in the public pension system, and the (slow) convergence towards the new contribution-based formula introduced, for the long run regime, by the 1995 reform. The description is quantitative and mainly adopts a 'generational accounting' framework, albeit limited to the social security component. It considers the generations affected by the transition and those of the future regime, and presents measures designed to capture, in different scenarios, the implicit money's worth of participation in the system[2];

ii. to estimate the effects of some reform proposals: in particular, the extension of the *pro rata* mechanism to cohorts excluded in 1995[3] and the introduction of an actuarially fair correction for the new flows of "seniority" pensions[4]. Both these measures would produce three main effects: a reduction in the present distortions favouring early retirement; a smoothing of the disparity of treatment of contiguous cohorts caused by the adoption, by the 1995 reform, of rigid lines of demarcation; a cut in expenditure, and thereby a correction of the system's financial imbalance.

The paper is structured as follows. Section 2 describes and compares different money's worth measures of participation in the public PAYG system. Section 3 describes the simulation model and its parameterisation. Section 4 sums up the main results, with reference to a particular scenario, for the transition period and the steady state (which, under our hypotheses, will be reached, for the flow of new pensions, around 2035). Section 5 shows the effects of the extension of the *pro rata* mechanism, distinguishing between microeconomic and aggregate effects. Section 6 presents some sensitivity analysis with respect to variations in the macroeconomic scenario. Section 7 discusses the limits of the simulation exercise. Section 8 is a very preliminary analysis of the opting out problem in Italy. Section 9 presents our conclusions. The tables referred to in the analysis of the results are contained in appendix A, while appendix B provides a detailed description of the simulation model and the sources of the data used for the calculation.

---

[2]The term is taken from Geanakoplos, Mitchell, Zeldes, 1998. Though the emphasis is placed on money's worth measures, the simulation clearly illustrates the microeconomic distortions embedded in the long transition, due to the lasting effects of the past earning-based pension formula (Cf. section 4).

[3]The 1995 reform excluded from the new rules workers with 18 and more years of seniority (reached before 31.12.1995). This confirmed the exclusion, established three years earlier by the Amato reform, for seniority of 15 years and more.

2. Social Security money's worth measures

In the following analysis, we assess social security money's worth for different cohorts and different retirement ages by adopting three indicators:

i. the ratio between the present values of benefits and of contributions (net present value ratio, or NPVR);

ii. the internal rate of return on contribution (IRR);

iii. the ratio between first pension and last wage (replacement ratio, or RR).

As the tables 1-7 show, all three indicators (which, as ratios, have the advantage of being independent from the unit of measurement[5]) offer the same trend pointers, which thus may be considered as robust. More specifically, the figures unequivocally demonstrate how - as an effect of the transition in progress and especially the passage from an earning-based formula to a contribution-based one - the value of social security for the different age groups is bound to decrease considerably over the next few decades.

Moving on to a comparison of the different indicators, the first two stem directly from financial choice criteria and thus stress the financial/insurance nature of the PAYG public system with respect to its redistributive character. They consequently possess all the advantages, but also all the limits, resulting from deterministic exercises that overlook not only the uncertainty but also the various imperfections of the market. It is worth recalling, however, that it is precisely market failures (such as adverse selection or the presence of liquidity constraints on subjects endowed solely or prevalently with human capital) which justify the very existence of public systems[6].

From a more technical point of view, given compulsory participation in the public system, the IRR is not subject to the usual objections about the reinvestment of flows, and,

---

[4] Seniority pensions are awarded when a given working seniority has been reached, irrespective of age (which can be as low as 55, and formerly even less).

[5] The drawback is that, although useful for intergenerational comparisons within the same system, measures in relative terms are less useful for comparisons of different social security systems, and cannot provide an aggregate measure of the social security debt (cf. Geanakoplos *et. al.* 1998).

[6] We address these questions and, more generally, the limits of the simulation exercise in section 7.

compared with the rate of return of alternative assets available on the market, measures the opportunity cost resulting from this participation.

The NPVR, on its part, is valued at the beginning of the individual's working life and measures the amount which – calculated in present value at the same date - is returned by the system for every "euro invested", taking into account the opportunity cost associated with a lost alternative, measured by the exogenously fixed interest rate.

Finally, the replacement ratio represents a spurious measure of money's worth of social security, since it crucially depends on the last part of the age earning profile and on the way pensions are indexed to the cost of living and real wages[7]. In our simulation, however, the redistributive effects associated with diverging trends in income profiles are neutralised, since, by hypothesis, the earning profiles of all generations have the same form, and differ only due to a scale-effect resulting from productivity growth. Likewise, we assume no indexation to real wages, but full indexation to prices, for all cohorts. This means that while, from the point of view of the individual, RR supplies an ambiguous measure of money's worth, it still conveys significant comparisons between cohorts.

3. The simulation model and its parameterisation (microeconomic aspects)

In this section, we confine ourselves to an informal exposition of the model (see the appendix for a full description of the software). First, we only consider private employees, not the self employed and the public employees. Each generation is identified by a representative agent, who begins to work at the age of 22, has an uninterrupted working career and a wage profile equal to $w_{t,\tau}$, where t is the calendar year and τ the age, and retires after 35-40 years' service, with a pension $\overline{P}$ constant in real terms throughout the retirement period.

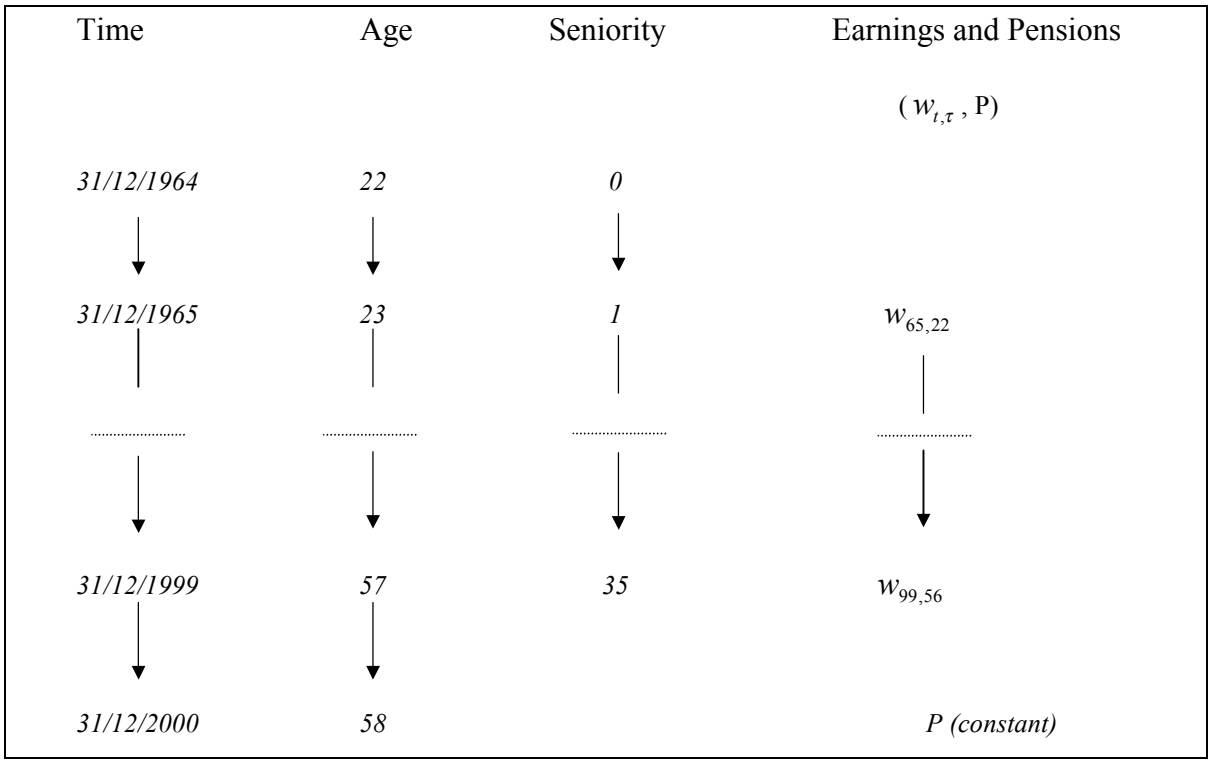
Focussing on intergenerational comparisons, we overlook the effects of redistribution within each cohort, which is still present due to the residual heterogeneity of

[7] For a given pension wealth at retirement, pension time profiles vary according to the indexation mechanism. If the pension level is constant in real terms (as envisaged by the 1995 reform), the replacement ratio will be higher – given the same pension wealth at retirement - than in the case where the pension is increasing because it is indexed to real wages.

the rules applied to different worker categories. Figure 3.1 illustrates, for the 1942 cohort, a typical individual profile.

The wage profile has been estimated from a cross section (1996) distribution of average wages obtained from INPS (the Italian Public Pension Agency), and adjusted for inflation. The curves relative to each generation are obtained by taking into account the rate of growth of real wages (historical data until 1997 and constant rates, but variable from scenario to scenario, for subsequent periods). This means that a typical individual has an annual wage increase equal to the sum of the sectional increase in productivity (g), the longitudinal increase (a) due to longer service, and the composition effect of the former two rates[8].

Figure 3.1 - Life cycle profiles of a representative worker (cohort 1942)



[8] As a consequence, assuming the number and composition by age of the working population do not vary, the wage bill grows at an annual rate g, whereas individual wages increase at rate g+a+ga.

As table3.2 shows, according to existing legislation (which obviously incorporates the Amato and Dini transitions), the social security position of each cohort at retirement is determined by age, effective seniority and seniority at December 31 1995.

The calculation of money's worth formulas is based on 1994 survival tables and takes into account both direct and survivors' pensions[9].

The simulation was performed considering different macroeconomic scenarios; in all cases, however, the interest rate was assumed higher than the GDP growth rate, even though the difference between the two (both known with certainty) is always rather low and fails to exceed one percentage point. The parameters were thus chosen so as not to 'exaggerate' the dominance of funding over PAYG.

Table 3.2 – Pension determination formulas – Private employees

pre-Amato situation	
Rule	Average wages in last 5 years, 2% annual accrual rate
Amato Reform (1992)	
Transition	≥ 15 years' seniority: gradual transition from the average wage of the last 5 years to the average of the last 10 (one every two years); <15 years' seniority: pro rata: for seniority matured subsequent to 1992 the average refers to 5 + t years (t = number of years since reform)
Long run provisions	Average wage of the whole working life (after correcting each yearly wage by a real increase of 1%)
Dini Reform (1995)	
Transition	≥ 18 years' seniority (the 15 fixed by the Amato reform + the three between the two reforms): like in the Amato transition with seniority over or equal to 15 years; with acceleration of the passage to the average of 10 wages, according, for the years subsequent to 1995, to an increase of 1 year every 1.5 years; <18 years' seniority: *pro rata* (for seniority matured before 1995, the formula is that of the Amato transition with fewer than 15 years' seniority)
Long run provisions	Contribution based formula[10]: $P(x) = c_x \sum_{t=0}^{N-1} aW_{N-t}(1+g)^t$

[9] For the calculation of the survivors' pension, we supposed the beneficiary to be the wife, three years younger than her husband.

4. Main results

The tables in the appendix present the main results of the simulation exercise. The comments which follow refer to tables 1, 2 and 3. With reference to a particular set of parameters and two normative scenarios (*status quo* on the left and extension of *pro rata* mechanism from 2000 on the right), the tables describe the three different measures for the generations between 1942 and 1988 (that will retire in the time period from 2000 to 2051). For the years up to 1997, the macroeconomic environment is defined by the historical growth rates of wages[11] and, for subsequent years, by a constant rate of growth of productivity (g), equal to 1.5 per cent. The rate of interest (r) used to calculate the present value of contributions and benefits is the same for all cohorts and is set at 2 per cent[12].

Table 1 reports the NPVR simulated values. The columns show these values for the different generations corresponding to a given seniority at the date of retirement; the lines show the values corresponding to the same generation, characterised by different seniority at retirement (from 35 to 40 years). Given the complexity of the interaction between age and length of service in determining the result, it is perhaps useful to separate the comments by column (different cohorts, but constant seniority) from those by line (same cohort with increasing seniority).

Reading by column, we see a progressive, continuous reduction of money's worth from the oldest cohorts to the youngest up to the attainment of a steady state (coinciding with the retirement of the first cohort that worked entirely within the Dini long run provision - i.e., who began activity on January 1 1996). In this scenario, the steady state NPVR is only slightly higher than half that of the first generation considered; in the hypothesis of retirement with 35 years' seniority (first column), the ratio is 0.57. Still considering a seniority of 35 years (and retirement at 57), participation in the public system begins to generate a 'loss' (NPVR lower than one) from the 1967 cohort[13].

---

[10] Where: a = payroll tax rate, x = retirement age, W_j = wages in year j, N = seniority at retirement, t = years until retirement, g = GDP growth rate, c_x= transformation coefficient set by law (actuarially fair at 1.5%).

[11] Processing of various sources (cf. table 2, appendix B).

[12] For the discussion on the variation of the macroeconomic framework and the difference between r and g, which is of crucial importance for all the results, see Section 6.

[13] The small differences in the steady state figures in rows are due to approximation.

The reasons for this trend reflect a mix of historical conditions and hypotheses for the future (in particular, with regard to rates r and g). More generally, the table shows the intrinsic redistributive nature of the PAYG system among generations and, more specifically, the fact that the institution of the system and every subsequent improvement entailing net benefits in favour of the generation concerned necessarily imply a lower NPVR subsequent for cohorts and, in any case, for the steady state generations. In this sense, all generations prior to that of 1967 still benefit from 'gifts' from the favourable legislation of the past, whereas for those under long run provisions the result derives directly from the spread of rate r over the PAYG implicit rate of return g.

Reading by line, we see an inverse correlation between the NPVR and retirement age. This correlation, which implies gradually decreasing returns from social security with the prolongation of the working life over 35 years of seniority, is due to the earning-based component of the pension, and becomes all the more significant the higher the weight of this component.

In order to correctly evaluate the disincentive to the continuation of work generated by the earning-based portion of the pension, it is necessary to estimate the variation in pension wealth of an individual who, having reached the minimum pension requirements, decides to continue to work for one or more years. This estimate is shown in figure 6 in appendix A, which presents the percentage reduction of social security wealth due to the lengthening of seniority from 35 to 40 years for the cohorts from 1942 to 1988. The figure reveals an especially sharp reduction (around 18 per cent) for the oldest cohorts, whose pension is determined exclusively using the earning based formula. For the other cohorts too, however, the "taxation" of pension wealth is far from negligible[14]. The disincentive obviously drops as the contribution-based component grows progressively in the pension calculation; it may be traced to the poor link between contributions and benefits typical of the defined benefit formula, which incorporates no actuarial correction for different life expectancy at retirement.

[14] A slight 'taxation' (less than 2%) still remains on the cohorts whose pension is totally defined contribution. This is essentially due to assumptions used in the simulation exercise. In particular, the reform's conversion coefficients contain actuarial hypotheses that are slightly different from those used in the model (for example, the coefficients envisaged by law consider average mortality for males and females, whereas in the model the typical pensioner is male).

Turning to the internal rate of return (table 2), similar considerations apply. The trend by column of this parameter shows a strong decrease: from values around 3.5 per cent for cohorts close to retirement it converges to the value of 1.5 per cent characteristic of the steady state, this being the hypothesis for the growth of productivity (and 1.5 per cent being the rate used in the coefficient which transforms into an annuity the capitalised value of contributions).

Finally, as far as the replacement ratio is concerned (table 3), the trend by column is fully consistent with the results for IRR and NPVR. For retirement with 35 years' seniority, the values range from around 70 per cent for the first cohorts to a steady state value lower than 50 per cent. Reading by line, instead, we see a trend at odds with financial choice criteria; taken as a target, the replacement ratio generates a strong incentive to postpone retirement, increasing with the incidence of the contribution related method in the determination of the pension. In fact, for the first cohort considered (1942), the replacement ratio is about 10 per cent lower for retirement with 35 years' seniority instead of 40; for the first cohort not protected by exclusion from the contribution based method (1956), this difference increases to about 18 per cent; for steady state cohorts, the figure rises to about 26 per cent. This contradiction confirms that the replacement ratio is not a reliable indicator when evaluating participation in the public system from the financial point of view[15].

Another aspect of the distortions still contained in the transition in progress emerges if we look at the social security wealth trend[16] of members of different cohorts who begin to work in the same year and retire with the same seniority and the same earning history (though obviously at different ages). Table 9 (part a) provides examples for two working careers.

For individuals who began to work in 1972, and are hence excluded from the application of the contributory method, the pension is independent of the retirement age,

[15] The positive correlation between RR and seniority is due to the divergence between the increase in wages and that in the pension following an additional year's work. The first is low, as compared to the second. The last reflects, for the earning based part, the average of wage growth rates and the addition of 2% of the average wage due to the additional year of seniority; and, for the contribution based part, the higher contributions paid, the longer period of capitalisation and the higher conversion coefficient due to the increase in age.

[16] Calculated at retirement age, as the present value of future benefits, taking account of survivors' pension.

hence constant; on the contrary, the pension wealth of the individual who retires at 57 years of age exceeds that of the individual who retires at 65 years of age by about 21 per cent. For careers commenced in 1982, hence subject to pro rata, with an incidence of the contributory component of 22 years, the disparity in social security wealth is notably reduced, since, wage profiles being equal, the pension adjusts (in the quota calculated with the contributory method) to life expectancy after retirement.

5. The effects of introducing actuarial fairness in the transition: extending the pro rata mechanism and cutting seniority pensions.

• *The correction of present distortions*. The option of reform considered here - whose microeconomic effects are shown in the right-hand side of tables 1, 2 and 3 in the appendix - consists of extending the new contributory rules to all the active cohorts for the remaining working life. As is well known, by preferring (perhaps out of necessity!) the political calculation to the actuarial calculation, the 1995 reform left unscathed those who, at December 31 1995, had 18 and more years of seniority, thus deferring far in the future the full phasing in of the new rules. With the extension of *pro rata* mechanism, instead, new pensions fall partly into the earning based method and partly into the contribution based method according to the number of years worked under the two different pension formulae.

The introduction of pro rata to seniority matured from 2000 for people with 18 years' seniority or more in 1995 would allow, first and foremost, to eliminate the disparity of treatment between contiguous cohorts, highlighted by the "jump" in figure 1. A strong disparity exists whereby, due to the preservation of the old earning based method, workers born before 1956 (in the hypotheses of entry onto the labour market outlined above) conserve a hefty advantage with respect to workers born afterwards. The dotted line clearly shows the equitable effects that would be produced with the application of the *pro rata* mechanism.

In terms of the indicators considered thus far, the extension of pro rata basically entails two effects: on the one hand, it reduces the money's worth of the PAYG system for all cohorts involved and for all retirement ages; on the other, it reduces the advantage of early retirement. The reason for this reduction is that, given the rather flat wage profile,

each lira of marginal contribution has little influence on the earning related component of the pension[17], whereas it is capitalised in the contribution related component, which also benefits from the higher conversion coefficient. Obviously, this effect is stronger, the higher the weight of the last component, that is, the younger the cohorts.

The reduction of the disincentive to postpone retirement is highlighted once more in figure 6; as can be seen, the introduction of pro rata would not appear to be crucial; however, for cohorts subsequent to 1944, it reduces the distortion by a non-negligible magnitude.

The extension of pro rata also helps to contain actuarial unfairness: as table 9 illustrates, a comparison of part b of the table to the corresponding section of part a shows lower differences between the pension wealth of seniority pensioners and that of 65-year-olds.

• *Containing expenditure.* The effects of the extension of the *pro rata* mechanism are not only microeconomic; indeed, in the political debate, the prevailing motivation is the aggregate reduction of pension expenditure.

Any estimate of this effect on suitable microeconomic bases entails a certain degree of difficulty, first because of the heterogeneity of insurance positions which the existing legislation still originates, and second, because of the lack of data about their actual number.

The method followed here consisted of the application to the workers registered in 1995 at the FPLD (the main fund, covering nearly all private employees) of the distribution of social security positions obtainable from the 1995 Bank of Italy survey on Italian Households' Income and Wealth. Supposing that none of them dies before retiring, we consider all those who will reach the minimum age and seniority pension requirements[18] between 2000 and 2017, and who at the end of 1995 had at least 18 years' seniority.

---

[17] Approximately only for the extra 2% of average wage due to the extra year of seniority.

[18] In the simulations, we used pension access conditions required by the fully phased in reform, which will actually only become operational from 2008; since these requirements are more selective than the present ones, this translates into a prudential estimate of reduction in expenditure.

The time period considered allows us to simulate, on the basis of the sample data, the entire pension flow originated by those excluded from the contribution based method, assuming, for simplicity's sake, that they retire as soon as they reach the minimum requirements. The pension expenditure for the same individuals is also simulated, according to the same hypotheses, for the case of the *pro rata* extension for seniority matured from year 2000 on. A final simplification - the hypothesis of death at a given age[19] - allow us to calculate the aggregate cut in expenditures due to the extension of the *pro rata* mechanism to subjects who gradually retire, net of those who gradually die[20].

The results of this analysis are shown in table 8 in the appendix. The reduction in the expenditure flows are very modest, accounting for no more than 0.16% of the GDP (about 4,000 billion lire at 1998 prices) in 2018[21]. It must be recalled, however, that the simulation only considers the FPLD fund, excluding public employees and self-employed workers. In all likelihood, the inclusion of these categories would generate a non-negligible further reduction in expenditure. On the whole the simulation confirms that, if seniority pension legislation remains unchanged, the extension of the *pro rata* mechanism will not suffice to achieve a significant reduction in pension expenditure and deficits.

An actuarial correction of seniority pensions appears much more effective from the financial point of view. To estimate the reduction in expenditure resulting from a policy intervention of this type, we have calculated the correction of the earning related quota of all pensions on the basis of retirement age, adopting as a correction coefficient the ratio between Dini's transformation coefficient for the age considered and that for 65 years[22].

Considering the distribution by age and seniority of the FPLD workers (about 11 millions workers), we have estimated future pension flows for three cases:

---

[19] Variable, however, from one simulation to the other, within the range 75 to 83.

[20] It is worth noting that a prolongation of life generates higher cuts, since the alternative is not between paying and not paying, but between paying with or without pro rata. Moreover, in the estimates we fail to take survivors' pensions into account. Nonetheless, the different simulations performed by varying the duration of life offer a rough indication of their effect.

[21] In terms of percentage of GDP, the estimates are in line with those obtained in other studies (Cf. Brambilla and Leoni, 1998), though lower than those recently obtained by INPS (cf. INPS, 1999). The reasons reside probably in different assumptions about mortality rates and wage profiles.

[22] Cf. Gronchi 1997. For ages lower than 57, the 57 coefficient was applied. The policy measure we simulated only applies to newly liquidated pensions. However, one could also consider, perhaps for the sake of fairness, a "solidarity contribution" on the part of those pensioners who already enjoy a seniority pension, subject to a given income floor.

a) existing legislation

b) actuarial correction of earning related quotas

c) extension of the *pro rata* mechanism plus actuarial correction of earning related quotas.

It can be seen (table 10 in the appendix) that the reduction in expenditure is much higher than that corresponding to the extension of the *pro rata* alone; more specifically, the annual "savings" flow reaches a maximum of about 0.7 per cent of the GDP in around 2022. It is interesting to note how the joint application of actuarial correction and *pro rata* mechanism fails to generate a saving higher than that of the correction of seniority pensions alone[23].

A last point concerns the social acceptability of the reform hypotheses outlined above. Whereas the extension of pro rata does not affect rights acquired at a certain date, since it establishes that the new norms will apply to all only for the future, the actuarial correction of the earning related component affects rights already matured and would thus be a rather hard measure to push through.

6. Result-sensitivity to changes in parameters

The simulations of tables 1-3 in the appendix are represented in tables 4-7 with reference to a different set of macroeconomic parameters. In particular, in tables 4 and 6 the interest rate has been raised to 3 per cent, and the growth in GDP (and real wages) to 2.5 per cent, for periods subsequent to 1997. In this way, though levels vary, the differential between interest rate and growth rate has been kept constant (0.5 percentage points).

From the qualitative point of view, comments on the benchmark case (r=2% and g=1,5%) are all the more valid for this new scenario; nonetheless, the tables highlight a problematic aspect of the fully phased 1995 reform. In fact, starting from the 1956 cohort (instead of the 1967 one), the NPVR is lower than 100 per cent for all retirement ages,

[23] In both cases (only actuarial correction and actuarial correction plus extension of pro rata), seniorities prior to 1999 are hit by actuarial correction alone, while subsequent seniorities are hit only by actuarial correction

whereas the steady state value is about 76 per cent (10 percentage points lower than in the benchmark case). The steady state internal rate of return, finally, settles at around 2 per cent. The reasons for this NPVR trend reside in the difference between the internal rate of return of the PAYG system and the assumed interest rate. Due to the weak link between contributions and benefits that continues in the transition, the internal rate of return of the system is not an immediate consequence of the growth rate of the economy; for the oldest cohorts, the (positive) differential between the IRR, which does not undergo sizeable variations in the two scenarios, and the interest rate is lower than in the benchmark case, implying a decrease in net benefits.

For the younger cohorts, it is also necessary to note that the link between IRR and GDP growth rate is not complete even in the contributory system. In fact, the transformation coefficient of the notionally accrued contributions into pension is fixed by law (and reviewed every ten years). A discount rate is implicit in the coefficient. If this discount rate is different from the rate of return recognised on contributions (equal to the GDP growth rate), the IRR is an average of the two. In the benchmark case, the problem did not rise since, as we have pointed out, the GDP growth rate (1.5 per cent) was equal to the rate implicit in the transformation coefficients of the 1995 reform; if the scenario varies, this is no longer true. For the steady state cohorts, the IRR is about two per cent, i.e. one per cent lower than the assumed interest rate, implying a decrease in net benefit.

Tables 5 and 7 consider a scenario characterised by a growth in GDP of 2.5 per cent and an interest rate of 3.5 per cent; the increase in the interest rate heightens the reduction in net benefits for the older cohorts, while the increase in the differential between the interest rate and the growth rate produces a further reduction for steady state cohorts. In fact, with respect to the situation suggested by tables 4 and 6, since there is no variation in g, IRR is unvaried for these cohorts, but the interest rate has increased by 0.5 percentage points.

One final consideration concerns the significance of simulations with different macroeconomic parameters: due to the ten year review of coefficients, the suggested reduction in net benefits has to be viewed with some caution. In fact, if we adopt a GDP growth rate different from the one implicit in the coefficients, the transformation

---

in the first case, and only by pro rata in the second. Since the contributory method is actuarially fair, the two

coefficient ought to be reviewed more than once in the course of the period simulated[24]. This would unquestionably reduce the effects of variations in the macroeconomic framework on benefits and the internal rate of return.

7. Limits of the simulation exercise

As we have already stressed, the calculations presented here have to be interpreted with some caution. Even greater caution is required when it comes to drawing certain implications for social security policy. More specifically, uncertainty, liquidity constraints and the redistributive function (in favour of the weakest, least fortunate workers) are totally lacking from the model. As we have argued elsewhere (Fornero 1999), it is precisely these market limits which call for public intervention, and so, perhaps, a PAYG (or, more generally, a not actuarially fair) component in the pension system.

Economic theory has, after all, demonstrated how, under certain conditions, the privatisation of the social security system (or, more specifically, the comprehensive passage to funding) is, per se, neutral both for the economy and the individuals' welfare (Pestieau and Possen, 1997; Geanakoplos, Mitchell and Zeldes, 1998; Murphy and Welch, 1998).

These conditions are strongly restrictive, demanding, in particular, that: i) the transition (towards a fully funded system) be financed with public debt, i.e. transforming the implicit social security debt into an explicit one and rolling it over in time; ii) the rules of determination of pension rights not be modified; iii) the saving and portfolio composition choices of families not be binded by more stringent constraints than the usual intertemporal constraint; and iv) the preferences of individuals encompass the utility of future generations[25].

---

cases end up by being equivalent.

[24] Though in most of the literature on the subject, only survival tables are subject to a ten-yearly review, a variety of reasons lead us to believe that the discount rate implicit in the transformation coefficients must be included. Reading the parliamentary debate, we have the impression that this latter hypothesis is more in compliance with the spirit of the legislation (Cf. Repubblica Italiana, *'Relazione per la presentazione alle Camere del disegno di legge*: *Riforma del sistema pensionistico obbligatorio e complementare*').

[25] In general, this means that individuals are perfectly capable of neutralising government public spending, taxation and social security choices; these are exactly the conditions that support Ricardian neutrality.

That these conditions are contradicted in reality is hardly questionable. First, if, as the calculations presented above show, the pension system is a source of distortion and redistribution between and within generations, in so far as it corrects such distortions and reduces redistributive flows, the passage to funding cannot be said to be neutral. It is also likely, however, that this correction could be obtained within the public system, without any need to switch to funding. Second, an intrinsic incoherence derives from the fact that the very institution of the social security PAYG system implies that the generations that "vote" it create a transfer in favour of themselves; in the presence of slow growth and adverse demographic trends[26], this transfer is paid by losses to the disadvantage of future generations, which find themselves tied to a system which they did not contribute to choose and design. Furthermore, given the different types of risk characterising the public PAYG system (variations in rules, demographic risk, poor economic growth) and the private funded one (risks inherent in financial investment), the optimal composition of social security wealth is likely to contemplate both a public and a private component. Finally, if families have restricted access to the stock market, institutions such as pension funds, thanks to the possibility of greater diversification which they offer, may represent a net improvement in terms of the risk-return combination. If we consider that, even in the United States, fewer than 50 per cent of families possess share portfolios, the asset allocation choices of Italian households – traditionally unwilling to buy shares – is unlikely to neutralise the effect on portfolios of the compulsory contribution to a PAYG system, apparently characterised by low rates but also relatively low risks[27].

Neutrality is thus the benchmark which serves to clarify how only 'privatisation' accompanied by an (at least partial) extinction of the previous social security debt can bring about a gain in welfare for subsequent generations, naturally at the cost of a 'double burden' for the generations of the transition period.

Room exists to increase the funded component of the Italian social security system, thus enabling households to enjoy the benefits of a greater portfolio diversification. For the same reason, however, the alternative of a passage to a fully funded system must be viewed

---

[26] Cf. Kotlikoff (1987).

[27] Of course, the question remains open as to whether this is a question of constraints (resulting from high entry costs) or of preferences, in the sense of a high risk-aversion. An analogy exists with the interpretation of

as sub-optimal, even before than unfeasible (where the implicit pension debt is particularly high). In this sense, the same low differential we have adopted in simulations in favour of the interest rate over the GDP growth rate should be seen as an expression of our preference for a mixed system.

8. Adopting an opting out clause for the Italian case

Contracting out of social security is a hot argument in the debate on pensions reform and one for which it is quite difficult to find a general theoretical framework (perhaps because there are too many ways to implement it, and the welfare implications are heavily dependent on the conditions that characterise this partial privatisation strategy)[28].

Opting out of national PAYG systems is in fact aimed at reducing the relative weight of the public pillar, while increasing that of the funded component; there are however some peculiarities with respect to a generic privatisation program. The main point is that the transition is based on individuals' free choice: workers are given the chance to call themselves out of the PAYG program, shifting (part of) their future payroll contributions to a private fund. At retirement, part of their benefits will then be privately provided, and part by the Government. The voluntary element may certainly be considered a good value per se, but it adds uncertainty on the final result and on the transition costs.

Supporters of opting out typically argue that:

a - A private funded pillar will improve the long run sustainability of the public system because of the reduction of future liabilities; dynamic efficiency will nonetheless guarantee a non-inferior amount of the pension benefit;

b - A choice based mechanism is welfare improving with respect to a mandatory one;

---

the low indebtedness of Italian households: should this be interpreted as the effect of stringent liquidity constraints or of prudent consumer behaviour?

[28] Literature on opting out is either theoretical or case-based.Recent contributions are: Disney, Whitehouse (1992 and 1993), Gustman, Steinmeier (1996), Mitchell, Zeldes (1996), Kotlikoff, Smetters, Walliser (1998), Castellino and Fornero (1999), Disney (1999), Disney, Palacios, Whitehouse (1999), Menzio (2000). Some of them follow a completely theoretical approach, while many are aimed at establishing a sound theoretical framework for the assessment of reform proposals or actual reforms. Case studies constitute a wide stream and follow a more descriptive approach; they are mainly centred on recent reforms in Latin America and Eastern Europe.

c - Individuals should not be required to divert their discretionary savings or to provide additional ones for old age consumption, and the private pillar should be funded via a reduction of contributions (and corresponding benefits) to the public system.

• *Incentive analysis*

The most obvious way to analyse incentives to opt out of PAYG is to look at the accrual structure of pension benefits. Within a deterministic framework the result does not take into account the portfolio composition argument, and a full shift to the funded system will be the optimal choice whenever the marginal net accrued benefit for the PAYG is negative, which means that the implicit return on the marginal contribution is lower than the risk free interest rate. This kind of analysis (Disney 1999) shows that whenever accrual structures are different for PAYG and funded plans, the individual may find optimal to spend part of the time in each of the systems, and also to switch more than once if this is allowed.

Our simulation model enables us to make these calculations; however, as we shall see, the results for Italy are somehow peculiar.

• *The Italian case*

The analysis – similar to that adopted by Disney, Palacios, Whitehouse (1999) for the UK - is based on the net accrued benefits.

Net accrued benefits are defined as the present value – at the beginning of working life - of the future pension flows accrued up to a certain seniority, less the present value of the contributions already paid, as shown by the following equation:

$$W(S) = P(S)\sum_{i=R}^{\infty}\eta_i(1+r)^{-i} - \sum_{j=1}^{S}c_j(1+r)^{-j}$$

where W(S) are the net accrued benefits, S stands for "seniority", P(S) is the pension accrued at seniority S, η is the actuarial coefficient, which depends on the probability of being alive or, if dead, of one's spouse being alive (and receiving half of the benefit); R is the retirement seniority, c are contributions paid and r is the risk free interest rate. If W(S) is increasing in S, contributions paid in the marginal year are invested at an implicit rate greater than r; in the opposite case, the implicit return on marginal contributions is lower than r.

The main difference with respect to Disney *et al*. is that they consider a given legislative framework for opting out, that of the UK, while in Italy, at the moment, opting out is not allowed.

We abstract from uncertainty and, moreover, make the following assumptions:

i) for the contribution-based component of the pension, given a fixed retirement year, accrued benefits at a given seniority, are based on the "notional capital" accrued at the age of retirement, but taking into account contributions only up to that seniority;

ii) for the earning-based component, again given a fixed retirement year, the legal accrual rate (2 per cent) is multiplied by the effective years of contribution, while the pensionable wage is the same which would have been had the subject chosen to remain in the system for his whole working life.

This hypothesis seems strong, but it may be justified once we consider that the defined-benefit component typically ties the pension benefit to a) the years of contribution and b) to the average wage of a specific final segment of the wage profile[29].

The certainty hypotheses refer to:

i) the market interest rate, which is the "outside option";

ii) the rate of growth of the wage bill, which is the implicit return of the notional accounts;

iii) the wage profile, which affects the implicit return of the defined benefits in the PAYG.

As already mentioned, an important implication of the certainty case is the irrelevance of the diversification argument for a mixed system: the only relevant variables are the (certain) returns, and the optimal choice is of course to switch completely to the plan offering the higher rate.

Figure 7 in the appendix presents net accrued benefits, discounted at 2 per cent, as a function of seniority spent in PAYG for different cohorts. The Italian peculiarity is that, after the 1995 reform, PAYG is characterised by an actuarially fair defined contribution method. However, as we already stressed, the new rules fully apply only to new entrants,

while a *pro rata* mechanism applies to intermediate working cohorts (the older ones being almost untouched by the reforms). In this framework, the old PAYG rules granted an implicit return above the market (risk free) interest rate; the return is however lower (given our assumptions on parameters) for the marginal contribution paid to the new PAYG. This implies that for all cohorts, with the exception of those excluded from the reform, the W(S) curve peaks in 1996. Again, this confirms that, given dynamic efficiency, a complete switch to the funded system would be the optimal choice, assuming that already accrued rights were preserved.

Of course, this clear cut result is due to the absence of any portfolio composition analysis; once risk is introduced, a good argument for a mixed choice is likely to emerge, at least on theoretical grounds; nevertheless our simulations suggest that any opting out proposal should be founded on a well focused incentive analysis, and that a limited and gradual implementation is likely to be the only feasible solution.

In this perspective, table 11 shows a rough projection of the additional costs to be sustained if new entrants in the labour market are allowed a partial rebate on their contributions to the PAYG; the simulation is performed for different rebates and considers constant flows in and out of the labour market and fixed lengths of work and retirement[30].

9. Conclusions

In this paper, we looked at the Italian social security system from a perspective that is at once strictly economic (money's worth) and sharply individualistic (albeit representing individuals through the generations they belong to). This perspective is particularly suitable for a description of the future Italian PAYG system, which, in so far as it is contributory, will be centred on principles of actuarial equivalence characteristic of private insurance, only tempered by a minimum income provision.

---

[29] For example, two per cent times 40 years gives the famous 80 per cent of the "last" wage, which was a benchmark in the pre-Amato legislation

[30] The simulation is an aggregate one. Starting from the actual payroll tax rate (33 per cent), we considered the official projections (Cf. Camera dei Deputati, Servizio Bilancio dello Stato, 1996) of the equilibrium payroll tax rates and of pension expenditure as a percentage of GDP. We then calculated the new average payroll tax were the opting out introduced via a partial rebate for new entrants and obtained a projection of the social security deficit (as a percentage of GDP). The exercise is limited to private employees and considers a GDP growth rate of 1.5 per cent.

Calculations show:

i. a progressive, strong reduction in social security's worth to the detriment of younger future generations, for whom benefits will no longer be determined according to the generous rules of the past;

ii. the tax on the continuation of the working activity still present in the long transition envisaged by the 1995 Dini reform;

iii. the effects in terms of the reduction in the disparity of treatment and microeconomic distortions produced by the extensions of the *pro rata* mechanism, as well as the modest expenditure savings generated by this measure;

iv. the larger reduction in expenditure (and consequently in the deficits) obtainable with the introduction of an actuarial correction of seniority pensions.

We recognise that these calculations are insufficient to grasp the complexity of the 'social security question', in particular its implications in terms of welfare. However they do have the advantage of moving the debate away from its more ideological formulations and provide a more objective basis for discussion. This is not to argue that the social security system has to loose the characteristics of social cohesion that constituted the great appeal of the PAYG system; on the contrary, the reform hypotheses discussed in the paper may be interpreted as reinforcing the sustainability and equity of the system. However, we cannot avoid wondering which forces and which values can push future generations too to give up the fruits of a greater diversification of their social security portfolio and remain bound, with particularly high coefficients, to a generally inefficient system. A partial and gradual opting out clause for younger generations could be the relatively painless way to introduce greater diversification in the Italian households' pension wealth.

References

Aprile, Rocco, 1997, '*I modelli di previsione del sistema pensionistico elaborati dalla Ragioneria Generale dello Stato: alcuni aspetti metodologici*', in Annali di Statistica, Istat, n127, Series X, vol. 16.

Borsch-Supan Axel, 1998, '*Incentive Effects of Social Security on Labor Force Participation: Evidence in Germany and Across Europe*', NBER Working Paper, n. 6780, Nov.

Brambilla Alberto, Stefano Leoni, 1998, '*Primi passi verso il riequilibrio tra previdenza pubblica di base e complementare*', in Economia Italiana, n.3, Sept.- Dec.

Brugiavini Agar, Elsa Fornero, 1999, '*A Pension System in Transition: the Case of Italy*', Quaderni del Dipartimento di Scienze Economiche e Finanziarie 'G. Prato', num. 38, Jan.

Camera dei Deputati, Servizio Bilancio dello Stato, 1996, '*Gli effetti finanziari di medio-lungo periodo della riforma del sistema pensionistico obbligatorio (Legge 8 agosto 1995, n. 335)'*, in Documenti e Ricerche, doc. n. 2, 10th June.

Castellino Onorato, 1995, '*Redistribution between and within generations in the Italian social security system*', pp. 317-327, Ricerche Economiche, 49.

Castellino Onorato, Elsa Fornero, 1999, '*From PAYG to Funding in Italy: a Feasible Transition*?', in The Geneva Papers on Risk and Insurance, Issues and Practice, Vol. 24, no. 4, Oct. 1999.

Ceprini Marialuisa, Franco Modigliani, 1998, '*Social Security: una proposta per l'Italia*', in Economia Italiana, n. 2, May-Aug.

Coronado Julia Lynn, Don Fullerton, Thomas Glass, 1999, '*Distributional Impacts of Proposed Changes to the Social Security System*', NBER wp series, wp 6989 , NBER, March

Disney Richard, Robert Palacios Edward Whitehouse, 1999, '*Individual Choice of Pension Arrangement as a Pension Reform Strategy*', IFS Working Paper 16 July, W99/18, IFS

Disney Richard, 1999, '*Declining Public Pensions in an Era of Demographic Ageing: Will Private Provision Fill the Gap*?', Paper for EEA 1999 Session*: 'Reforming our pension systems'* 4th Sept.

Disney Richard, 1999b, '*Notional Account-Based Pension Reform Strategies: an Evaluation'*, *mimeo, 22 Oct.*

Disney Richard, Edward Whitehouse, 1992, '*Personal Pensions and the Review of Contracting-Out Terms*', Fiscal Studies Vol. 13 - Feb. pp. 39 - 53

Disney Richard, Edward Whitehouse, 1993, '*Contracting-Out and Lifetime Redistribution in the UK State Pension System*', Oxford Bulletin of Economics and Statistics Vol. 55 Feb. pp. 25 - 41

Diamond Peter, 1998, '*The Economics of Social Security Reform*', NBER Working Paper, n. 6719, Sept.

Feldstein Martin, et. al., 1998, '*Privatizing Social Security*', The University of Chicago Press

Fornero Elsa, 1996, '*Scelte collettive e previdenza sociale. Fondamenti teorici ed esperienza italiana*', in Fiorella Padoa Schioppa Kostoris (ed.), *Pensioni e risanamento della finanza pubblica*, pp. 19 – 58, Il Mulino, Bologna

Fornero Elsa, 1999, '*L'economia dei fondi pensione. Potenzialità e limiti della previdenza privata in Italia*', Il Mulino, Bologna.

Geanakoplos John, Olivia S. Mitchell, Stephen P. Zeldes, 1998, '*Social Security Money's Worth*', PaineWebber WP Series in Money, Economics and Finance, PW-98-05 Columbia Business School, Aug.

Gronchi Sandro, 1997, '*Un'ipotesi di correzione e completamento della riforma delle pensioni del 1995*', Ministry of the Treasury, Technical Commission for Public Spending, Note n. 10, June.

Gruber Jonathan, David Wise (eds.), 1999, '*Social Security and Retirement Around the World*', NBER.

Gustman Alan L., Thomas L. Steinmeier, 1998, '*Privatizing Social Security: First-Round Effects of a Generic, Voluntary, Privatized U.S. Social Security System*', in: Martin Feldstein *Privatizing Social Security* pp. 313 – 361, The University of Chicago Press

INPS, 1999, '*Analisi dei rapporti tra i trattamenti pensionistici liquidati con il metodo retributivo ed il metodo misto (applicazione del calcolo contributivo in pro-rata dal 1.1.2000)*', edited by the Actuarial Statistical General Coordination, June.

Kotlikoff Laurence J., Kent A. Smetters, Jan Walliser, 1998, '*Opting Out of Social Security and Adverse Selection*', NBER wp. 6430, February.

Menzio Guido, 2000, *Opting out of Social Security over the Lyfe Cycle*, CeRP (Centre for Research on Pensions and Welfare Policies); Working Paper no.1, May.

Mitchell Olivia S., Stephen P. Zeldes, 1996, '*Social Security Privatization: a Structure for Analysis*', NBER wp 5512, March.

Ministero del Tesoro, Ragioneria Generale dello Stato, 1996, '*Tendenze Demografiche e Spesa Pensionistica*', Conti Pubblici e Congiuntura economica, monographic notebook n. 9.

Murphy, K.M., F. Welch, 1998, '*Perspectives on the Social Security Crisis and Proposed Solutions*', The American Economic Review, Vol. 88, No. 2, May.

OECD, 1999, OECD Economic Surveys n. 1, Italy.

Pestieau, P. , U.M. Possen, 1997, '*Investing Social Security in the Equity Market. Does it Make a Difference*?', Dec., working paper.

Repubblica Italiana *'Relazione per la presentazione alle Camere del disegno di legge*: *Riforma del sistema pensionistico obbligatorio e complementare*'.

Repubblica Italiana, D.Lgs. n. 503 30 Dicembre 1992.

Repubblica Italiana, L. n. 335 8 Agosto 1995.

Repubblica Italiana, L. n. 449 27 Dicembre 1997.

APPENDIX A:
tables and figures

Table 1

retirement year			NPVR present legislation (r=2% - g=1.5%) seniority at retirement						NPVR pro rata extension (r=2% - g=1.5%) seniority at retirement					
from	to	cohort	35	36	37	38	39	40	35	36	37	38	39	40
2000	2005	1942	152.4%	144.5%	138.2%	132.6%	127.4%	122.3%	152.4%	143.6%	136.7%	130.9%	125.7%	121.0%
2001	2006	1943	147.1%	140.8%	135.3%	130.1%	125.1%	120.3%	146.1%	139.1%	133.3%	128.0%	123.2%	118.7%
2002	2007	1944	143.5%	138.0%	132.8%	127.8%	123.0%	118.5%	141.6%	135.6%	130.3%	125.3%	120.8%	116.6%
2003	2008	1945	140.7%	135.5%	130.6%	125.8%	121.2%	116.7%	137.9%	132.5%	127.5%	122.9%	118.7%	114.7%
2004	2009	1946	138.3%	133.3%	128.6%	124.1%	119.6%	115.2%	134.7%	129.7%	125.1%	120.8%	116.7%	113.0%
2005	2010	1947	136.3%	131.6%	127.1%	122.6%	118.3%	114.0%	132.1%	127.3%	123.0%	118.9%	115.1%	111.5%
2006	2011	1948	134.7%	130.2%	125.7%	121.4%	117.1%	112.9%	129.7%	125.2%	121.1%	117.2%	113.6%	110.2%
2007	2012	1949	133.1%	128.7%	124.3%	120.1%	115.9%	111.7%	127.3%	123.1%	119.2%	115.5%	112.1%	108.8%
2008	2013	1950	131.8%	127.4%	123.2%	119.0%	114.8%	110.8%	125.2%	121.2%	117.5%	114.0%	110.7%	107.7%
2009	2014	1951	130.7%	126.5%	122.3%	118.1%	114.0%	110.0%	123.4%	119.6%	116.1%	112.7%	109.6%	106.7%
2010	2015	1952	129.8%	125.6%	121.5%	117.4%	113.3%	109.4%	121.8%	118.2%	114.8%	111.6%	108.6%	105.8%
2011	2016	1953	129.1%	124.9%	120.8%	116.8%	112.8%	108.8%	120.3%	116.8%	113.6%	110.6%	107.7%	105.0%
2012	2017	1954	128.8%	124.7%	120.6%	116.6%	112.6%	108.6%	119.2%	115.9%	112.8%	109.9%	107.2%	104.6%
2013	2018	1955	128.5%	124.4%	120.3%	116.3%	112.3%	108.4%	118.1%	114.9%	112.0%	109.2%	106.6%	104.1%
2014	2019	1956	115.8%	113.2%	110.8%	108.5%	106.4%	104.4%	115.8%	113.2%	110.8%	108.5%	106.4%	104.4%
2015	2020	1957	114.5%	112.1%	109.8%	107.6%	105.6%	103.7%	114.5%	112.1%	109.8%	107.6%	105.6%	103.7%
2016	2021	1958	113.3%	111.0%	108.8%	106.8%	104.9%	103.1%	113.3%	111.0%	108.8%	106.8%	104.9%	103.1%
2017	2022	1959	111.9%	109.7%	107.7%	105.9%	104.1%	102.4%	111.9%	109.7%	107.7%	105.9%	104.1%	102.4%
2018	2023	1960	110.4%	108.4%	106.6%	104.8%	103.2%	101.7%	110.4%	108.4%	106.6%	104.8%	103.2%	101.7%
2019	2024	1961	108.9%	107.1%	105.4%	103.8%	102.2%	100.8%	108.9%	107.1%	105.4%	103.8%	102.2%	100.8%
2020	2025	1962	107.3%	105.6%	104.1%	102.6%	101.2%	99.9%	107.3%	105.6%	104.1%	102.6%	101.2%	99.9%
2021	2026	1963	105.6%	104.1%	102.7%	101.3%	100.1%	98.9%	105.6%	104.1%	102.7%	101.3%	100.1%	98.9%
2022	2027	1964	104.0%	102.6%	101.3%	100.1%	99.0%	98.0%						
2023	2028	1965	102.3%	101.1%	100.0%	98.9%	97.9%	97.0%						
2024	2029	1966	100.7%	99.6%	98.6%	97.7%	96.9%	96.1%						
2025	2030	1967	99.0%	98.1%	97.2%	96.5%	95.7%	95.1%						
2026	2031	1968	97.1%	96.4%	95.7%	95.1%	94.5%	93.9%						
2027	2032	1969	95.3%	94.7%	94.1%	93.6%	93.2%	92.8%						
2028	2033	1970	93.3%	92.9%	92.5%	92.2%	91.8%	91.5%						
2029	2034	1971	91.9%	91.6%	91.3%	91.1%	90.8%	90.7%						
2030	2035	1972	90.3%	90.1%	90.0%	89.9%	89.8%	89.7%						
2031	2036	1973	87.2%	87.2%	87.3%	87.3%	87.3%	87.4%						
2032	2037	1974	87.1%	87.1%	87.2%	87.2%	87.2%	87.3%						
2033	2038	1975	87.0%	87.0%	87.1%	87.1%	87.2%	87.2%						
2034	2039	1976	87.0%	87.0%	87.0%	87.1%	87.1%	87.1%						
2035	2040	1977	86.9%	86.9%	87.0%	87.0%	87.1%	87.1%						
2036	2041	1978	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%						
2037	2042	1979	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%						
2038	2043	1980	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%						
2039	2044	1981	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%						
2040	2045	1982	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%						
2041	2046	1983	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%						
2042	2047	1984	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%
2043	2048	1985	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%
2044	2049	1986	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%
2045	2050	1987	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%
2046	2051	1988	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%	86.9%	86.9%	87.0%	87.0%	87.0%	87.1%

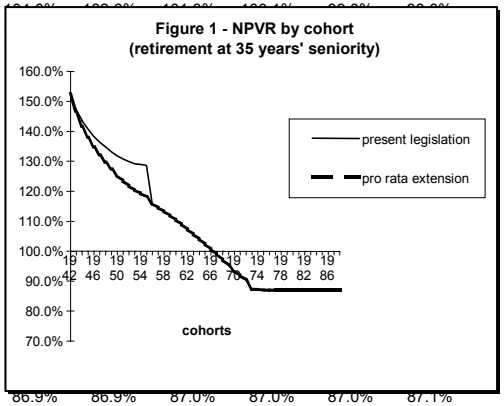


Table 2

retirement year			IRR present legislation (r=2% - g=1.5%) seniority at retirement						IRR pro rata extension (r=2% - g=1.5%) seniority at retirement					
from	to	cohort	35	36	37	38	39	40	35	36	37	38	39	40
2000	2005	1942	3.5%	3.3%	3.2%	3.0%	2.9%	2.7%	3.5%	3.3%	3.1%	3.0%	2.8%	2.7%
2001	2006	1943	3.4%	3.2%	3.1%	2.9%	2.8%	2.6%	3.4%	3.2%	3.0%	2.9%	2.7%	2.6%
2002	2007	1944	3.3%	3.1%	3.0%	2.9%	2.7%	2.6%	3.2%	3.1%	2.9%	2.8%	2.7%	2.5%
2003	2008	1945	3.2%	3.1%	2.9%	2.8%	2.7%	2.5%	3.1%	3.0%	2.9%	2.7%	2.6%	2.5%
2004	2009	1946	3.1%	3.0%	2.9%	2.7%	2.6%	2.5%	3.1%	2.9%	2.8%	2.7%	2.5%	2.4%
2005	2010	1947	3.1%	3.0%	2.8%	2.7%	2.6%	2.4%	3.0%	2.8%	2.7%	2.6%	2.5%	2.4%
2006	2011	1948	3.0%	2.9%	2.8%	2.7%	2.5%	2.4%	2.9%	2.8%	2.7%	2.5%	2.4%	2.3%
2007	2012	1949	3.0%	2.9%	2.7%	2.6%	2.5%	2.4%	2.8%	2.7%	2.6%	2.5%	2.4%	2.3%
2008	2013	1950	3.0%	2.8%	2.7%	2.6%	2.5%	2.3%	2.8%	2.7%	2.6%	2.4%	2.3%	2.2%
2009	2014	1951	2.9%	2.8%	2.7%	2.6%	2.4%	2.3%	2.7%	2.6%	2.5%	2.4%	2.3%	2.2%
2010	2015	1952	2.9%	2.8%	2.7%	2.5%	2.4%	2.3%	2.7%	2.6%	2.5%	2.4%	2.3%	2.2%
2011	2016	1953	2.9%	2.8%	2.6%	2.5%	2.4%	2.3%	2.6%	2.5%	2.4%	2.3%	2.3%	2.2%
2012	2017	1954	2.9%	2.8%	2.6%	2.5%	2.4%	2.3%	2.6%	2.5%	2.4%	2.3%	2.2%	2.2%
2013	2018	1955	2.9%	2.7%	2.6%	2.5%	2.4%	2.3%	2.6%	2.5%	2.4%	2.3%	2.2%	2.1%
2014	2019	1956	2.5%	2.4%	2.3%	2.3%	2.2%	2.1%	2.5%	2.4%	2.3%	2.3%	2.2%	2.1%
2015	2020	1957	2.5%	2.4%	2.3%	2.2%	2.2%	2.1%	2.5%	2.4%	2.3%	2.2%	2.2%	2.1%
2016	2021	1958	2.4%	2.4%	2.3%	2.2%	2.2%	2.1%	2.4%	2.4%	2.3%	2.2%	2.2%	2.1%
2017	2022	1959	2.4%	2.3%	2.3%	2.2%	2.1%	2.1%	2.4%	2.3%	2.3%	2.2%	2.1%	2.1%
2018	2023	1960	2.3%	2.3%	2.2%	2.2%	2.1%	2.1%	2.3%	2.3%	2.3%	2.2%	2.1%	2.1%
2019	2024	1961	2.3%	2.2%	2.2%	2.1%	2.1%	2.0%						
2020	2025	1962	2.2%	2.2%	2.1%	2.1%	2.0%	2.0%						
2021	2026	1963	2.2%	2.1%	2.1%	2.0%	2.0%	2.0%						
2022	2027	1964	2.1%	2.1%	2.0%	2.0%	2.0%	1.9%						
2023	2028	1965	2.1%	2.0%	2.0%	2.0%	1.9%	1.9%						
2024	2029	1966	2.0%	2.0%	2.0%	1.9%	1.9%	1.9%						
2025	2030	1967	2.0%	1.9%	1.9%	1.9%	1.9%	1.8%						
2026	2031	1968	1.9%	1.9%	1.9%	1.8%	1.8%	1.8%						
2027	2032	1969	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%						
2028	2033	1970	1.8%	1.8%	1.7%	1.7%	1.7%	1.7%						
2029	2034	1971	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%						
2030	2035	1972	1.7%	1.6%	1.6%	1.6%	1.6%	1.6%						
2031	2036	1973	1.5%	1.5%	1.5%	1.5%	1.5%	1.6%						
2032	2037	1974	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%						
2033	2038	1975	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%						
2034	2039	1976	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%						
2035	2040	1977	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%						
2036	2041	1978	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%						
2037	2042	1979	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%						
2038	2043	1980	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%						
2039	2044	1981	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
2040	2045	1982	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
2041	2046	1983	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
2042	2047	1984	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
2043	2048	1985	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
2044	2049	1986	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
2045	2050	1987	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
2046	2051	1988	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%

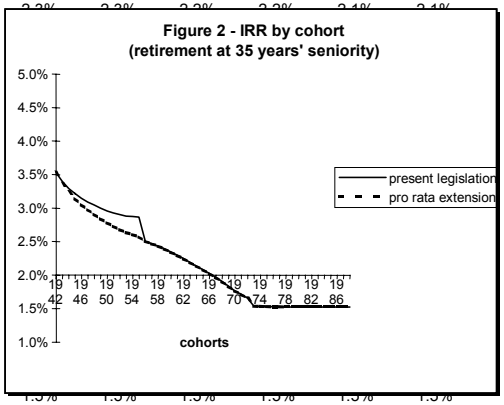


Table 3

retirement year from	retirement year to	cohort	RR present legislation (r=2% - g=1.5%) seniority at retiremnt 35	36	37	38	39	40	RR pro rata extension (r=2% - g=1.5%) seniority at retirement 35	36	37	38	39	40
2000	2005	1942	70.2%	71.0%	72.5%	74.2%	76.0%	77.8%	70.2%	70.6%	71.7%	73.2%	75.0%	77.0%
2001	2006	1943	69.0%	70.5%	72.2%	74.1%	75.9%	77.8%	68.6%	69.7%	71.2%	72.9%	74.7%	76.8%
2002	2007	1944	68.6%	70.3%	72.1%	74.0%	75.9%	77.8%	67.6%	69.1%	70.7%	72.5%	74.5%	76.6%
2003	2008	1945	68.4%	70.2%	72.0%	73.9%	75.9%	77.8%	67.0%	68.6%	70.3%	72.2%	74.3%	76.5%
2004	2009	1946	68.2%	70.1%	72.0%	73.9%	75.9%	77.8%	66.5%	68.2%	70.0%	72.0%	74.1%	76.3%
2005	2010	1947	68.1%	70.0%	72.0%	73.9%	75.9%	77.8%	66.0%	67.8%	69.7%	71.7%	73.8%	76.1%
2006	2011	1948	68.1%	70.1%	72.0%	73.9%	75.9%	77.8%	65.6%	67.4%	69.3%	71.4%	73.6%	76.0%
2007	2012	1949	68.1%	70.0%	72.0%	74.0%	75.9%	77.9%	65.1%	67.0%	69.0%	71.1%	73.4%	75.8%
2008	2013	1950	68.1%	70.1%	72.0%	74.0%	75.9%	77.9%	64.7%	66.7%	68.7%	70.9%	73.2%	75.7%
2009	2014	1951	68.1%	70.1%	72.0%	74.0%	75.9%	77.9%	64.3%	66.3%	68.4%	70.6%	73.0%	75.5%
2010	2015	1952	68.1%	70.1%	72.0%	74.0%	75.9%	77.9%	63.9%	65.9%	68.1%	70.3%	72.8%	75.4%
2011	2016	1953	68.1%	70.1%	72.0%	74.0%	75.9%	77.9%	63.5%	65.5%	67.7%	70.1%	72.5%	75.2%
2012	2017	1954	68.2%	70.1%	72.1%	74.0%	76.0%	77.9%	63.1%	65.2%	67.4%	69.8%	72.3%	75.0%
2013	2018	1955	68.2%	70.1%	72.1%	74.0%	76.0%	77.9%	62.6%	64.8%	67.1%	69.5%	72.1%	74.8%
2014	2019	1956	61.5%	63.9%	66.5%	69.2%	72.1%	75.1%	61.5%	63.9%	66.5%	69.2%	72.1%	75.1%
2015	2020	1957	60.9%	63.4%	66.0%	68.7%	71.7%	74.8%	60.9%	63.4%	66.0%	68.7%	71.7%	74.8%
2016	2021	1958	60.3%	62.8%	65.4%	68.2%	71.2%	74.4%	60.3%	62.8%	65.4%	68.2%	71.2%	74.4%
2017	2022	1959	59.7%	62.2%	64.9%	67.7%	70.8%	74.0%	59.7%	62.2%	64.9%	67.7%	70.8%	74.0%
2018	2023	1960	59.0%	61.6%	64.3%	67.2%	70.3%	73.6%	59.0%	61.6%	64.3%	67.2%	70.3%	73.6%
2019	2024	1961	58.3%	60.9%	63.7%	66.6%	69.8%	73.1%	58					
2020	2025	1962	57.6%	60.3%	63.1%	66.0%	69.2%	72.6%	57					
2021	2026	1963	56.9%	59.5%	62.4%	65.4%	68.6%	72.1%	56					
2022	2027	1964	56.1%	58.8%	61.7%	64.7%	68.0%	71.5%	56					
2023	2028	1965	55.3%	58.0%	60.9%	64.0%	67.3%	70.9%	55					
2024	2029	1966	54.5%	57.2%	60.2%	63.3%	66.7%	70.3%	54					
2025	2030	1967	53.6%	56.4%	59.4%	62.6%	66.0%	69.6%	53					
2026	2031	1968	52.8%	55.6%	58.6%	61.8%	65.3%	68.9%	52					
2027	2032	1969	51.8%	54.7%	57.8%	61.0%	64.5%	68.2%	51					
2028	2033	1970	50.9%	53.8%	56.9%	60.2%	63.7%	67.4%	50					
2029	2034	1971	50.2%	53.2%	56.3%	59.6%	63.1%	66.9%	50					
2030	2035	1972	49.5%	52.5%	55.6%	59.0%	62.6%	66.4%	49					
2031	2036	1973	48.0%	50.9%	54.1%	57.5%	61.0%	64.8%	48					
2032	2037	1974	47.9%	50.9%	54.0%	57.4%	61.0%	64.8%	47					
2033	2038	1975	47.9%	50.8%	54.0%	57.3%	60.9%	64.7%	47					
2034	2039	1976	47.8%	50.8%	53.9%	57.3%	60.9%	64.7%	47					
2035	2040	1977	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2036	2041	1978	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2037	2042	1979	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2038	2043	1980	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2039	2044	1981	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2040	2045	1982	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2041	2046	1983	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2042	2047	1984	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2043	2048	1985	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2044	2049	1986	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2045	2050	1987	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%
2046	2051	1988	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%	47.8%	50.8%	53.9%	57.3%	60.8%	64.6%

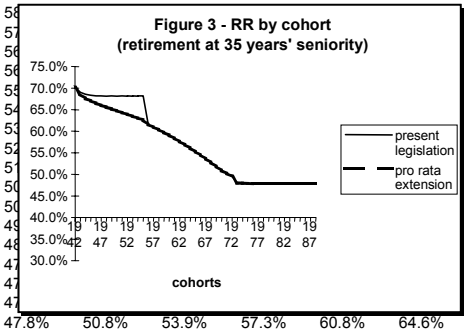


Table 4

retirement year		cohort	NPVR present legislation (r=3% - g=2.5%) seniority at retirement						NPVR pro rata extension (r=3% - g=2.5%) seniority at retirement					
from	to		35	36	37	38	39	40	35	36	37	38	39	40
2000	2005	1942	116.5%	110.9%	106.6%	103.0%	99.5%	96.0%	116.5%	110.3%	105.7%	102.0%	98.6%	95.4%
2001	2006	1943	112.9%	108.7%	105.1%	101.5%	98.1%	94.9%	112.2%	107.5%	103.7%	100.3%	97.1%	94.2%
2002	2007	1944	110.7%	107.1%	103.6%	100.2%	97.0%	93.9%	109.4%	105.5%	102.0%	98.8%	95.8%	93.1%
2003	2008	1945	109.2%	105.7%	102.3%	99.1%	96.0%	93.0%	107.3%	103.7%	100.4%	97.5%	94.7%	92.1%
2004	2009	1946	107.8%	104.5%	101.3%	98.2%	95.2%	92.2%	105.4%	102.1%	99.1%	96.3%	93.7%	91.2%
2005	2010	1947	106.8%	103.7%	100.6%	97.6%	94.6%	91.6%	104.0%	100.9%	98.1%	95.4%	92.9%	90.6%
2006	2011	1948	106.1%	103.1%	100.1%	97.1%	94.1%	91.1%	102.8%	99.9%	97.2%	94.6%	92.2%	90.0%
2007	2012	1949	105.4%	102.4%	99.4%	96.5%	93.5%	90.6%	101.5%	98.8%	96.2%	93.8%	91.5%	89.3%
2008	2013	1950	104.8%	101.9%	98.9%	96.0%	93.1%	90.2%	100.5%	97.9%	95.4%	93.1%	90.9%	88.8%
2009	2014	1951	104.5%	101.6%	98.7%	95.7%	92.8%	90.0%	99.6%	97.1%	94.8%	92.5%	90.4%	88.5%
2010	2015	1952	104.3%	101.4%	98.5%	95.6%	92.7%	89.8%	98.9%	96.5%	94.2%	92.1%	90.1%	88.2%
2011	2016	1953	104.2%	101.3%	98.4%	95.5%	92.6%	89.7%	98.2%	95.9%	93.8%	91.7%	89.8%	88.0%
2012	2017	1954	104.5%	101.5%	98.6%	95.7%	92.8%	89.9%	97.9%	95.7%	93.6%	91.7%	89.8%	88.1%
2013	2018	1955	104.7%	101.7%	98.8%	95.9%	93.0%	90.1%	97.6%	95.4%	93.4%	91.5%	89.8%	88.1%
2014	2019	1956	95.9%	94.1%	92.5%	91.1%	89.7%	88.4%	95.9%	94.1%	92.5%	91.1%	89.7%	88.4%
2015	2020	1957	95.3%	93.6%	92.1%	90.7%	89.4%	88.2%	95.3%	93.6%	92.1%	90.7%	89.4%	88.2%
2016	2021	1958	94.7%	93.1%	91.7%	90.4%	89.2%	88.1%	94.7%	93.1%	91.7%	90.4%	89.2%	88.1%
2017	2022	1959	93.9%	92.5%	91.2%	90.0%	88.8%	87.8%	93.9%	92.5%	91.2%	90.0%	88.8%	87.8%
2018	2023	1960	93.0%	91.7%	90.5%	89.4%	88.4%	87.4%	93.0%	91.7%	90.5%	89.4%	88.4%	87.4%
2019	2024	1961	92.1%	90.9%	89.8%	88.8%	87.9%	87.0%	92.1%	90.9%	89.8%	88.8%	87.9%	87.0%
2020	2025	1962	91.0%	89.9%	89.0%	88.1%	87.2%	86.5%	91.0%	89.9%	89.0%	88.1%	87.2%	86.5%
2021	2026	1963	89.8%	88.9%	88.0%	87.2%	86.5%	85.8%	89.8%	88.9%	88.0%	87.2%	86.5%	85.8%
2022	2027	1964	88.7%	87.8%	87.1%	86.4%	85.8%	85.2%	88.7%	87.8%	87.1%	86.4%	85.8%	85.2%
2023	2028	1965	87.5%	86.8%	86.1%	85.6%	85.0%	84.6%	87.5%	86.8%	86.1%	85.6%	85.0%	84.6%
2024	2029	1966	86.3%	85.7%	85.2%	84.7%	84.3%	83.9%	86.3%	85.7%	85.2%	84.7%	84.3%	83.9%
2025	2030	1967	85.0%	84.5%	84.2%	83.8%	83.5%	83.2%	85.0%	84.5%	84.2%	83.8%	83.5%	83.2%
2026	2031	1968	83.6%	83.2%	83.0%	82.7%	82.5%	82.3%	83.6%	83.2%	83.0%	82.7%	82.5%	82.3%
2027	2032	1969	82.1%	81.9%	81.7%	81.6%	81.5%	81.4%	82.1%	81.9%	81.7%	81.6%	81.5%	81.4%
2028	2033	1970	80.5%	80.5%	80.4%	80.4%	80.4%	80.4%	80.5%	80.5%	80.4%	80.4%	80.4%	80.4%
2029	2034	1971	79.7%	79.7%	79.7%	79.8%	79.9%	80.0%	79.7%	79.7%	79.7%	79.8%	79.9%	80.0%
2030	2035	1972	78.7%	78.8%	79.0%	79.1%	79.3%	79.5%	78.7%	78.8%	79.0%	79.1%	79.3%	79.5%
2031	2036	1973	76.4%	76.7%	76.9%	77.2%	77.5%	77.8%	76.4%	76.7%	76.9%	77.2%	77.5%	77.8%
2032	2037	1974	76.4%	76.6%	76.9%	77.2%	77.5%	77.8%	76.4%	76.6%	76.9%	77.2%	77.5%	77.8%
2033	2038	1975	76.4%	76.6%	76.9%	77.2%	77.4%	77.7%	76.4%	76.6%	76.9%	77.2%	77.4%	77.7%
2034	2039	1976	76.3%	76.6%	76.9%	77.1%	77.4%	77.7%	76.3%	76.6%	76.9%	77.1%	77.4%	77.7%
2035	2040	1977	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2036	2041	1978	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2037	2042	1979	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2038	2043	1980	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2039	2044	1981	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2040	2045	1982	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2041	2046	1983	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2042	2047	1984	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2043	2048	1985	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2044	2049	1986	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2045	2050	1987	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%
2046	2051	1988	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%	76.3%	76.6%	76.8%	77.1%	77.4%	77.7%

Table 5

retirement year		cohort	NPVR present legislation (r=3.5% - g=2.5%) seniority at retirement						NPVR pro rata extension (r=3.5% - g=2.5%) seniority at retirement					
from	to		35	36	37	38	39	40	35	36	37	38	39	40
2000	2005	1942	101.6%	96.6%	92.8%	89.5%	86.4%	83.3%	101.6%	96.1%	92.0%	88.6%	85.6%	82.7%
2001	2006	1943	98.4%	94.6%	91.3%	88.2%	85.1%	82.2%	97.8%	93.6%	90.2%	87.1%	84.2%	81.6%
2002	2007	1944	96.4%	93.2%	90.0%	87.0%	84.1%	81.3%	95.2%	91.8%	88.6%	85.7%	83.1%	80.6%
2003	2008	1945	95.0%	91.8%	88.8%	85.9%	83.2%	80.4%	93.3%	90.1%	87.2%	84.5%	82.0%	79.7%
2004	2009	1946	93.7%	90.7%	87.8%	85.1%	82.4%	79.7%	91.6%	88.7%	85.9%	83.4%	81.1%	78.8%
2005	2010	1947	92.8%	89.9%	87.2%	84.5%	81.8%	79.2%	90.3%	87.6%	85.0%	82.6%	80.4%	78.2%
2006	2011	1948	92.1%	89.4%	86.7%	84.0%	81.3%	78.7%	89.2%	86.6%	84.2%	81.9%	79.7%	77.7%
2007	2012	1949	91.4%	88.7%	86.1%	83.4%	80.8%	78.2%	88.1%	85.6%	83.3%	81.1%	79.0%	77.1%
2008	2013	1950	90.9%	88.3%	85.6%	83.0%	80.4%	77.8%	87.1%	84.8%	82.5%	80.4%	78.5%	76.6%
2009	2014	1951	90.6%	88.0%	85.3%	82.7%	80.1%	77.6%	86.4%	84.1%	82.0%	80.0%	78.1%	76.3%
2010	2015	1952	90.4%	87.8%	85.2%	82.6%	80.0%	77.4%	85.7%	83.5%	81.5%	79.6%	77.7%	76.0%
2011	2016	1953	90.3%	87.7%	85.1%	82.5%	79.9%	77.3%	85.1%	83.0%	81.1%	79.2%	77.5%	75.9%
2012	2017	1954	90.6%	87.9%	85.3%	82.7%	80.1%	77.5%	84.9%	82.9%	81.0%	79.2%	77.5%	76.0%
2013	2018	1955	90.7%	88.1%	85.5%	82.9%	80.3%	77.7%	84.6%	82.6%	80.8%	79.1%	77.5%	76.0%
2014	2019	1956	83.1%	81.6%	80.1%	78.7%	77.4%	76.2%	83.1%	81.6%	80.1%	78.7%	77.4%	76.2%
2015	2020	1957	82.6%	81.1%	79.8%	78.5%	77.2%	76.1%	82.6%	81.1%	79.8%	78.5%	77.2%	76.1%
2016	2021	1958	82.1%	80.7%	79.4%	78.2%	77.1%	76.0%	82.1%	80.7%	79.4%	78.2%	77.1%	76.0%
2017	2022	1959	81.5%	80.2%	79.0%	77.8%	76.8%	75.8%	81.5%	80.2%	79.0%	77.8%	76.8%	75.8%
2018	2023	1960	80.8%	79.5%	78.4%	77.4%	76.4%	75.5%	80.8%	79.5%	78.4%	77.4%	76.4%	75.5%
2019	2024	1961	79.9%	78.8%	77.8%	76.8%	76.0%	75.1%	79.9%	78.8%	77.8%	76.8%	76.0%	75.1%
2020	2025	1962	79.0%	78.0%	77.1%	76.2%	75.4%	74.7%	79.0%	78.0%	77.1%	76.2%	75.4%	74.7%
2021	2026	1963	78.0%	77.1%	76.3%	75.5%	74.8%	74.1%	78.0%	77.1%	76.3%	75.5%	74.8%	74.1%
2022	2027	1964	77.0%	76.2%	75.5%	74.8%	74.2%	73.6%	77.0%	76.2%	75.5%	74.8%	74.2%	73.6%
2023	2028	1965	76.0%	75.3%	74.7%	74.1%	73.5%	73.1%	76.0%	75.3%	74.7%	74.1%	73.5%	73.1%
2024	2029	1966	74.9%	74.4%	73.8%	73.3%	72.9%	72.5%	74.9%	74.4%	73.8%	73.3%	72.9%	72.5%
2025	2030	1967	73.9%	73.4%	73.0%	72.6%	72.2%	71.9%	73.9%	73.4%	73.0%	72.6%	72.2%	71.9%
2026	2031	1968	72.6%	72.2%	71.9%	71.6%	71.4%	71.1%	72.6%	72.2%	71.9%	71.6%	71.4%	71.1%
2027	2032	1969	71.3%	71.1%	70.8%	70.7%	70.5%	70.3%	71.3%	71.1%	70.8%	70.7%	70.5%	70.3%
2028	2033	1970	70.0%	69.8%	69.7%	69.6%	69.5%	69.5%	70.0%	69.8%	69.7%	69.6%	69.5%	69.5%
2029	2034	1971	69.2%	69.1%	69.1%	69.1%	69.1%	69.1%	69.2%	69.1%	69.1%	69.1%	69.1%	69.1%
2030	2035	1972	68.3%	68.4%	68.4%	68.5%	68.5%	68.6%	68.3%	68.4%	68.4%	68.5%	68.5%	68.6%
2031	2036	1973	66.3%	66.5%	66.6%	66.8%	67.0%	67.2%	66.3%	66.5%	66.6%	66.8%	67.0%	67.2%
2032	2037	1974	66.3%	66.5%	66.6%	66.8%	66.9%	67.1%	66.3%	66.5%	66.6%	66.8%	66.9%	67.1%
2033	2038	1975	66.3%	66.4%	66.6%	66.8%	66.9%	67.1%	66.3%	66.4%	66.6%	66.8%	66.9%	67.1%
2034	2039	1976	66.3%	66.4%	66.6%	66.7%	66.9%	67.1%	66.3%	66.4%	66.6%	66.7%	66.9%	67.1%
2035	2040	1977	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2036	2041	1978	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2037	2042	1979	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2038	2043	1980	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2039	2044	1981	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2040	2045	1982	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2041	2046	1983	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2042	2047	1984	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2043	2048	1985	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2044	2049	1986	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2045	2050	1987	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%
2046	2051	1988	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%	66.2%	66.4%	66.6%	66.7%	66.9%	67.1%

Table 6

retirement year from	to	cohort	IRR present legislation (r=3% - g=2.5%) seniority at retirement 35	36	37	38	39	40	IRR pro rata extension (r=3% - g=2.5%) seniority at retirement 35	36	37	38	39	40
2000	2005	1942	3.6%	3.4%	3.2%	3.1%	3.0%	2.9%	3.6%	3.4%	3.2%	3.1%	2.9%	2.8%
2001	2006	1943	3.4%	3.3%	3.2%	3.1%	2.9%	2.8%	3.4%	3.3%	3.1%	3.0%	2.9%	2.8%
2002	2007	1944	3.4%	3.2%	3.1%	3.0%	2.9%	2.8%	3.3%	3.2%	3.1%	3.0%	2.9%	2.8%
2003	2008	1945	3.3%	3.2%	3.1%	3.0%	2.9%	2.7%	3.3%	3.1%	3.0%	2.9%	2.8%	2.7%
2004	2009	1946	3.3%	3.2%	3.0%	2.9%	2.8%	2.7%	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%
2005	2010	1947	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.1%	3.0%	2.9%	2.8%	2.7%	2.7%
2006	2011	1948	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%
2007	2012	1949	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%
2008	2013	1950	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.0%	2.9%	2.8%	2.8%	2.7%	2.6%
2009	2014	1951	3.2%	3.1%	3.0%	2.9%	2.7%	2.6%	3.0%	2.9%	2.8%	2.7%	2.7%	2.6%
2010	2015	1952	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%	3.0%	2.9%	2.8%	2.7%	2.6%	2.6%
2011	2016	1953	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%	2.9%	2.9%	2.8%	2.7%	2.6%	2.6%
2012	2017	1954	3.2%	3.1%	3.0%	2.9%	2.7%	2.6%	2.9%	2.8%	2.8%	2.7%	2.6%	2.6%
2013	2018	1955	3.2%	3.1%	3.0%	2.9%	2.8%	2.6%	2.9%	2.8%	2.8%	2.7%	2.6%	2.6%
2014	2019	1956	2.9%	2.8%	2.7%	2.7%	2.6%	2.6%	2.9%	2.8%	2.7%	2.7%	2.6%	2.6%
2015	2020	1957	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%
2016	2021	1958	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%
2017	2022	1959	2.8%	2.7%	2.7%	2.6%	2.6%	2.6%	2.8%	2.7%	2.7%	2.6%	2.6%	2.6%
2018	2023	1960	2.7%	2.7%	2.7%	2.6%	2.6%	2.5%	2.7%	2.7%	2.7%	2.6%	2.6%	2.5%
2019	2024	1961	2.7%	2.7%	2.6%	2.6%	2.6%	2.5%	2.7%	2.7%	2.6%	2.6%	2.6%	2.5%
2020	2025	1962	2.7%	2.6%	2.6%	2.6%	2.5%	2.5%	2.7%	2.6%	2.6%	2.6%	2.5%	2.5%
2021	2026	1963	2.6%	2.6%	2.6%	2.5%	2.5%	2.5%	2.6%	2.6%	2.6%	2.5%	2.5%	2.5%
2022	2027	1964	2.6%	2.5%	2.5%	2.5%	2.5%	2.5%	2.6%	2.5%	2.5%	2.5%	2.5%	2.5%
2023	2028	1965	2.5%	2.5%	2.5%	2.5%	2.4%	2.4%	2.5%	2.5%	2.5%	2.5%	2.4%	2.4%
2024	2029	1966	2.5%	2.5%	2.4%	2.4%	2.4%	2.4%	2.5%	2.5%	2.4%	2.4%	2.4%	2.4%
2025	2030	1967	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%
2026	2031	1968	2.4%	2.4%	2.3%	2.3%	2.3%	2.3%	2.4%	2.4%	2.3%	2.3%	2.3%	2.3%
2027	2032	1969	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
2028	2033	1970	2.2%	2.2%	2.2%	2.2%	2.2%	2.3%	2.2%	2.2%	2.2%	2.2%	2.2%	2.3%
2029	2034	1971	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%
2030	2035	1972	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%
2031	2036	1973	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2032	2037	1974	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2033	2038	1975	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2034	2039	1976	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2035	2040	1977	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2036	2041	1978	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2037	2042	1979	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2038	2043	1980	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2039	2044	1981	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2040	2045	1982	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2041	2046	1983	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2042	2047	1984	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2043	2048	1985	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2044	2049	1986	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2045	2050	1987	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2046	2051	1988	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%

Table 7

retirement year from	retirement year to	cohort	IRR present legislation (r=3.5% - g=2.5%) seniority at retirement 35	36	37	38	39	40	IRR pro rata extension (r=3.5% - g=2.5%) seniority at retirement 35	36	37	38	39	40
2000	2005	1942	3.6%	3.4%	3.2%	3.1%	3.0%	2.9%	3.6%	3.4%	3.2%	3.1%	2.9%	2.8%
2001	2006	1943	3.4%	3.3%	3.2%	3.1%	2.9%	2.8%	3.4%	3.3%	3.1%	3.0%	2.9%	2.8%
2002	2007	1944	3.4%	3.2%	3.1%	3.0%	2.9%	2.8%	3.3%	3.2%	3.1%	3.0%	2.9%	2.8%
2003	2008	1945	3.3%	3.2%	3.1%	3.0%	2.9%	2.7%	3.3%	3.1%	3.0%	2.9%	2.8%	2.7%
2004	2009	1946	3.3%	3.2%	3.0%	2.9%	2.8%	2.7%	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%
2005	2010	1947	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.1%	3.0%	2.9%	2.8%	2.7%	2.7%
2006	2011	1948	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%
2007	2012	1949	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%
2008	2013	1950	3.2%	3.1%	3.0%	2.9%	2.8%	2.7%	3.0%	2.9%	2.8%	2.8%	2.7%	2.6%
2009	2014	1951	3.2%	3.1%	3.0%	2.9%	2.7%	2.6%	3.0%	2.9%	2.8%	2.7%	2.7%	2.6%
2010	2015	1952	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%	3.0%	2.9%	2.8%	2.7%	2.6%	2.6%
2011	2016	1953	3.1%	3.0%	2.9%	2.8%	2.7%	2.6%	2.9%	2.9%	2.8%	2.7%	2.6%	2.6%
2012	2017	1954	3.2%	3.1%	3.0%	2.9%	2.7%	2.6%	2.9%	2.8%	2.8%	2.7%	2.6%	2.6%
2013	2018	1955	3.2%	3.1%	3.0%	2.9%	2.8%	2.6%	2.9%	2.8%	2.8%	2.7%	2.6%	2.6%
2014	2019	1956	2.9%	2.8%	2.7%	2.7%	2.6%	2.6%	2.9%	2.8%	2.7%	2.7%	2.6%	2.6%
2015	2020	1957	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%
2016	2021	1958	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%
2017	2022	1959	2.8%	2.7%	2.7%	2.6%	2.6%	2.6%	2.8%	2.7%	2.7%	2.6%	2.6%	2.6%
2018	2023	1960	2.7%	2.7%	2.7%	2.6%	2.6%	2.5%	2.7%	2.7%	2.7%	2.6%	2.6%	2.5%
2019	2024	1961	2.7%	2.7%	2.6%	2.6%	2.6%	2.5%	2.7%	2.7%	2.6%	2.6%	2.6%	2.5%
2020	2025	1962	2.7%	2.6%	2.6%	2.6%	2.5%	2.5%	2.7%	2.6%	2.6%	2.6%	2.5%	2.5%
2021	2026	1963	2.6%	2.6%	2.6%	2.5%	2.5%	2.5%	2.6%	2.6%	2.6%	2.5%	2.5%	2.5%
2022	2027	1964	2.6%	2.5%	2.5%	2.5%	2.5%	2.5%	2.6%	2.5%	2.5%	2.5%	2.5%	2.5%
2023	2028	1965	2.5%	2.5%	2.5%	2.5%	2.4%	2.4%	2.5%	2.5%	2.5%	2.5%	2.4%	2.4%
2024	2029	1966	2.5%	2.5%	2.4%	2.4%	2.4%	2.4%	2.5%	2.5%	2.4%	2.4%	2.4%	2.4%
2025	2030	1967	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%
2026	2031	1968	2.4%	2.4%	2.3%	2.3%	2.3%	2.3%	2.4%	2.4%	2.3%	2.3%	2.3%	2.3%
2027	2032	1969	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
2028	2033	1970	2.2%	2.2%	2.2%	2.2%	2.2%	2.3%	2.2%	2.2%	2.2%	2.2%	2.2%	2.3%
2029	2034	1971	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%
2030	2035	1972	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%
2031	2036	1973	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2032	2037	1974	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2033	2038	1975	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2034	2039	1976	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2035	2040	1977	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2036	2041	1978	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2037	2042	1979	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2038	2043	1980	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2039	2044	1981	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2040	2045	1982	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2041	2046	1983	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2042	2047	1984	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2043	2048	1985	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2044	2049	1986	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2045	2050	1987	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%
2046	2051	1988	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%	2.1%	2.1%	2.1%	2.1%	2.1%

Table 8 – extension of the *pro rata* mechanism - % savings on GDP (g=1.5%)

year	flows (% on GDP) death at 75	death at 78	death at 80	death at 83
2000	0	0	0	0
2001	0.002	0.002	0.002	0.002
2002	0.004	0.004	0.004	0.004
2003	0.007	0.007	0.007	0.007
2004	0.012	0.012	0.012	0.012
2005	0.019	0.019	0.019	0.019
2006	0.028	0.028	0.028	0.028
2007	0.035	0.035	0.035	0.035
2008	0.045	0.045	0.045	0.045
2009	0.055	0.055	0.055	0.055
2010	0.064	0.064	0.064	0.064
2011	0.081	0.081	0.081	0.081
2012	0.089	0.089	0.089	0.089
2013	0.103	0.103	0.103	0.103
2014	0.117	0.117	0.117	0.117
2015	0.123	0.123	0.123	0.123
2016	0.136	0.136	0.136	0.136
2017	0.142	0.143	0.143	0.143
2018	0.146	0.148	0.148	0.148
2019	0.142	0.146	0.146	0.146
2020	0.138	0.143	0.144	0.144
2021	0.132	0.140	0.141	0.142
2022	0.124	0.136	0.139	0.139
2023	0.116	0.132	0.136	0.137
2024	0.107	0.126	0.132	0.135
2025	0.096	0.119	0.128	0.133
2026	0.087	0.111	0.122	0.130
2027	0.079	0.102	0.115	0.126
2028	0.070	0.092	0.108	0.123
2029	0.060	0.083	0.099	0.117
2030	0.051	0.076	0.089	0.110
2031	0.038	0.067	0.081	0.103
2032	0.030	0.057	0.074	0.095
2033	0.024	0.049	0.065	0.085
2034	0.017	0.037	0.055	0.077
2035	0.013	0.028	0.047	0.070
2036	0.006	0.023	0.036	0.062
2037	0.003	0.016	0.028	0.053
2038	0.001	0.012	0.022	0.045
2039	0.000	0.006	0.016	0.034
2040	0.000	0.003	0.012	0.026
2041	0.000	0.001	0.006	0.021
2042	0.000	0.000	0.003	0.015
2043	0.000	0.000	0.001	0.011
2044	0.000	0.000	0.000	0.006
2045	0.000	0.000	0.000	0.002
2046	0.000	0.000	0.000	0.001
2047	0.000	0.000	0.000	0.000

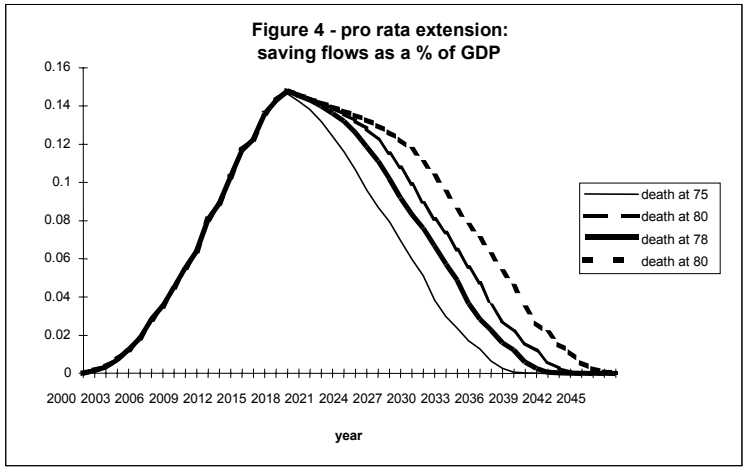


Table 9 – the contribution based method and the reduction of actuarial unfairness

a) present legislation

Age at retirement	Year of entry into job 1972 (retirement at 35 years' seniority)			Year of entry into job 1982 (retirement at 35 years' seniority)		
	Pension	Pension wealth	Δ% w.r.t. retir. at 65	Pension	Pension wealth	Δ% w.r.t. retir. at 65
57	29,448	591,259	20.95%	29,620	594,722	7.33%
58	29,448	576,037	18.86%	30,120	589,189	6.46%
59	29,448	560,717	16.64%	30,656	583,735	5.59%
60	29,448	545,307	14.28%	31,226	578,242	4.69%
61	29,448	529,826	11.78%	31,833	572,736	3.77%
62	29,448	514,273	9.11%	32,483	567,283	2.85%
63	29,448	498,687	6.27%	33,178	561,854	1.91%
64	29,448	483,053	3.24%	33,924	556,478	0.96%
65	29,448	467,417	0.00%	34,721	551,124	0.00%

b) pro rata extension

Age at retirement	Year of entry into the job 1972 (retirement at 35 years' seniority)		
	pensione	ricchezza pension.	Δ% rispetto a 65enni
57	27,985	561,890	16.52%
58	28,138	550,429	14.78%
59	28,303	538,929	12.96%
60	28,478	527,361	11.05%
61	28,665	515,743	9.05%
62	28,865	504,094	6.95%
63	29,078	492,432	4.74%
64	29,307	480,755	2.43%
65	29,553	469,084	0.00%

Notes: values of pension wealth are calculated at the moment of retirement in thousands of lire at 1998 prices; the pension is in thousands of lire at 1998 prices; the discount rate is 2%; the growth rate of real wages is 1.5% for years subsequent to 1997, the historical rate for previous years; life tables 1994.

Table 10 - Extension of the *pro rata* mechanism and actuarially fair correction of seniority pensions

Savings in % of GDP (g=1.5%)

year	Actuarially fair correction Flows (% of GDP)		Actuarially fair correction + pro rata extension Flows (% of GDP)	
	death at 75	death at 80	death at 75	death at 80
2000	0.0000	0.0000	0.0000	0.0000
2001	0.0529	0.0529	0.0530	0.0530
2002	0.0879	0.0879	0.0881	0.0881
2003	0.1330	0.1330	0.1331	0.1331
2004	0.1825	0.1825	0.1825	0.1825
2005	0.2296	0.2296	0.2292	0.2292
2006	0.2927	0.2927	0.2917	0.2917
2007	0.3296	0.3296	0.3282	0.3282
2008	0.3778	0.3778	0.3757	0.3757
2009	0.4193	0.4193	0.4166	0.4166
2010	0.4517	0.4517	0.4483	0.4483
2011	0.5083	0.5085	0.5038	0.5040
2012	0.5312	0.5319	0.5263	0.5269
2013	0.5691	0.5704	0.5634	0.5647
2014	0.6066	0.6092	0.6004	0.6029
2015	0.6226	0.6267	0.6162	0.6203
2016	0.6569	0.6660	0.6503	0.6593
2017	0.6712	0.6851	0.6647	0.6785
2018	0.6664	0.7017	0.6601	0.6952
2019	0.6472	0.7067	0.6410	0.7003
2020	0.6328	0.7137	0.6267	0.7074
2021	0.6030	0.7239	0.5972	0.7178
2022	0.5641	0.7242	0.5587	0.7182
2023	0.5334	0.7123	0.5285	0.7065
2024	0.4972	0.6930	0.4928	0.6873
2025	0.4561	0.6741	0.4524	0.6685
2026	0.4312	0.6366	0.4280	0.6313
2027	0.4077	0.5946	0.4049	0.5896
2028	0.3818	0.5593	0.3795	0.5548
2029	0.3533	0.5202	0.3516	0.5162
2030	0.3266	0.4751	0.3253	0.4716
2031	0.2866	0.4411	0.2859	0.4381
2032	0.2562	0.4121	0.2558	0.4095
2033	0.2317	0.3775	0.2315	0.3754
2034	0.2055	0.3426	0.2055	0.3409
2035	0.1839	0.3120	0.1840	0.3108
2036	0.1551	0.2709	0.1552	0.2702
2037	0.1343	0.2402	0.1344	0.2398
2038	0.1135	0.2161	0.1136	0.2160
2039	0.0958	0.1911	0.0958	0.1911
2040	0.0773	0.1707	0.0773	0.1708
2041	0.0637	0.1439	0.0637	0.1440
2042	0.0526	0.1247	0.0526	0.1248
2043	0.0429	0.1054	0.0429	0.1054
2044	0.0337	0.0889	0.0337	0.0889
2045	0.0251	0.0717	0.0251	0.0717
2046	0.0168	0.0592	0.0168	0.0592
2047	0.0115	0.0488	0.0115	0.0488
2048	0.0069	0.0398	0.0069	0.0398
2049	0.0042	0.0313	0.0042	0.0313
2050	0.0023	0.0233	0.0023	0.0233
2051	0.0013	0.0156	0.0013	0.0156
2052	0.0007	0.0107	0.0007	0.0107
2053	0.0003	0.0064	0.0003	0.0064
2054	0.0001	0.0039	0.0001	0.0039
2055	0.0000	0.0022	0.0000	0.0022
2056	0.0000	0.0012	0.0000	0.0012
2057	0.0000	0.0006	0.0000	0.0006
2058	0.0000	0.0002	0.0000	0.0002
2059	0.0000	0.0000	0.0000	0.0000
2060	0.0000	0.0000	0.0000	0.0000

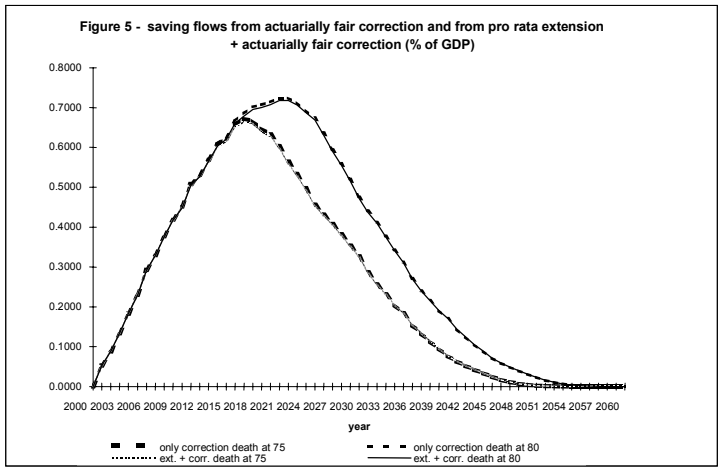


Figure 6 - implicit taxation when retirement is postponed from 35 to 40 years' seniority

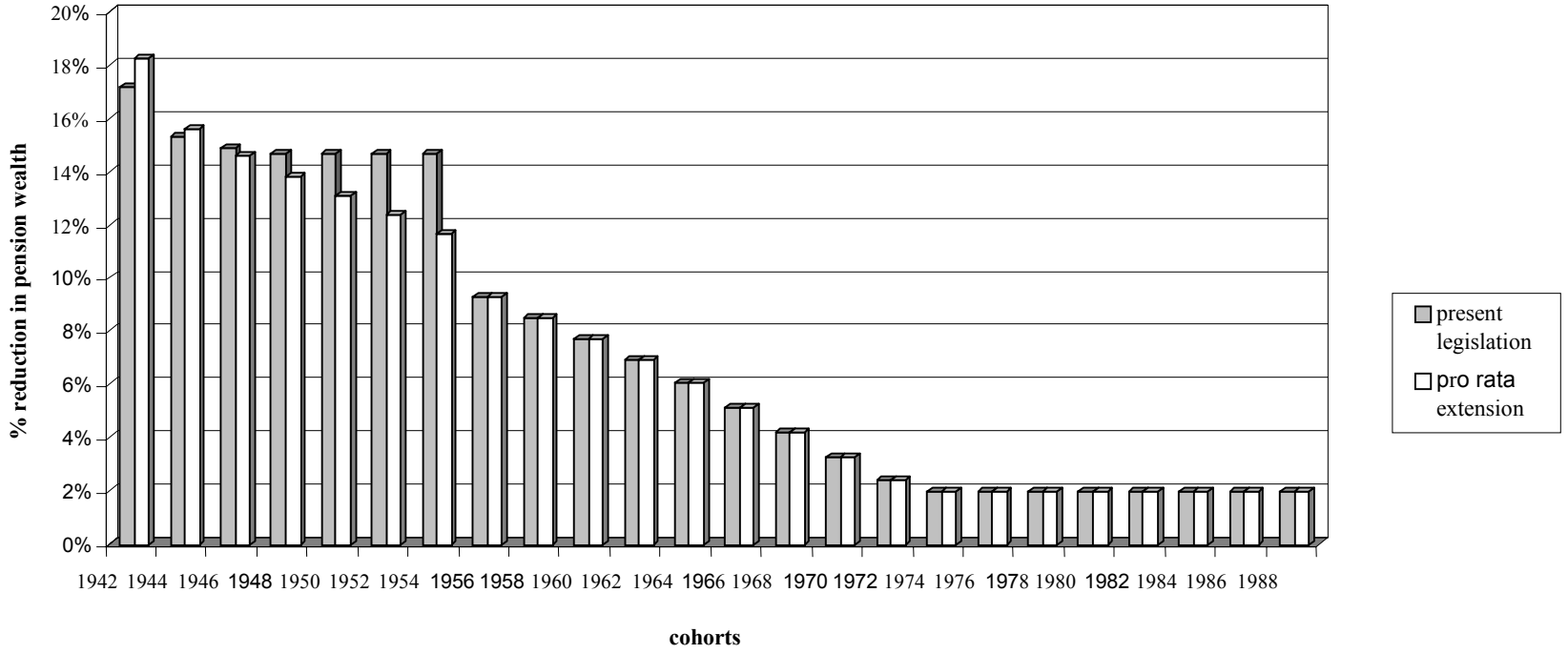
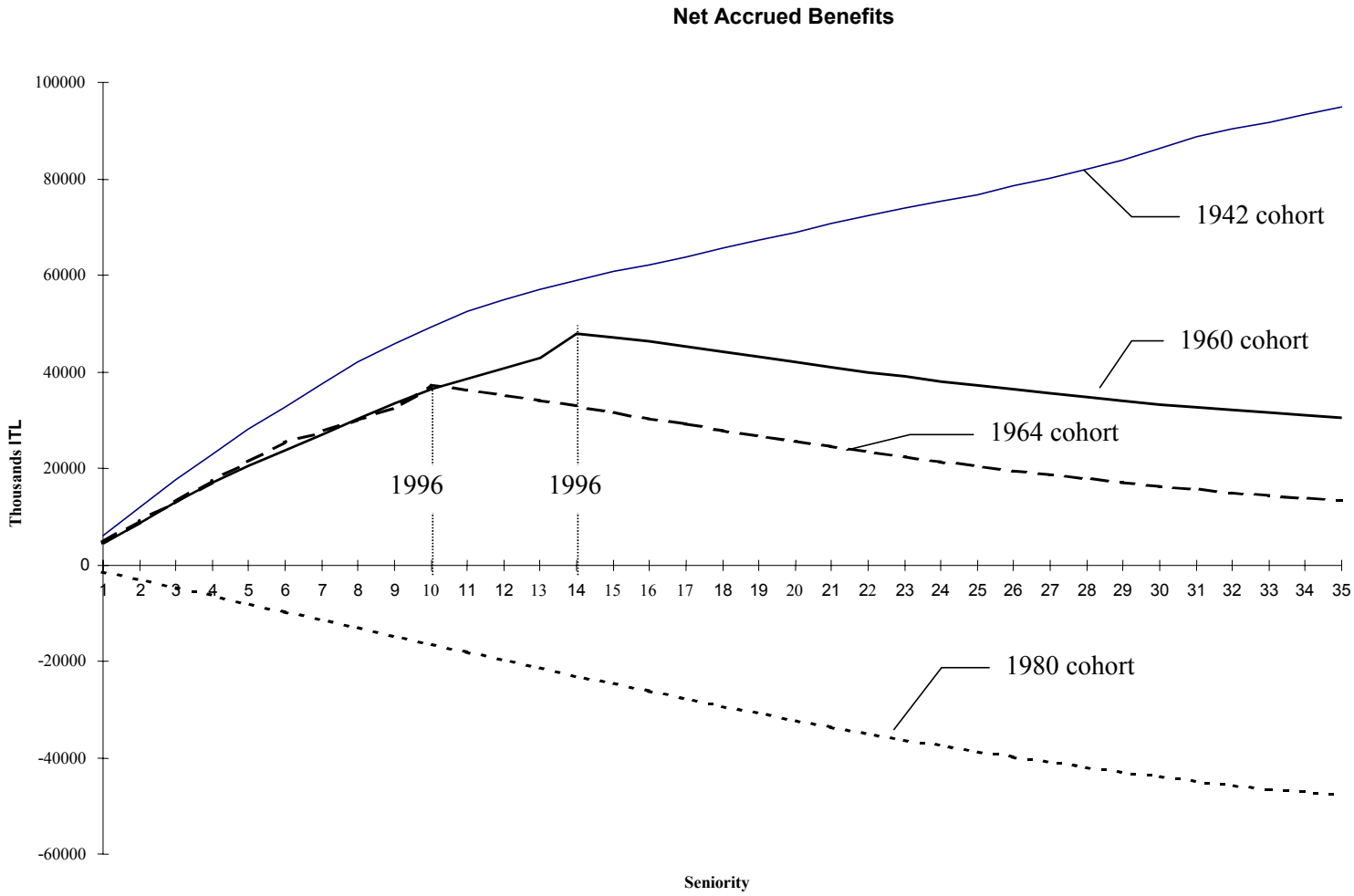


Figure 7



Hps: constant prices 1998; g=1,5%; r=2%; start of working life: 22; real wage growth: 1,5% after 1997, historical before; seniority-wage profiles: OLS estimates from 1996 cross section.

Table 11 - Excess deficit in percentage points of GDP caused by partial rebates of the payroll tax (private employees – new entrants)

	Payroll tax rebate			
Year	5 percentage points	10 percentage points	15 percentage points	20 percentage points
1	0,020	0,040	0,060	0,080
3	0,060	0,119	0,179	0,239
5	0,099	0,199	0,298	0,398
7	0,142	0,285	0,427	0,570
9	0,188	0,375	0,563	0,750
11	0,224	0,448	0,672	0,895
13	0,265	0,529	0,794	1,058
15	0,298	0,597	0,895	1,193
17	0,346	0,692	1,038	1,384
19	0,378	0,756	1,134	1,511
21	0,418	0,835	1,253	1,670
23	0,447	0,894	1,342	1,789
25	0,476	0,951	1,427	1,902
27	0,503	1,005	1,508	2,011
29	0,529	1,057	1,586	2,115
31	0,565	1,130	1,695	2,260
33	0,602	1,203	1,805	2,406
35	0,652	1,303	1,955	2,606
37	0,704	1,408	2,111	2,815
39	0,776	1,551	2,327	3,102
41	0,669	1,338	2,006	2,675
43	0,614	1,227	1,841	2,455
45	0,562	1,124	1,687	2,249
47	0,515	1,030	1,545	2,061
49	0,373	0,747	1,120	1,494
51	0,319	0,637	0,956	1,275
53	0,243	0,486	0,729	0,971
55	0,167	0,334	0,501	0,668
57	0,091	0,183	0,274	0,365
59	0,016	0,031	0,047	0,062
61	-0,022	-0,045	-0,067	-0,089
63	-0,022	-0,045	-0,067	-0,089
65	-0,022	-0,045	-0,067	-0,089
67	-0,022	-0,045	-0,067	-0,089
69	-0,022	-0,045	-0,067	-0,089

APPENDIX B:
the calculation model

1. Introduction

The model was developed using 'Mathematica®', in order to simulate pension flows of a representative individual identified on the basis of the age he started his job, of his seniority in 1995 and his age at retirement, assuming that his career is continuous; the software calculates also the present value of retirement benefits, taking into account survivors' pension. A specific module (limited to private employees) aggregates microeconomic values, and calculates by age the pension expenditure for individuals who reach retirement year by year.

2. The structure of the program

The program is based on four modules:

1) 'data', whose function is to contain and prepare (for example by adding inflation or by running regressions) the data for the simulations;

2) 'calculation': which defines the procedures for simulating pensions flows and for calculating present values;

3) 'aggregation': which defines the procedures for the aggregate estimates;

4) 'simulation': which provides results by activating the previous modules on the basis of specific requests.

2.1 The 'data' module

It contains data on GDP growth, inflation, actuarial transformation and revaluation coefficients envisaged by the legislation, male and female survival tables updated to 1994 and historical and present payroll tax rates. The parameters and the variables of the model are illustrated in table 1.

Table 1 - parameters and variables of the model

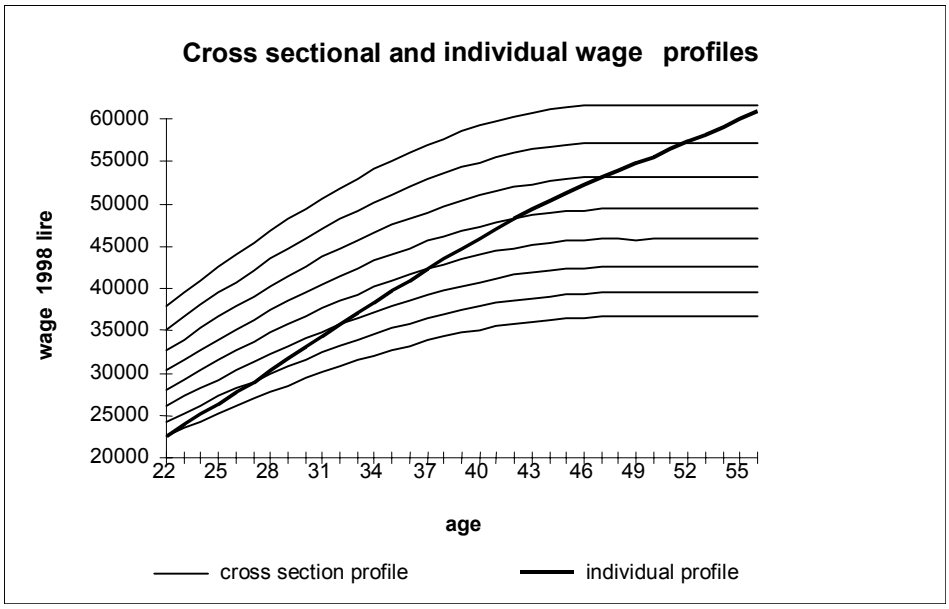
Symbol	Meaning
g_x	nominal GDP growth rate relative to year in which individual reaches seniority x
$\overline{g}_x$	geometric average of nominal GDP growth rate relative to the 5 years previous to the one in which the individual reaches seniority x
R	real interest rate used to calculate present values
w_x ; wn_x	wages, at 1998 and current prices respectively, of an individual with seniority x and relative to the year in which the individual reaches said seniority
$w*_x$; $w**_x$	wages, at current prices, of an individual with seniority x and relative to the year in which the individual reaches said seniority, corrected with legal revaluation coefficients for pension quotas relative to the pre-Amato legislation and post-Amato/pre-Dini legislation respectively
s; a; o	respectively: age of entry into job, seniority in 1995, seniority at retirement
c_x; $c*_x$	social security contributions, respectively at current prices and at 1998 prices, paid in the year in which the individual reaches seniority x
δ_e	Dini transformation coefficient (Law n. 335 of Aug. 8 1995), relative to age "*e*"
η_e	actuarial coefficient relative to age "e" for the calculation of present value of pension benefits, taking into account survivors' pension

The individual wage profile is derived from an interpolation of average wages (workers and clerks) by age on a 1996 INPS cross-section; values (at 1998 prices) are then updated year by year for the average variation (historical for the past or hypothesised for the future) of the real wage. As figure 1 shows, the individuals' wage thus varies both on account of the variation in productivity (shift of the cross-section), and of longer seniority (movement along the cross-sectional curve).

The cross-section data show a decreasing trend in wages after the age of 50. This trend is not typical of individual data, but is an aggregation effect: at advanced ages a higher fraction of

low-wage individuals stays in the job world. This effect was neutralised by replacing the interpolator with a relatively weak upward linear trend[31] in the age group concerned.

Figure 1 - construction of the individual wage profile



Note: the "individual" wage profile refers to the 1973 cohort; cross-section profiles start from 1995 (the lowest) and are separated by 5-year intervals.

2.2 The 'calculation' module

The module determines, according to existing legislation, the pension of individuals who had fewer than 18 years' seniority in 1995, that of individuals who had reached or exceeded said seniority in 1995, the pension deriving from the extension to these latter of the *pro rata* mechanism, the present value of contributions and pension services (taking survivors' into account) of a parametrically-defined individual and the PAYG internal rate of return for the same individual.

a) The pension of individuals who had at least 18 years' seniority at December 31 1995 is determined according to the following formula:

$$P_{a\geq 18} = (a-3)\cdot 0{,}02\frac{\sum_{i=0}^{4} w^{*}_{o-i}}{5} + (o-a+3)\cdot 0{,}02\frac{\sum_{i=0}^{\beta(a,o)-1} w^{**}_{o-i}}{\beta(a,o)}$$

[31] More precisely, the slope of the straight line is equivalent to that of the final growing section of the wage curve by age.

with :

$$\beta(a,o) = \min\left\{10; Int[6{,}5 + \frac{2}{3}(o-a)]\right\}$$

where : Int(x) is the largest integer $\leq$ x

b) The pension of those who had less than 18 years' seniority is determined as follows:

$$P_{a<18} = \underbrace{0{,}02 \cdot \left[\frac{\beta_2(a)\sum_{i=0}^{\beta_3(a,o)-1} w^{**}_{o-i}}{\beta_3(a,o)} + \frac{[a-\beta_2(a)]\beta_4(a)\sum_{i=0}^{4} w^{*}_{o-i}}{5}\right]}_{\text{earning based} \qquad \text{nent}} +$$

$$+ \underbrace{\left[c_o + \sum_{i=1-\beta_4(a)+a\beta_4(a)}^{o-1} c_i \prod_{j=i+1}^{o}(1+\bar{g}_i)\right]\delta_{s+o}}_{\text{contribution based} \qquad \text{onent}}$$

Where:

$$\beta_2(a) = \begin{cases} 0 \Leftrightarrow a \leq 0 \\ a \Leftrightarrow 0 < a < 3 \\ 3 \Leftrightarrow a \geq 3 \end{cases}$$

$$\beta_3(a,o) = \min\{o; 8 + o - a\}$$

$$\beta_4(a) = \begin{cases} 0 \Leftrightarrow a \leq 0 \\ 1 \Leftrightarrow a > 0 \end{cases}$$

c) In the hypothesis of extension of the *pro rata* mechanism, for seniority matured from the year 2000, the formula for those who had more than 18 years' seniority at 31.12.1995 is modified as follows:

$$P_{prorata} = \underbrace{(a-3)\cdot 0{,}02\frac{\sum_{i=0}^{4} w^{*}_{o-i}}{5} + 7\cdot 0{,}02\frac{\sum_{i=0}^{\beta(a,o)-1} w^{**}_{o-i}}{\beta(a,o)} +}_{\text{retributive component}}$$

earning based

$$\underbrace{\left[c_o + \sum_{i=a+5}^{o-1} c_i \prod_{j=i+1}^{o}(1+\overline{g}_i)\right]\delta_{s+o}}_{\text{contributive component}}$$

contribution based

d) The present value of retirement benefits (pvb) is calculated according to the following formula:

$$p.v.b. = P\sum_{o+1}^{100-s}\eta_{s+i}(1+r)^{-i}$$

where P indicates the constant pension, calculated according to one of the criteria outlined above.

e) The internal rate of return is obviously obtained by solving for a discount factor x the equation which equalises the present value of benefits to those of contributions:

$$\sum_{i=1}^{o} c^{*}_{i}\, x^{-i} = P\sum_{j=o+1}^{100-s}\eta_{s+j}x^{-j}$$

assuming that the individual always reaches the retirement age.

2.3 The 'aggregation' module

The aggregation module is based on the following hypotheses on the composition of workers registered on the FPLD (the main fund, covering nearly all private employees) and on the resulting flow of pensioners:

a) the application to the workers registered in 1995 on the FPLD of the distribution of social security positions obtainable from the 1995 Bank of Italy survey on Italian Households' Income and Wealth;

b) retirement as soon as requirements have been reached, adopting the ones of the fully phased reform, that will be fully applied only from 2008, even for earlier years;

c) hypotheses of continuous careers, in relation both to the future and to the past.

The aim is to obtain the distribution by age of the pension expenditure for all those who retired, year by year, from 1995 onwards. The calculation breaks down into four phases:

a) Determination of the matrix containing the number of private employees registered on the FPLD by age and seniority;

b) from the above matrix, for every year subsequent to 1995 a new matrix is obtained, containing the flows of individuals who reach their pension, they too divided by age and seniority[32];

c) only one social security position may be associated at each cell of the matrices at point b, the corresponding pension is calculated and multiplied by the number of new pensioners, thus obtaining, for each year, another matrix;

d) the final result is a set of vectors (one for each year subsequent to 1995) achieved by summing, for each age, the pension flows contained in each matrix generated in c.

The vectors obtained at point d are valued according to different hypotheses[33], and flows are then cumulated over the years, adopting the simplification of death at a given age and without taking into account survivors' pensions.

2.4 The 'simulation' module

The 'simulation' module activates the procedures of previous modules on the basis of a specific request referable to any magnitude that the program is able to calculate. In order to make the calculation, the module requires a set of input parameters: a) age of entry into the job world, b) seniority at 31.12.1995, c) seniority at retirement d) discount rate for present values, e) hypothesis on the annual variations of the real wage and GDP for the years subsequent to 1997.

Parameters above may be supplied as point values, or else the result can be tabulated for a set of parameter values.

---

[32] As we have already pointed out, careers are assumed to be continuous, and no one dies before reaching pension requirements.

[33] And for a number of years sufficient to exhaust the flow of pensions paid to individuals who were registered on the FPLD in 1995.

3. Data sources

To conclude the description of the model, table 2 lists the sources used for the calculation.

Table 2 - Sources of data used for the calculation

Datum	Source
Growth rates of nominal GDP from 1952 to 1997	Processing of: Bank of Italy, Annual Report, appendix, various years.
Inflation	Consumer price index for families of workers and clerks, Istat, "Annuario statistico italiano", various years (in particular for the years 1951-1996: Istat, Annuario stat. italiano, 1997 table 22.14, value of the lira); for 1998: Istat, "Bollettino mensile di statistica", April 1999.
Growth rates of real wages from 1951 to 1997	Processing of: for the years 1950-1968: INPS, "Settant'anni dell'Istituto Nazionale della Previdenza Sociale e Cinquant'anni dell'assicurazione generale obbligatoria per l'invalidità e la vecchiaia", Rome, 1970 (p.415); for the years 1969-80: Ministry of the Treasury, "La spesa previdenziale e i suoi effetti sulla finanza pubblica", Rome, 1981 (pp.104-107); for the years 1981-95: INPS, "FPLD. Indicazioni di carattere statistico", Rome, 1996; for 1997, ISTAT, "Annuario statistico italiano 1998".
Coefficient of correction of nominal wages for the calculation of the two retributive pension quotas (pre-Amato and Amato)	Il Sole 24 ore, 2.2.1999
Payroll tax rates from 1951 to 1997	Processing by Castellino (1995) of: INPS, "Raccolta di studi per i settant'anni dell'INPS e i cinquant'anni dell'assicurazione obbligatoria" (1970) - "Notizie statistiche" (various years).
Life tables	Istat, "Annuario statistico italiano", 1994
Average wages by age – cross-section datum for 1996.	Processing of INPS data by Claudia Villosio (1999)

Our papers can be downloaded at:

http://cerp.unito.it

CeRP Working Paper Series:

N° 1/00	Guido Menzio	Opting Out of Social Security over the Life Cycle
N° 2/00	Pier Marco Ferraresi Elsa Fornero	Social Security Transition in Italy: Costs, Distorsions and (some) Possible Correction