Effects of Labour Market Changes on the Sustainability of the Italian Pension System*

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Introduction

According to recent demographic projections (UNFPA, 1998), Italy will have one of the most aged population in Europe at the mid of the next century. Factors accounting for this process are the projected increase in life expectancy at old ages, given very low fertility levels and the social and economic constraints to large increases in the immigration flows. Projected demographic changes in the population age structure are supposed to have relevant effects on the financial balance of the pension system (World Bank, 1994). In fact, as in most developed countries, in Italy the Social Security scheme is financed on a pay-as-you-go basis. Therefore the payroll taxes levied on today's workers are used to pay the benefits to pensioners living in the same period. If one assumes no changes in the labour force participation and in the factors that influence the demand of labour, the pension expenditure burden will have to be carried by a smaller amount of working people than today. Of course labour market indicators could vary in the future, particularly as far as female labour participation and young people unemployment are concerned. In Italy, in fact, both parameters are very far from the European Union country values.

Social Security expenditures are particularly high in Italy, where around 15% of GDP is devoted to pensions while the ratio of social protection benefit expenditures to GDP is only 23.5% that is lower than the average of European Union member countries (27.2%). The majority of social protection expenditures is therefore devoted to cover economic risks mainly associated to old age, while only a small amount of social benefits is provided to other categories of needing population (unemployed, poor, large households). Among the latter, the incidence of the young population is very high. So, many authors have been starting to complain about the possibility of an intergenerational conflict if the welfare state will not be reformed.

Both financial sustainability issues and intergenerational equity aspects have raised a great concern about the future of the Social Security system in Italy. In the last years several attempts have been made to cut social benefits and to reduce inequalities. In 1995 and 1997 benefit entitlement rules and calculation methods have been dramatically changed. Workers can choose when to retire between the ages of 57 and 65 and receive a pension liability which is dependent on lifetime contributions accrued through the GDP growth rate. The value of benefits is also dependent on the number of years an individual is expected to live after retirement according to the life tables. The new pension system will be applied to people who entered the labour market from January 1996, while a mixed method will be used for workers who had no more than 18 years of contribution seniority at the time of the Reform Act. The new system will be then fully operative only after 2030 when the baby boom generation reaches the retirement age. According to the new pension rules the Social Security system will reach a stable equilibrium in the second half of the next century. However, recent estimates show that the level of the equilibrium contribution rate will be such that for over 50 years state transfers are needed to cover the Pension Fund unbalances, with a peak around the year 2035.

Usually long term projection have not considered important changes in the labour market, such as increased female participation or reduced unemployment. The main reason is that the projection of such aggregates is highly difficult to manage if complex interdependencies among demographic and economic variables (first and second order effects) have to be considered.

In this paper we use a dynamic cell-based simulation model developed at ISTAT (MODSIM) to assess the impact of different assumptions about the labour market evolution on the Italian pension system. We explicitly take into account the

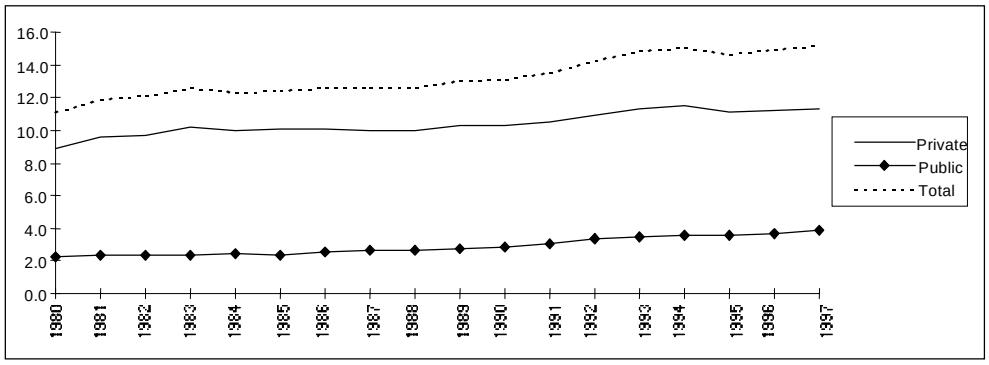
interdependence among demographic and economic variables and its consequences on the sustainability of the Social Security system.

In the next section we provide a brief and highly stylised description of the Italian Social Security system and we introduce some theoretical consideration about financial sustainability and the role of labour market (section 3). In section 4 the simulation model is presented and the results of different set of simulations are commented. Some final remark about long term sustainability of the Social Security system in Italy can be found in the last section.

The Italian pension system

Pension expenditures have been growing continuously from 11% to 15% of GDP in the last decades (figure 1). The rate of growth has been higher in the public sector (where it is concentrated around 25% of total expenditures) than in the private sector and it has slowed down, on average, only after 1993 due to the effects of different Social Security reform Acts in 1992, 1995 and 1997. Nevertheless, both the level of expenditures and its rate of growth are still very high and can cause many concerns for fiscal policy.

Figure 1- Evolution of pension expenditures to GDP by sector (% values)



Different typologies of pension benefits are provided by the State and by Social Security funds to workers who had to leave the labour force or to people with particular needs. *Old age, disability and survivor* (OADS) pensions are provided to public and private sector workers by around 800 Social Security funds. *Compensatory* pensions include work injury benefits (contributory scheme) and war injury allowances. *Welfare* pensions are paid to disabled or old people with low incomes. *Merit* allowances are provided to people who particularly distinguished in war actions.

Different rules concern OADS pensions of self-employed, dependent workers and special categories as journalists, private sector managers and professionals (table 1). In 1997 old age pension was provided to dependent workers who paid contributions for at least 18 years and who reached the age of 63 years for men and 58 years for women in the private sector and in local Government. Higher legal ages were applied for self-employed and State workers (65 years for men and 60 for women). The amount of pension liabilities (indexed to CPI on an yearly basis) results from the product of the number of years of contribution, the average retirement income and a 2% coefficient. Retirement income is an average of the last 10 years yearly wages indexed to CPI plus a coefficient of 1% per year applied only for private sector workers who had more than 15 years of contribution

in 1993. A shorter period length is allowed for public sector and a longer one for younger workers.

Since 1997 retirement was also sometimes allowed to people who did not reach legal age. This rule has been responsible for the rapid growth of seniority pension especially in the public sector. With the 1997 Reform, the access to this benefit has been made more difficult. Since 1998 people can therefore retire only if they contributed for at least 36 years (or 35 years with an age of 54 years) for private employees. Self-employed have to contribute for 40 years (or 36 years with an age of 57) while public sector workers can leave the labour force with 36 years of contribution (or 35 years with an age of 53 years) with a full pension but even before if they accept a proportional cut in benefits. In the first decade of the new century only workers who paid contributions for 40 years will be able to apply for the benefit.

Disability pensions are made available to people who lost more the 70% of their working capacity and paid contributions for at least 5 years. Survivor pensions are granted to the spouse and the children of a deceased pensioner or insured person who had become already eligible for a pension. The amount of the liability varies from 60% to 100% of the former pension.

Compensatory benefits are provided to workers who lost their capacity due to work injuries (most of them are in the private sector) and to people who did it due to war accidents. The amount of the pension is dependent on the degree of disability. Welfare benefits for the elderly and disabled persons with low income are flat rate means-tested pensions and merit pension are flat rate very low allowances.

In the future the pension system is going to change drastically due to the reforms approved by the Parliament in 1995 that will be full operative only after 2030. The Social Security system will undergo fundamental changes in the eligibility rules and in the calculation method for old age, disability and survivor pensions. The new rules will be fully applied to those who entered the labour market from 1996, but transitional mixed scheme will be provided also to workers who had less than 18 years of seniority at the end of 1995.

Under the new system seniority pensions for people with less than 40 years of lifetime contributions will be abolished and retirement age made flexible between the ages of 57 and 65. The minimum number of years of contribution to apply for an old age pension has been lowered to 5 years and the amount of the benefit will be based on an actuarially fair method related to the whole lifetime income. In fact, pension liabilities will depend on the amount of lifetime accrued contributions and on the life expectancy at retirement. Taking w as wage income, τ as the contribution rate and δ as a discount factor which is a function of mortality at retirement age β, pension liability p at time t , for an individual who enters the labour force at the age α, will be:

$$p_t = \delta(\beta,\rho)\, \Sigma_i\, w_i\, \tau_i\, (1+\rho)^i \qquad [1]$$

with $i=1,\ldots,N$, $\beta=t+\alpha+N$ and ρ equal to the yearly GDP growth rate. The discount rate is a positive function of the accrual rate and a negative function of life expectancy, which should take into account the disability risk and the occurrence rate for survivor benefits.

Table 1 - Basic features of the most important OADS pension schemes

Pension schemes	Mandatory retirement age M	Mandatory retirement age F	Minimum contribution period for old age pension	Number of years of pensionable wage	Replacement rate (%) (a)	Seniority pension number of contribution years
BEFORE 1992						
General schemes						
Private employees	60	55	15	5	80	35
Self-employed	65	60	15	10	80	35
Special schemes						
State employees	65	65	15	last month	94.4	20
Local government employees	60	55	20	last month	100	25
Private managers	65	60	15	5	80	35
1992 REFORM	65	60	20	whole working life	66	35
1995 REFORM	57 / 65	57 / 65	5	whole working life	45 / 74 (b)	40

(a) Estimated for a real GDP growth rate of 1.5% and a real wage growth rate of 2%.
(b) The first value is referred to the self-employed and the second to employees.

Source: Baldacci and Lugaresi (1995).

In 1997 the pension system provided 21,5 millions benefits to around 16 millions pensioners (table 2). The majority of pension liabilities have been paid for old age, disability and survivor pensions (17.7 millions) whose amount was around 14% of GDP (table 3). Most of OADS pensions are concentrated in the private sector (15.1 millions) but the average amount of benefits is more than double in the public sector than in the former. The ratio between average pension and per capita GDP is 40.5% for the total, 45.1% for OADS pensions but is 82.7% for public sector benefits and only 38.7% for private sector. This ratio is around 20% of per capita GDP for welfare and compensatory pensions, while it is only 2% for merit allowances.

Table 2 – Pension benefits in Italy *(pensions in thousands and amounts in billions of lira)*

	1995			1996			1997		
		EXPENDITURE			EXPENDITURE			EXPENDITURE	
SECTORS Pensions	N	total	mean	N	total	mean	N	total	mean
PRIVATE	**18,428**	**196,039**	**10,638**	**18,424**	**210,752**	**11,439**	**18,399**	**220,680**	**11,994**
OADS	14,945	173,017	11,577	14,998	186,863	12,459	15,098	197,652	13,091
Injury	1,311	7,466	5,696	1,287	8,047	6,253	1,276	7,891	6,184
Welfare	2,172	15,555	7,161	2,139	15,842	7,406	2,024	15,137	7,477
PUBLIC	**3,017**	**63,334**	**20,990**	**3,128**	**69,000**	**22,058**	**3,145**	**74,988**	**23,842**
OADS	2,387	60,578	25,378	2,560	66,500	25,974	2,584	72,410	28,022
Injury	574	2,728	4,752	517	2,477	4,787	513	2,552	4,976
Merit	56	29	517	51	23	456	48	26	531
TOTAL	**21,445**	**259,373**	**12,095**	**21,552**	**279,752**	**12,980**	**21,544**	**295,668**	**13,724**
OADS	17,332	233,595	13,478	17,558	253,363	14,430	17,682	270,062	15,273
Injury	1,885	10,194	5,409	1,804	10,524	5,833	1,789	10,443	5,838
Welfare	2,172	15,555	7,161	2,139	15,842	7,406	2,024	15,137	7,477
Merit	56	29	517	51	23	456	48	26	531

OADS: Old-age, disability and survivor benefits.
Source: ISTAT (1998b).

Table 3 – Indicators of the Italian pension system *(% values)*

	1995			1996			1997		
SECTORS PENSIONS	SR	RR	RI	SR	RR	RI	SR	RR	RI
PRIVATE	**11.06**	**32.14**	**34.41**	**11.25**	**32.06**	**35.10**	**11.31**	**31.95**	**35.41**
OADS	9.76	26.07	37.45	9.98	26.10	38.23	10.13	26.22	38.65
Injury	0.42	2.29	18.43	0.43	2.24	19.19	0.40	2.22	18.25
Welfare	0.88	3.79	23.17	0.85	3.72	22.72	0.78	3.52	22.07
PUBLIC	**3.57**	**5.26**	**67.90**	**3.68**	**5.44**	**67.68**	**3.84**	**5.46**	**70.38**
OADS	3.42	4.16	82.10	3.55	4.46	79.70	3.71	4.49	82.72
Injury	0.15	1.00	15.37	0.13	0.90	14.69	0.13	0.89	14.69
Merit	0.00	0.10	1.67	0.00	0.09	1.40	0.00	0.08	1.57
TOTAL	**14.64**	**37.40**	**39.13**	**14.94**	**37.51**	**39.83**	**15.16**	**37.41**	**40.51**
OADS	13.18	30.23	43.60	13.53	30.56	44.28	13.84	30.71	45.09
Injury	0.58	3.29	17.50	0.56	3.14	17.90	0.54	3.11	17.23
Welfare	0.88	3.79	23.17	0.85	3.72	22.72	0.78	3.52	22.07
Merit	0.00	0.10	1.67	0.00	0.09	1.40	0.00	0.08	1.57

OADS: Old-age, disability and survivor benefits.
SI=Sustainability index (Pension expenditures / GDP); RR= Retirement ratio (Pensions / Population);
RI= Replacement index (Average benefit / per capita GDP).
Source: ISTAT(1998b).

Pension system sustainability: the role of labour market

Population ageing is one of the major concerns for the future of Social Security systems because it can have effects, among other economic consequences, on pension benefits growth and on their related public expenditure. It is well known that in pay-as-you-go schemes the amount of contributions is used to finance pension expenditures of the retired population. The balance between costs and resources of the system can be achieved raising taxes using an average tax rate τ_G on total incomes (Y) or levying social security contributions on labour

income ($\tau \in w$). We define, in a given time, P as the number of pensioners, E the employed people, p the average pension and S,T,C and W respectively the amount of pension expenditures, total taxes collected for welfare pensions, Social Security contributions and wages. The equilibrium condition gives:

$$\begin{aligned} S &= T+C \\ &= \tau_G\ Y + \tau\ W \end{aligned} \qquad [2]$$

assuming for the sake of simplicity that the only taxable income is labour income and that all workers pay taxes, we have the following fiscal budget equilibrium condition:

$$p\ P = (\tau_G + \tau\ )\ w\ E \qquad [3]$$

assuming the tax rate is fixed, the equilibrium contribution rate is:

$$\tau = (DR\ RR) - \tau_G \qquad [4]$$

where DR=P/E is the dependency ratio and RR=p/w is the replacement rate. The equilibrium contribution rate will the higher the lower is the amount of resources the Government transfers to the pension system through general taxes.

The dependency ratio can be further decomposed into pure demographic and socio-economic factors, which affect the equilibrium contribution rate. We define *ODR* as the ratio of the aged population to the population in the active age range, *LR* the labour force participation rate, *UR* the unemployment rate and *ER* the pension eligibility rate, which is the ratio of pensions number to the aged population. The dependency ratio becomes:

$$DR = \frac{ODR\ ER}{LR\ (1\text{-}UR)} \qquad [5]$$

hence it is clear the linear relationship between the direct population ageing effect, measured by *ODR*, and the financial balance of the public pension system. In fact, the process of population ageing influences the equilibrium contribution rate also indirectly through the labour market and the factor remuneration (Barro and Sala-i-Martin, 1995; Masson and Tyron, 1990; Samuelson 1976). Labour market indicators play a major role in the sustainability of pension system schemes. In fact, assuming that in the long run the output factor shares are constant, being λ the ratio of labour income to GDP we can derive that the expenditure/GDP ratio σ=S/Y is proportional to the equilibrium contribution rate:

$$\sigma = \lambda\ (\tau+\tau_G) \qquad [6]$$

therefore:

$$\sigma=\lambda\ (DR\ RR) \qquad [7]$$

If actual contribution rate levied on the employed population is lower than the equilibrium contribution given by [4], the unfunded pension system runs a deficit, which should be financed by general taxation or public debt. In the last decades the pension expenditures of the Italian pension system have been growing faster than GDP and the equilibrium contribution rate has been significantly higher than the actual rate. The pension system deficit has contributed to enlarge the

amount of public debt and it represents a serious problem in next years when the ageing process will reach its peak.

Nevertheless, both the equilibrium contribution rate and the sustainability index σ can be influenced by an increase in labour participation and by a decrease in the unemployment rate which could shift the dependency ratio (given the eligibility ratio) and therefore warrant the financial balance of the pension system.

Also factor remuneration can be influenced by labour market changes according to the production technique of economy. Assuming a neo-classical production world, for instance, one can expect that the decline in the rate of growth of employment can bring, through diminishing marginal rates of return of factors to higher labour productivity and higher wage rates. Different results can emerge once technical progress or endogenous growth models are considered (Barro and Sala-I-Martin, 1995).

In the following section the empirical effects of alternative assumptions about the future evolution of demographic, macroeconomic and labour market variables are simulated using a dynamic model built at the Italian Statistical Office for the projection of social expenditures (MODSIM).

Long term simulation of pension expenditures

MODSIM: a long term simulation model

The simulation model *MODSIM* is a dynamic cell-based projection tool of the Italian social expenditures. The model allows the simulation of different independent modules which describe the demographic evolution, the educational system, the labour market, the pension and health care system and the economic growth. The projection method used in the model (Baldacci and Lugaresi, 1996a; 1996b; Baldacci and Tuzi, 1998) can be described in a simple matrix notation by:

$$\mathbf{K}_{t+h} = \mathbf{G}_{t,t+h}\,\mathbf{K}_t \qquad [8]$$

where the vector $\boldsymbol{K}_t$ represents the initial population which is classified by sex, age-group, educational level and position in the labour market. The matrix $\boldsymbol{G}_{t,t+h}$ contains the specific rates which cause the transitions between the different states of the population from time *t* to time *t+h*. Once the new population vector has been estimated, it is possible to derive the use of social services and the provision of social benefits applying the specific take-up rates matrix ($\mathbf{T}_{t+h}$) and calculate social expenditures ($\mathbf{S}_{t+h}$) using the average benefit matrix ($\mathbf{B}_{t+h}$) for each sector of the Welfare system:

$$\mathbf{S}_{t+h} = \mathbf{T}_{t+h}\,\mathbf{B}_{t+h}\,\mathbf{K}_{t+h} \qquad [9]$$

The following life course events are considered for each age-group in the population: birth, entry into the education system, primary, secondary and upper secondary educational attainment[1], entry in the labour market, unemployment, use of health services, retirement and death. The evolution of the transition matrix is dynamically simulated through a set of equations that describe the future evolution of school participation, labour force participation and unemployment.

After the simulation of demographic events, the model estimates the population by sex, age and educational level, the number of students and the

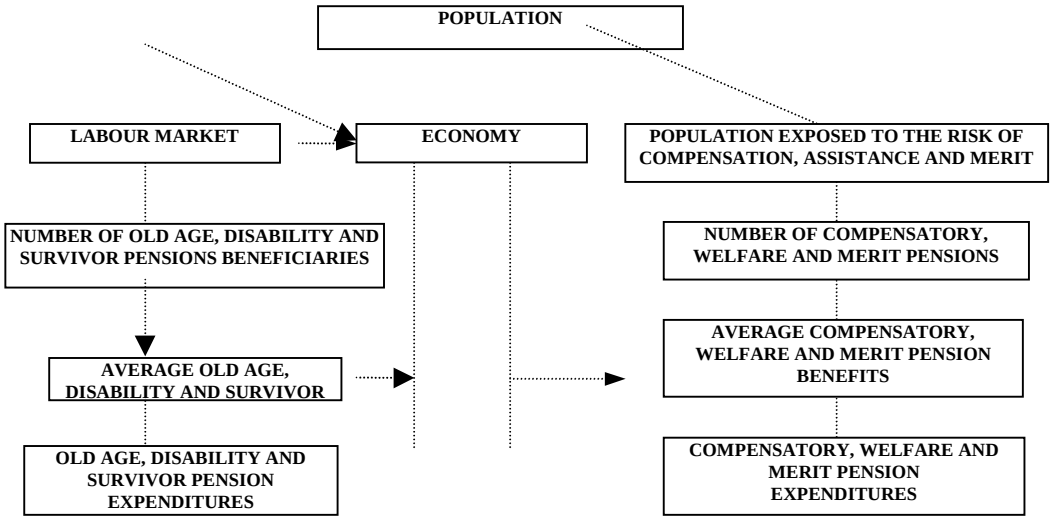
[1] See OECD (1995b) for further details about the indicators and the classification of education.

public expenditure for education. Then, labour market participation and unemployment are simulated and the results are the inputs for the health care and the pension system modules. In the latter we simulate the evolution of benefits and their amount, considering all the different Social Security funds and their different rules[2].

In the present research we use MODSIM to analyse the future evolution of pension expenditures in Italy. In the simulation for the period 1995-2050, we consider the changes in the take-up rules and in the benefit calculation method that will progressively be adopted in the next years due to several reforms introduced in the past and particularly to the 1995 Reform Act. The model can simulate all different pension typologies at a very detailed level of analysis in order to apply the actual rules for pension calculation and eligibility. Therefore OADS, compensatory, welfare and merit pensions and their expenditures are simulated according to different assumptions about macroeconomic trends, demographic scenarios and labour market evolution.

A representation of MODSIM mechanism of pension expenditures projection is shown in figure 2.

Figure 2 – The mechanism of pension expenditures projection in MODSIM



Given the estimation of resident population for each period of simulation, the projection model MODSIM estimates the number of employed people as the basis for the determination of the numeric consistency of individuals exposed to the risk of OADS coverage, thereby the number of OADS pensions. On the other hand, the resident population allows the determination of individual exposed to the risk of compensatory, welfare and merit coverage and, consequently, the number of their beneficiaries. From the number of pension liabilities the model projects pension expenditures, accruing their values by some estimated economic growth parameters.

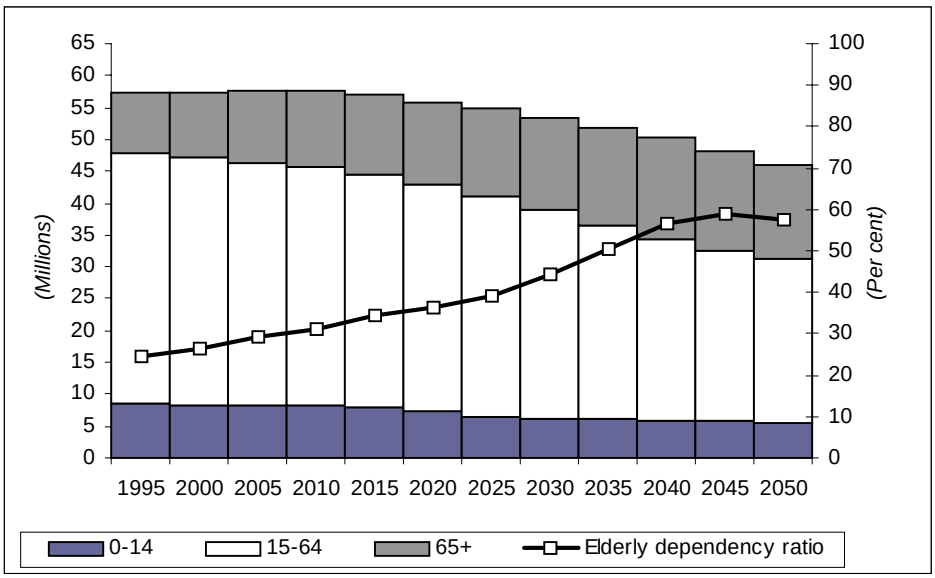
[2] In 1995 there were over 70 social security funds for public and private employees and for the self-employed workers.

Simulation results

According to demographic trends which characterise Italy since some decades, a process of decline of fertility is becoming evident. In the last years, along with the reduction in the number of births, the growth in life expectancy at old ages is contributing to the process of population ageing. Recent demographic projections (ISTAT, 1997) show that, if present level of mortality and fertility persist, the number of elderly people for each active person in the labour market will considerably grow before 2050. Moreover, from about 2030 the cohorts born during the demographic boom of the '60s will reach the retirement age, while the smaller cohorts of the following decades will constitute the active force and bear the costs of the equilibrium of a rapid growth of the Welfare State system.

Figure 3 traces some of the results of the recent demographic projections. The simulation is based on a *benchmark scenario*: stable cohort fertility, a slight reduction of mortality and a constant level of the net migration flow rates are therefore assumed[3]. The figure shows that the total population will face a deep fall in the next quinquennia, moving from 57.3 (1995) to 46 millions forecasted for 2050. The evolution described, as emerges in table 4, will be characterised by a slow rate of decrease occurring in the initial period of the projection, which increases considerably in the following years.

Figure 3 – Population projections and elderly dependency ratio (1995-2050)



The elderly dependency ratio is defined as the population aged more than 64 to the population aged between 15 and 64.

Source: ISTAT (1996).

[3] It has been assumed that life expectancy at birth, estimated in 75 years for men and 80 years for women, will reach 78.3 years for men and 84.7 years for women in 2030, while the average number of children will grow from 1.2 to 1.43 in the period 1995-2020; the volume of net migration will be equal to 50,000 units per year.

Along with an evident decline in the levels, figure 3 and table 4 show the significant changes occurring in the age structure of the Italian population: the demographic hypothesis assumed in the projections will result in a strong process of ageing. This process will face a great acceleration from the beginning of the next century, to keep on growing at least until 2040, when the elderly population reaches a level close to 16 millions of individuals. On the other hand, population aged less than 15 years, will dramatically decrease from 8.5 millions of individuals in 1995 to 5.4 millions in 2050, while the population in active age will vary from 39 millions of individuals in 1995 to 26 millions in 2050. The elderly dependency ratio will grow from about 25% in 1995 to around 33% in 2015 to reach a peak around 50% in 2035.

Table 4 – Demographic and socio-economic indicators (1995-2020) - *Rates of growth in percentage*

Years of Projection	**POPULATION**				**LABOUR FORCE**	**EMPLOYMENT**
	Total	**0-14**	**15-64**	**65+**		
1995	-	-	-	-	-	-
2000	0.16	-2.57	-0.86	7.05	1.46	2.13
2005	0.13	0.41	-1.88	8.16	0.18	1.03
2010	-0.28	-1.10	-1.58	5.26	-1.21	-0.65
2015	-1.14	-4.20	-2.67	6.29	-2.26	-2.05
2020	-1.75	-8.58	-2.09	3.95	-3.66	-3.62
2025	-2.14	-8.77	-3.08	4.45	-4.80	-4.91
2030	-2.54	-5.16	-5.49	6.50	-5.43	-5.51
2035	-2.89	-2.25	-7.04	6.34	-5.54	-5.50
2040	-3.37	-2.08	-7.16	3.68	-5.10	-5.02
2045	-3.97	-4.00	-5.39	-1.35	-4.45	-4.41
2050	-4.56	-6.01	-3.62	-5.52	-4.11	-4.13

The labour force participation and employment rates are assumed to be constant throughout the period
of projection at the values observed in 1995.

Source: MODSIM.

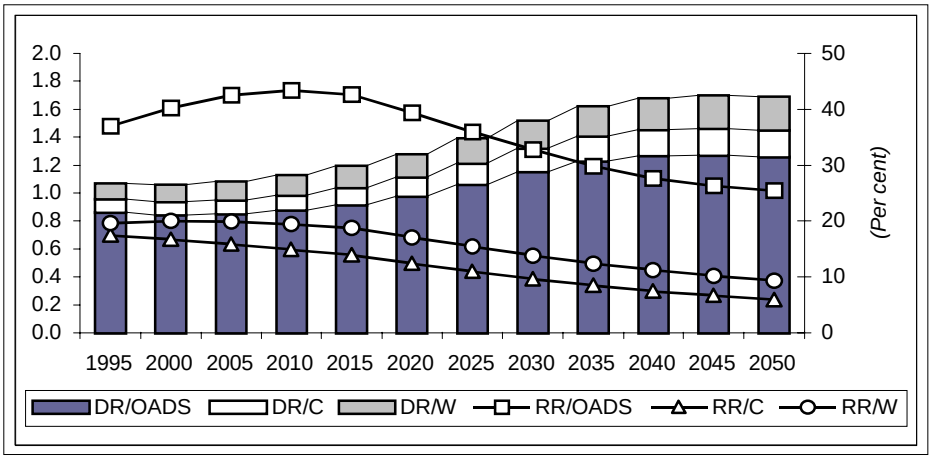
Assuming constant values for the future rates of labour force participation and unemployment (*benchmark scenario*), the declining tendency of Italian population will integrally be reflected by the fundamental variables on labour market. The reduction of fertility will probably cause a drop in the number of active individuals which, other things being equal, could cause a fall in the number of workers. The described trends clearly emerge observing table 4: after a slight growth, the labour force faces a slow decline up to 2015, when the decreasing tendency becomes more evident. The same shape can be found in the evolution of the number of workers, whose level will fall considerably in the next years.

The projection of the elderly dependency ratio traces a non favourable scenario for the Italian Social Security scheme which, as marked before, is financed on a pay-as-you-go basis. The fall of the labour force and the deferring of the fruition period of pension liabilities due to the extension of life expectancy at old ages will affect the growth of the pensioners/employed ratio. Figure 4 shows the evolution for the pensions dependency ratio of old age, disability and survivor benefits (DR/OADS), compensatory benefits (DR/C) and welfare benefits (DR/W)[4]. The figure shows that the dependency ratio, whose total value is already

[4] Merit allowances are also considered. However, for the sake of simplicity the are assimilated to the war injury allowances, included in the Compensatory pensions.

higher than 1 in 1995, will increase in the following years. This tendency seems to be not relevant between 1995 and 2010 because of the recent worsening of the eligibility rules for seniority pensions. However, in this period, the number of non-contributory pensions shows a growing trend due to the high growth rate of older people, who hold the greatest share of these benefits. The high flow of new contributory pensions caused by the entrance in the quiescence state of the *baby-boom* generation has a great effect on the ratio of the OADS pension liabilities, which get over the numeric consistency of employed people just in 2025. During the last projection quinquennia, a fall in the number of elderly people is attended, due to the decline of the fertility rate happening in the '70s. The dependency ratio tends in fact to settle: according to the estimations, in 2050 there will be 1.7 pension benefits each employed individual, 1.3 due to contributory entitlements.

Figure 4 – Pensioners dependency ratio and replacement rate (1995-2050)



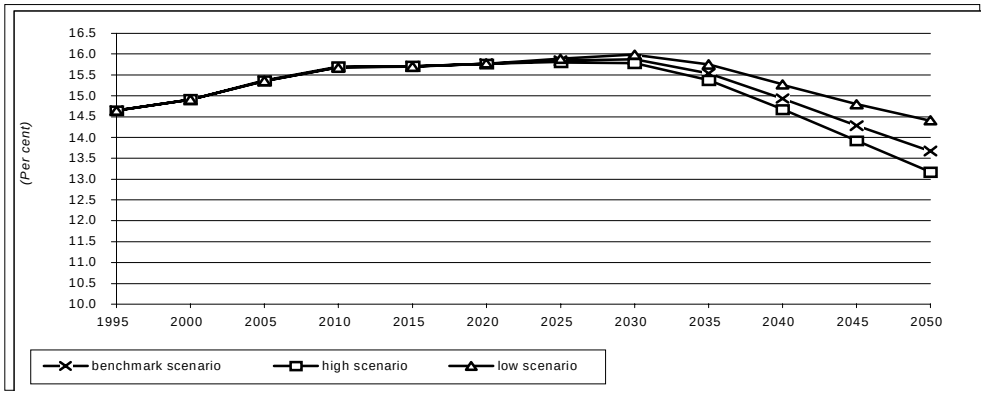
DR / OADS = dependency rate of old age, disability and survivor pensions;
DR / C = dependency rate of compensatory pensions;
DR / W = dependency rate of welfare pensions;
RR / OADS = replacement rate of old age, disability and survivor pensions;
RR / C = replacement rate of compensatory pensions;
RR / W = replacement rate of welfare pensions.

Source: MODSIM.

Given the behaviour of the dependency ratio the dynamic of pension expenditures depends on the evolution of the average amount of pension liabilities. Figure 4 shows that a relevant role has to be attributed to the trends of average OADS benefits. In the following years this variable will mostly be influenced by the recent reform measures (1995 Reform Act): during the first quinquennia OADS benefits are fully calculated on the basis of a *retributive system* and this substantially affects the growth of the replacement rate, which begins to fall just from 2015, when a *mixed method* will be applied. The *new system* will be then fully operative only after 2030 generating a clear drop of the replacement rate. Figure 5 represents the evolution of pension expenditures on GDP. The figure shows that the share of resources devoted to finance pension liabilities grows substantially only during the initial period of the simulation passing from 14.6% in 1995 to 15.7% in 2010, reducing between 2015 and 2025, reaching the peak of 15.9% in 2030 and stabilising just in the last quinquennia.

The analysis on the effects of demographic changes can be further enlarged to consider two alternative situations: an *high scenario* where more favourable conditions about fertility rates are assumed and a *low scenario* where it is supposed that the fertility rates remain at their present cross sectional values. In any case pension expenditures grow until 2030, when the strong demographic and economic effects generated by the evolution over time of the *baby boom* cohort become more and more evident.

Figure 5 - Pension expenditures in different demographic scenarios (1995-2050)
as a percentage of GDP

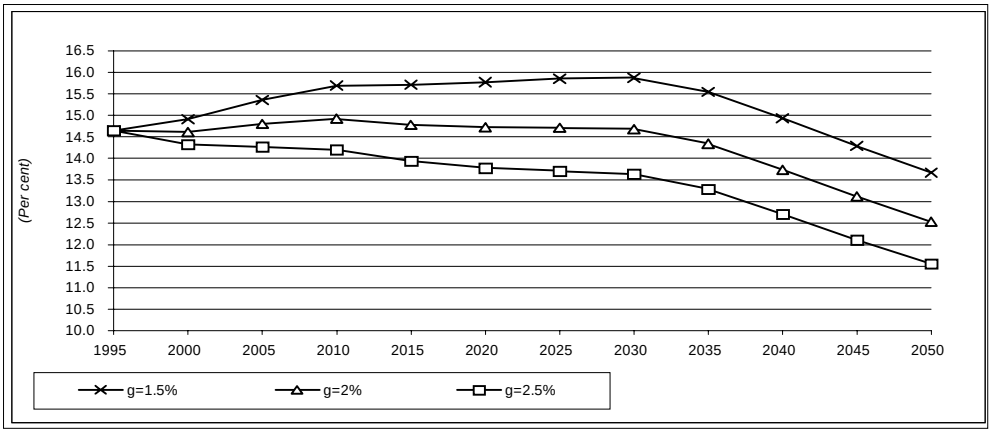


1. The GDP growth rate is assumed to be constant at the level of 1.5% per year.
2. Benchmark, high and low scenarios have been built alternating different hypothesis on the evolution of fertility, mortality and net migration rates.

Source: MODSIM.

The effects of different economic growth perspectives on the evolution of the pension expenditures / GDP ratio can be analysed observing figure 6. Assuming a more favourable hypothesis on GDP growth rate (g=2% per year) positive effects are produced: the indicator reaches the peak of 14.9% in 2010 and it decreases substantially in the following years. If an higher rate of GDP growth is supposed (g=2.5%) the stabilisation becomes more evident: pension expenditures evolve less rapidly than GDP and the ratio assumes its highest value in 1995.

Figure 6 – Pension expenditures in different economic growth scenarios (1995-2050)
as a percentage of GDP



The scenarios traced above have been built alternating 3 different hypothesis on the growth rate of GDP (g=1.5% g=2% g=2.5%) and assuming the benchmark demographic scenario.

Source: MODSIM.

Let now redefine the *benchmark scenario* of economic growth and assume that GDP grows constantly throughout the period of projection keeping the level of 1.5% per year.

We then assume a gradual improvement in labour market female participation rates. In figure 7, s*cenario 2* describes a first hypothesis, where the specific participation rates of women aged between 20 and 44 years are expected to grow towards the 1995 European average levels (EUROSTAT, 1997) into 2020. The assumed evolution causes an average growth of about 20% of the pre-existent rates. The specific rates of activity of women aged more than 44 are also adjusted in order to have into 2030 small increments decreasing by age. In figure 7a we show the evolution of pension expenditures (PE) to GDP: the figure shows that the hypotheses have immediate positive effects on the proportion of gross domestic product devoted to finance pension expenditures, as also confirmed in table 5, whose values estimate the differences of financial Social Security indicators[5] between scenarios. The PE/GDP index constantly remains under the values assumed in the *benchmark scenario*, even if table 5 shows that this divergence, which seems to be more accentuated in the central years of the projection, tends to attenuate progressively in the following years. The described effect has to be attributed to different trends characterising the factors of the indicator. If, in fact, the growth of employment causes the improvement of the dependency ratio (DR), on the other hand the increase of labour force availability causes a reduction of labour income growth rates that, given other conditions, induces a worsening of the replacement ratio (RR). Hence, this crowding-out effect is not complete: the direct impact coming from the improvement of labour force participation seems, in fact, to be higher than the indirect effect, as emerges from table 5. On the whole, the Social Security deficit (SSD) defined as the difference between pension expenditures and the total amount of contribution payments of workers[6] improves. However the relative change in the difference from benchmark decreases when the inflow of new employed people induced by an higher rate of participation begins to produce an outflow toward the Social Security System.

Scenario 2 has been therefore characterised by different hypothesis of convergence for younger and older age activity rates. This assumption reflects the knowledge of structural features of the Italian labour market, which seem to be not easily comparable to the conditions of many European economies: the reticence of Italian women to join the labour force, but also the easy way they can leave the labour market due to low retirement ages are just some of the aspects explaining the difficulties mentioned before. Hence, supposing a convergence of labour market participation rates for women aged more than 44 to the values of the European average into 2030, a worsening situation will emerge. This scenario *(scenario 2b)* where, for instance, the activity rates of women aged between 55 and 59 gradually double, causes a substantial deterioration of all indicators of the Social Security system whose values, as shown in figure 7 and table 5, will have a great worsening around 2030 when the proportion of older population dramatically increases.

Let keep again *scenario 2* and add on it an improvement on young people unemployment rates, assuming convergence toward the values of the most developed countries in Europe. Different adjustments are yet assumed for individuals aged between 15 and 29 years, whose rates of unemployment are assumed to converge into 2020, while the unemployment rates of individuals aged

[5] In table 5 we calculate the pension expenditures/GDP ratio and its elements according to formula [7]. However, in the table we do not show the evolution of λ, which we defined as the share of labour income to GDP. In fact, in the model these two variables are estimated through the same determinants, so their ratio keeps constant all over the projection span.

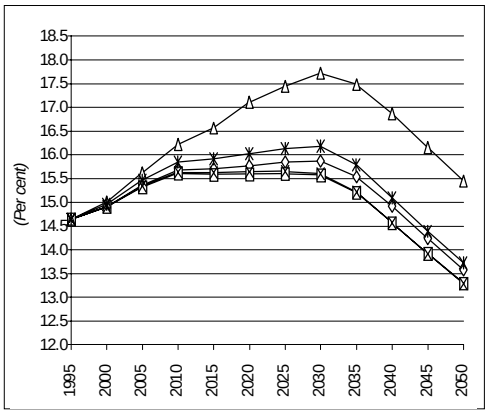
[6] Total contributions are calculated applying an average rate of 28.5% on the labour income.

between 30 and 39 years will converge ten years later. Male rates are supposed to converge towards the levels recorded in 1995 in the Netherlands (EUROSTAT, 1997), increasing on average of about 40%, while female rates tend to the 1995 European average (EUROSTAT, 1997), increasing of about 30% *(scenario 3)*. Figure 7 and table 5 show a positive effect on the financial sustainability of the Social Security system if compared to *benchmark scenario*. However, *scenario 3* does not seem to generate positive effects relative to *scenario 2*: the appreciable improvement of the dependency ratio, particularly during the years of greater tension, is completely reversed by the increase of the replacement ratio. This behaviour does not derive just by the decrease of the labour market income rate of growth, but has to be also attributed to the growth of the number of worked years and by its consequences on pension income.

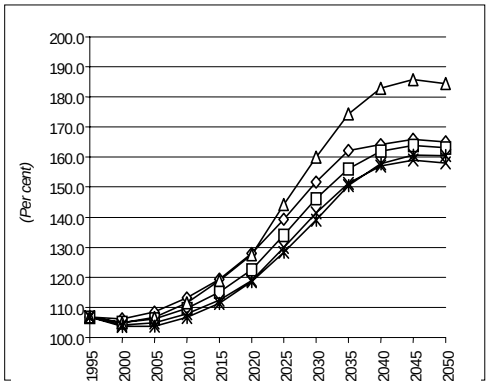
In the last scenario *(scenario 4)* we assume labour market activity rates adjusting to guarantee, given the other economic and demographic conditions, the achievement into 2030 of target male and female employment. The target values are supposed to be equal to the highest *stock* of employed people obtained in the simulation of the *benchmark scenario:* these conditions were verified in 2010 for male and in 2000 for female workers. Once again the results show positive effects on the indicators of pension expenditures financial sustainability. Although pension expenditures does not fall immediately because of the strong increases in the replacement rate provoked by an higher labour market participation, the ratio is generally lower than in the *benchmark scenario*. Nevertheless, *scenario 4* seems to be less favourable than *scenario 2* because of the deeper crowding-out effect caused by the reduction of labour income growth rates. This effect gradually attenuates as the employment growth rates begin to fall.

Figure 7 - Financial sustainability indicators of pension expenditures (1995-2050)

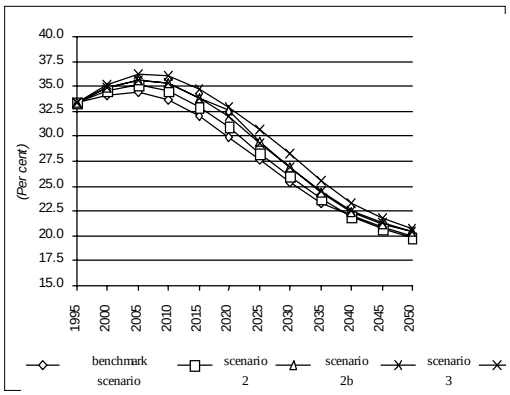
7.a. Pension expenditures
as a percentage of GDP



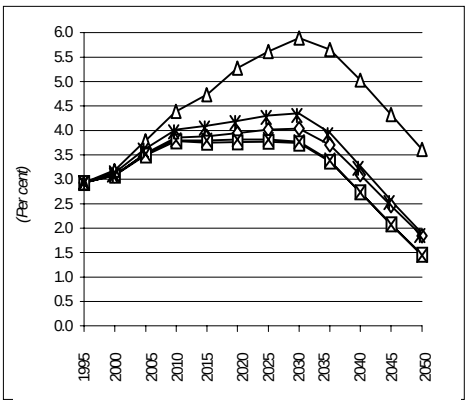
7.b. Pensioners dependency ratio
percentage values



7.c. Pension benefits replacement ratio
percentage values



7.d. Social Security Deficit
as a percentage of GDP



Benchmark scenario = Activity and unemployment rates are assumed to be constant throughout the period of projection at the values observed in 1995;
Scenario 2 = Younger ages female activity rates converge to the European levels into 2020, older ages rates gradually improve into 2030;
Scenario 2b = Younger ages female activity rates converge to the European levels into 2020, older ages rates into 2030;
Scenario 3 = Scenario 2 + Male and Female younger unemployment rates gradually improve into 2020;
Scenario 4 = Male and Female unemployment rates improve throughout the period of projections to guarantee the higher level of employment resulted in the benchmark scenario. *Source*: MODSIM.

Table 5 - Effects of different labour market evolution hypothesis on pension expenditures (1995-2050) *percentage variations*

g=1.5%	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
scenario2 versus benchmark scenario											
PE/GDP	-0.05	-0.22	-0.49	-0.80	-1.10	-1.53	-1.89	-2.19	-2.35	-2.24	-1.97
DR	-1.17	-2.19	-3.00	-3.59	-4.27	-3.78	-3.74	-3.68	-1.33	-1.21	-1.23
RR	1.13	2.01	2.59	2.90	3.30	2.34	1.93	1.54	-1.03	-1.04	-0.75
SSD/GDP	-0.23	-0.98	-1.99	-3.24	-4.42	-6.04	-7.41	-9.18	-11.68	-15.04	-20.28
scenario 2b versus benchmark scenario											
PE/GDP	0.65	1.72	3.39	5.43	8.48	10.10	11.66	12.50	13.03	13.48	13.88
DR	-1.27	-1.79	-1.41	-0.38	-0.38	3.47	5.38	7.55	11.41	11.97	11.75
RR	1.94	3.57	4.87	5.82	8.89	6.41	5.96	4.61	1.45	1.35	1.91
SSD/GDP	3.14	7.50	13.79	21.99	33.98	39.89	45.84	52.40	62.40	76.13	96.77
scenario 3 versus benchmark scenario											
PE/GDP	0.01	-0.11	-0.31	-0.55	-0.79	-1.23	-1.68	-2.08	-2.34	-2.30	-2.10
DR	-1.90	-3.45	-4.71	-5.83	-7.07	-6.75	-6.80	-6.69	-4.35	-4.20	-4.24
RR	1.95	3.46	4.62	5.61	6.77	5.91	5.50	4.94	2.10	1.99	2.24
SSD/GDP	0.03	-0.48	-1.27	-2.24	-3.15	-4.87	-6.58	-8.73	-11.62	-15.41	-21.23
scenario 3 versus scenario 2											
PE/GDP	0.05	0.11	0.18	0.25	0.32	0.30	0.22	0.11	0.01	-0.07	-0.13
DR	-0.74	-1.29	-1.76	-2.32	-2.93	-3.08	-3.18	-3.13	-3.06	-3.03	-3.05
RR	0.80	1.42	1.98	2.63	3.35	3.49	3.50	3.35	3.17	3.05	3.01
SSD/GDP	0.26	0.50	0.74	1.04	1.33	1.24	0.90	0.50	0.07	-0.44	-1.19
scenario 4 versus benchmark scenario											
PE/GDP	0.32	0.69	1.04	1.34	1.61	1.84	1.94	1.58	1.21	1.10	1.16
DR	-2.45	-4.33	-5.73	-6.73	-7.41	-7.92	-8.39	-7.10	-3.95	-3.18	-2.76
RR	2.84	5.26	7.18	8.65	9.75	10.59	11.28	9.35	5.36	4.42	4.04
SSD/GDP	1.57	3.02	4.23	5.44	6.46	7.25	7.64	6.64	5.44	4.35	2.83

PE = Pension Expenditures; GDP = Gross Domestic Product; DR = Dependency Rate; RR = Replacement Rate; SSD = Social Security Deficit. *Source:* MODSIM.

Final remarks

According to the simulation results, the demographic evolution and its interdependence with labour market will cause a growth in the Social Security expenditure. In spite of the 1995 reform law, which will reduce by almost 30% the amount of the pension benefits, the ratio of pension expenditure to GDP will not stabilise until 2050. At the same time the ageing process will reach its peak, caused by the past demographic waves. The number of births almost halved from 1965 to the early '90s. Around 2030 the small generations born in the '90s will enter the active population while, at the same time, the cohorts born in the middle of the '60s will reach retirement.

The decline of the replacement rate begins only after 2030 when the dependency ratio will reach a maximum. For this reason there seem to be a strong need for a reduction of the transition period to the new system. The adoption of the new pension formula for all workers independently from the number of years worked in 1996, would allow a reduction in the amount of benefits. The reduction of the replacement rate should be anticipated in order to contrast properly the growth of the dependency ratio.

The latter is directly influenced by the demographic trends and by the labour market. Given the assumed path of fertility, immigration and mortality, which are coherent with the recent evolution of these variables, one way to reduce the growth in the dependency ratio is through the labour market. Italy has one of the highest young unemployment rates and a very low female labour participation that could be improved in order to reduce the demographic burden on the pension system. Another possible measure seems to be a raise in the minimum retirement age of the new pension rule, which is presently fixed at 57 years for both sexes and could be raised to 60 or 62 years.

The results of the simulation show that a rapid convergence toward European levels in young age employment rates would be needed to slow down the projected increase in the dependency ratio. However, indirect effects on the replacement rate under this scenario should also be taken into account. Once those effects are fully considered the reduction in the future pension expenditures / GDP ratio could be negligible.

References

Andreasson L, Fredriksen D: and Ljones O. (1994) *The Future Burden of Public Pension Benefits. A microsimulation Study*, Discussion Paper n.115, Statistics Norway.

Atkinson A. B. (1995) *Incomes and the Welfare State*, Cambridge University Press, Cambridge.

Auerbach A.J. e Kotlikoff L.J. (1987) *Dynamic Fiscal Policy*, Cambridge University Press.

Azariadis C. (1994) Intertemporal Macroeconomics.

Baldacci E. (1995) Ageing and Pension System, IRP, *Contribution of Italian Scholars. European Association for Population Studies Conference 1995*, CNR, Rome.

Baldacci E. and Lugaresi S. (1995) The New Pension System in Italy: Gainers and Losers under Different Macroeconomic Assumptions , ISTAT, *Documenti ISTAT*, n. 4, Rome.

Baldacci E. and Lugaresi S. (1996a) Social Expenditures and Demographic Evolution: a Dynamic Approach, *Genus*, nn.3-4.

Baldacci E. and Lugaresi S. (1996b) Assessing the Impact of Population Ageing on the Welfare State. A Dynamic Simulation, *Statistical Journal of the ECE*, n.4.

Baldacci E. and Lugaresi S., Raffaelli F. (1997) Tendenze demografiche e Stato Sociale: un modello dinamico. in: Da Empoli D. and Muraro G. *Verso un nuovo Stato Sociale. Tendenze e criteri.* Franco Angeli, Milano.

Baldacci E. and Tuzi D. (1998) MODSIM. Un modello dinamico di simulazione della spesa pensionistica e sociale. in: Baldacci E. and Peracchi F. (1998) Le previsioni della spesa per pensioni. Metodologie a confronto. *Annali di Statistica.* Anno 127, serie X, volume 16, 1998 ISTAT, Rome.

Barro R. e Sala-I-Martin X. (1995) *Economic Growth*, Mc Graw Hill, New York.

Blanchard O. and S. Fisher (1989) *Lectures on Macroeconomics*, Cambridge, Mass., MIT.

Blanchet D. (1991) *Modélization démo-economique*, Ined, Paris.

Blanchet D. e Kessler D. (1991) Optimal Pension Funding with Demographic Instability and Endogenous Returns on Investment, *Journal of Population Economics*, n.4.

Creedy J. e Disney R. (1992) Financing State Pensions in Alternative Pay As You Go Schemes, *Bulletin of Economic Research*, n.44.

Deardoff A.W. (1976) The Optimum Growth Rate for Population: Comment, *International Economic Review*, n.17.

EUROSTAT (1997) *Enquête sur les Forces de Travail 1996*. Luxembourg: Office for Official Publications of the European Communities.

Falkingham J. and J.Hills eds.(1995) *The Dynamic of Welfare. The Welfare State and the Life Cycle.* Prentice Hall / Harvester Wheatheaf, London.

Hills J. (1995) The Welfare State and the Redistribution between Generations in Falkingham J. and J.Hills eds, *The Dynamic of Welfare. The Welfare State and the Life Cycle.*

ISTAT (1997) *Previsione della popolazione residente per sesso, età e regione. Base 1.1.1996.* Informazioni ISTAT, Rome.

ISTAT (1998a) *Rapporto Annuale. La situazione del Paese 1997*. IPZS, Rome.

ISTAT (1998b) *Trattamenti pensionistici 1997*. Annuario n.3, Rome.

Keyfitz N. (1979) Multidimensionality in Population Analysis in K.F. Schuessler (ed.) *Sociological Methodology 1980*, Jossey-Bass Publishers, San Francisco.

Hancock R. and H. Sutherland eds. (1992) *Microsimulation Models for Public policy Analysis. New Frontiers*, STIRCED Occasional Paper n.17, London, LSE.

Heller P.S. and others (1986) *Ageing and Social Expenditure in the Major Industrial Countries, 1980-2025*, IMF Occasional Paper, n.47.

Hollenbeck K. (1995) A Review of Retirement Income Policy Models, *Staff Working Papers*, W.E. Upjohn Institute, august.

Leibfritz W. and others (1995) *Ageing Populations, Pension Systems and Government Budgets: How Do They Affect Saving* ?, Economic Department Working Papers, n.156.

Masson P.R. and R.W. Tryon (1990) Macroeconomic Effects of Projected Population Aging in Industrial Countries, *IMF Staff Papers*, vol.37, n.3, September.

Nelissen J.H.M. (1995) Lifetime Income Redistribution by the Old-age State Pension in The Netherlands, *Journal of Public Economics*, n.58.

OECD (1988), *Ageing of Population. The Social Policy Implications*. Paris.

OECD (1995) *Education at a Glance. OECD Indicators*. Centre for Educational Research and Innovation, Paris.

Samuelson P.A. (1975) The Optimum Growth Rate of a Population, *International Economic Review*, n.16.

Samuelson P.A. (1976) The Optimum Growth Rate for Population: Agreements and Evaluations, *International Economic Review*, n.17.

Van Praag B. e Poeth G. (1975) The Introduction of An Old Age Pension in a Growing Economy. A First Approach, *Journal of Public Economics*, n.4.

World Bank (1994), *Averting the Old-Age Crisis.*World Bank Policy Research Report. Oxford University Press.

UNFPA (1998), *World Population Report*, UN, New York.