Demographic transition and household saving in Italy

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Abstract[•]: This paper studies the relationship between population ageing and saving formation by Italian households. We use five cross-sectional budget surveys to separately construct the age and cohort profiles of the saving rate. After detrending the data, we isolate the age and cohort effects on saving. Cohort effects show that, in the current Italian population, saving behaviour is markedly different across generations. The estimates obtained on survey data are then used to derive a forecast of the medium and long run tendency of the household saving rate (2000-2050). In the absence of any changes in the saving behaviour of young cohorts, the saving rate falls by 15% at the end of the period. The recent reforms of the pension system will significantly reduce the social security wealth of future pensioners, and could induce the young to increase their saving, but the available empirical evidence leads to a scenario where the effects of the pension reform on the incentive to save and accumulate are low, and may be neutralised by the mechanism of intergenerational transfers. Even in a scenario where the young actually react to the pension reform, the reduction in total household wealth at the end of the life-cycle induced by the pension reform leads to a decrease in aggregate household saving.

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1. Introduction: demographic transition and private saving.

The evolution of the age structure of the population is a topic of great relevance in the political and economic debate. Population ageing is studied both for its consequences on the sustainability of public finances, and for its effects on saving and capital accumulation. If in the future the fertility rate remains at last decade's levels, and average life expectancy keeps increasing, the old-age dependency ratio (the ratio between the number of individuals with more than 65 years and the number of individuals between 15 and 65 years) in the OECD countries is bound to increase until halfway through the XXI century, with radical consequences for all social protection institutes. Fig. 1.1 describes the forecast on the relative consistency of various age classes in the next decades, according to ISTAT (1997). Total population has been divided into five age groups (0-19, 20-39, 40-59, 60-79 and >=80). Some crucial aspects of the demographic transition emerge: until 2015-2020, there is a fall in the relative number of individuals belonging to the 20-39 age class, while the age class 40-59 shows a marked increase; next, from 2020 onwards, the share of this class falls, while the last two rise. The humps in the top part of the figure make clear the passage of the baby boom generation along the central and final stages of life. Further, one can notice the continuous increase in the share of those who are more than 80 years old, which doubles over the whole period, and the constant decrease in the number of youngest individuals.

The implications of these changes on public budgets have been thoroughly analysed by economists and international organisations, particularly as far as the effects of ageing on pension and health expenditures are concerned. The reforms in pension and health care systems which took place in most European countries during the last decade have had the main purpose of making the expenditure path of these sectors sustainable and consistent with population forecasts and the limits on public deficits imposed by the Stability and Growth Pact (which should also guarantee a neutral effect of public accounts on national saving).

Less attention, perhaps, has been devoted to studying the contribution of the private sector, in particular by households, to total saving during the demographic transition. The research on the relationship between population ageing and the fall in the saving rate performed over the last 30 years in developed economies has not found a clear answer to the question whether ageing implies also a reduction in saving. On the one hand, empirical research based on macroeconomic data generally concludes that ageing is actually one of the main causes of the low saving rate for those economies where the elderly represent a greater share of the population. On the other hand, empirical work on microdata from budget surveys has found no clear evidence in favour of the hypothesis that the change in the demographic structure of the population has been responsible, in the recent past, for the fall in the saving

rate (Bosworth et al. 1991; Cannari 1994; Jappelli and Pagano 1998). Even the research providing projections about the future dynamics of aggregate saving for next decades (Börsch-Supan 1996; Ministero del Tesoro 1998) points out that imbalances between supply and demand of funds should come particularly from the negative contribution of the public sector, while the private contribution to total saving should not change significantly.

The main objective of this paper is to provide an estimate of the impact of the demographic transition on saving formation by Italian households over the period 2000-2050. The Italian case is in this respect very interesting because the process of population ageing will be very pronounced if compared to other advanced economies, the saving rate has been traditionally high, and the pension system characterised by a dominant role of the state.

While the recent reforms of the pension system have drastically reduced the future dynamics of pension expenditure (particularly after 2020-2030), and observance of the Stability and Growth Pact should imply a limited impact of public finances on aggregate saving, on the other hand the saving rate of Italian households has recently fallen to levels which are not significantly different form those of the other European countries. In particular, as will be explained in the following pages, two aspects seem to be particularly worrying: i) the reduction in the saving rate by younger cohorts; ii) the possibility that the pension reform may not determine an increase in saving by these same cohorts, owing both to the limited evidence on a significant elasticity of private saving to pension wealth, and to the possibility of compensating inter-generational transfers aimed at neutralising the effects of the reforms, with the consequent reduction in the need to increase private saving in order to face the reduction in pension wealth.

The paper is organised as follows. Section 2 makes use of the time series of cross-sectional surveys on Italian households carried out by the Bank of Italy over the period 1987-95 to isolate the age profile of the saving rate for Italian households. The data show the presence of a strong time effect and, after its removal, non-uniform cohort effects across living generations. The second part of this section studies the dynamics of accumulation and decumulation of real and financial wealth. All these pieces of information are used in section 3 to provide some forecasts of the impact of population ageing on household saving over the period 2000-2050. Some alternative scenarios are considered: with and without cohort effects on saving, and with and without the interaction between the recent pension reforms and the ageing process. In this last case, we also consider different possibilities regarding the reaction of younger cohorts' saving to changes in their social security wealth.

2. The dynamics of household saving and wealth in the Bank of Italy survey: data and methodology.

2.1 The data and the aggregation of variables

The main objective of this section consists in determining, on the basis of the Bank of Italy Survey of Household Income and Wealth, how saving and wealth accumulation behaviour changes over the life cycle. Once obtained, the age profiles of saving and wealth will be applied to study the effects of the demographic transition on the aggregate saving rate of Italian households.

The first step in the study of saving is its correct definition; in particular, it is necessary that the concept adopted be consistent with the purpose of the analysis. Recently, many authors[1] have argued that the definition of saving traditionally used in the analysis of sample surveys — namely the simple difference between disposable income (net of taxes and contributions) and consumption expenditure — is inappropriate: this definition does not take

[1] Jappelli and Modigliani (1998), Deaton and Paxson (1998), Miles (1999).

into account the presence, in modern economies, of the public pay-as-you-go social security systems which, in an intertemporal framework, may be interpreted as programs of compulsory saving in the active phase of life. Social security contributions would not therefore be qualitatively different, for a single individual, from saving for later expenditure, while pensions would not represent disposable income, but the running down of the stock of social security wealth, and would thus represent negative saving. One should therefore add to the disposable income of sample surveys the contributions paid during the working years, while pensioners' income would be composed only of those flows arising from real and financial wealth.

This new interpretation of the data is appropriate if the analysis aims at verifying, at individual level, the life-cycle hypothesis of saving. If, as in our case, one wants to study the macroeconomic consequences of individual choices, some further considerations must be made. First, pensions could be considered wholly as wealth decumulation only if their total amount is consumed. If this is not the case, the share of pension income not consumed becomes saving again, in a form different from «pension saving». Second, the interpretation of social security contributions as saving and of pensions as capital decumulation is consistent only with the actual presence of a fully funded system, without any form of redistribution among generations. The effects of social security saving on the aggregate saving rate are indeed completely different according to the nature of the pension system, whether fully funded or pay-as-you-go: in the first case the flow of contributions actually corresponds to new saving, which can be invested and transformed into new capital, in the second case it is a mere transfer of income across generations, and cannot increase the stock of wealth of a nation, unless it is saved by pension recipients. In the context of a pay-as-you-go pension system, the consideration of social security contributions as saving is not consistent with the aims of our analysis, because no possible investment in new real of financial capital can correspond to these payments.

We have therefore adopted the traditional definition of saving, represented by the simple difference between disposable income, net of taxes and contributions, and total consumption (including expenditure in durables: results would not change by excluding these).

To obtain the saving profile over the life-cycle, we have used the five surveys carried out by the Bank of Italy from 1987 to 1995. We do not use the data from a single survey because, in this case, an estimation of the saving rate on a polynomial in the age of the household head could lead to misleading results, if cohort effects are present in the data.

In fact, the saving and consumption behaviour of individuals of different ages embodies both an age and a generation effect: if cohorts are different, it is not correct to extrapolate from cross-sectional data the life-cycle behaviour of a hypothetical representative agent. In these cases, the commonly adopted methodology to isolate the «true» age effect makes use, in the absence of panel data, of a series of repeated cross-sectional surveys, where the age profile of the variable of interest can be decomposed into three components: an age effect, a cohort effect, and a period effect. The first effect describes the life-cycle profile of a variable, that remains after the elimination of the other two components: i) the cohort effect, i.e. the fact that households interviewed in a given period are characterised by different productivity and, presumably, different preferences, influencing economic decisions and the total amount of resources of each household; ii) the period effect, i.e. the fact that macroeconomic shocks (for example, a fall in the growth rate of the economy) may temporarily modify, in a given period, the age profile of the variable of interest.

A pseudo-panel enables us to follow over time not the same households, like a true panel, but a representative sample of the same cohort of households, defined as the set of family units whose heads were born in the same year or in the same interval of years.

The empirical analysis is conducted on the time series of the five Surveys on Household Income and Wealth (SHIW) carried out by the Bank of Italy over the period 1987-1995, covering a total of 40,713 observations. This survey represents the most complete source now available in Italy for the empirical study of household economic behaviour, and is extensively described by Brandolini (1999) and by Brandolini and Cannari (1994). In existence from 1965, its structure has been modified several times, and the various changes prevented us from using jointly all surveys potentially available. The age of the reference person, for example, which is essential for this research, is gathered only from 1984 onwards.

We have divided the households of the 1987-95 surveys into 12 cohorts, defined over five year-of-birth periods: the first cohort groups all households whose head was born between 1910 and 1914, while those with the head born between 1965 and 1969 belong to the last one. Cohorts are labelled with an index ranging from 1 for the oldest to 12 for the youngest. All households belonging to the same cohort are attributed the median cohort age: so, for example, the first cohort is followed from the age of 75 in 1987 to 83 in 1995, while the youngest one is followed from 20 to 28 years of age. All economic variables are expressed in 1995 prices, using the consumer price index, and all computations have been carried out using the sample weights provided in the surveys. Excluding those households whose head was born before 1910 or after 1969, the sample size reduces from 40,713 to 39,456. In what follows, the graphs describing the data have been constructed using all these observations, while the estimations of the life-cycle profile of saving have been carried out on the sub-sample of those between 25 and 75 years of age. Table 2.1 shows the average size of each cohort, the respective years of birth and the ages at the beginning and end of the observation period.

Tab. 2.1 Cohort definition and size

Cohort number	Year of birth	Age in 1987	Age in 1995	Average Size
1	1910-14	75	83	355
2	1915-19	70	78	390
3	1920-24	65	73	714
4	1925-29	60	68	799
5	1930-34	55	63	835
6	1935-39	50	58	918
7	1940-44	45	53	859
8	1945-49	40	48	936
9	1950-54	35	43	794
10	1955-59	30	38	696
11	1960-64	25	33	459
12	1965-69	20	28	165

Not all the variables of the SHIW have the same quality, in particular for our purposes three main problems are relevant:

a) Values of the stocks of financial wealth substantially underestimate the available national accounts evidence. The difference between the per household average amounts from the SHIW and the national accounts varies (Brandolini and Cannari, 1994) from 67% for bank deposits to 89% for shares. Evidence on real wealth is more difficult to evaluate, since there is no national account source for a comparison.
b) Consumption data also appear to be of poor quality: the survey section devoted to consumption is extremely scanty; apart from few specific questions on some consumption

items, households are asked only their total expenditure during the previous year, a retrospective question perhaps too generic to produce reliable results.

c) Self-employment incomes suffer from a greater degree of underestimation in comparison with other incomes, in particular incomes from employment and pensions. (Brandolini 1999).

Given these potential shortcomings, we have studied both the original SHIW data and also two new series of consumption and income, which try to tackle these three problems.

a) Financial wealth: original survey data have been replaced with the values (for both the stocks and the corresponding income flows) estimated with the methodology proposed by Cannari and D'Alessio (1993), who use the Banca Nazionale del Lavoro (BNL) survey on household saving to correct the distortions caused, in the SHIW, by non-reporting and under-reporting behaviour. Since the BNL survey is carried out only on those households who are also clients of that bank, and therefore are linked to the bank by a relationship of trust and knowledge, it is a commonly shared opinion that its evidence is more reliable than the SHIW data, though the BNL survey, too, produces average values that are lower than the national accounts (but closer to them than the SHIW). The correction methodology consists in subdividing financial assets into three categories (bank and postal accounts, government bonds, shares and other assets), estimation of the probability of possessing each of these forms of wealth (correcting non-reporting behaviour), and imputation of new amounts using the coefficients from an estimate of the log of each of the three variables on a wide array of social and economic variables. Results show clearly that the propensity to underestimate the stock of financial wealth is not uniformly distributed across the population, being particularly high for the self-employed and pensioners. The Bank of Italy has provided the adjusted stocks for years 1987-95; the corresponding income flows have been obtained using the average rates of return distinguished by year and category, and have been substituted for the original values of financial income in the determination of total household disposable income.

b) Consumption: to each SHIW household a new value of total consumption expenditure has been associated, obtained using the ISTAT (the Italian Institute of Statistics) surveys on household consumption carried out in the same period. The annual ISTAT survey gathers information on a great number of goods (nearly 200), and is based not on retrospective interviews (durables apart) but on the compilation of a booklet for 15 days, a method which should guarantee more reliable results. The imputation has been conducted through simple regressions of the logarithm of total expenditure on a vector of demographic and work-related characteristics available in both surveys, and then applying the coefficients to the SHIW sample[2]. We have also taken into account the necessity to adjust imputed values on the basis of the characteristics of the lognormal distribution. The aim of this imputation process consists in assigning to each cohort a new value of average total consumption expenditure. Instead of imputing total consumption on the SHIW households, one could simply compute cohort averages on the ISTAT surveys, and construct a pseudo-panel with income from SHIW and consumption from ISTAT data. We computed these means and obtained values always very close to the averages of the imputed series.

[2] We have made use of the following explanatory variables: dummies for household living in the North and in the South, dummy for reference person's education not greater than the compulsory level, dummy for reference person with a degree, third-order polynomial in the variable (age of the head - 40)/10, dummies for head's activity: dependent manual worker, manager, self-employed, entrepreneur, pensioner, unemployed, other, dummy for the sex of the head. We do not use indicators of household's dimension because the definition of the family unit is different in the two surveys (the average number of components is consistently greater in the SHIW), and this would have distorted the imputation. Moreover, no use is made of disposable income, because this variable in the ISTAT survey is of insufficient quality. Results are available on request.

c) Self-employment income: total disposable income of households with an independent (self-employed, professional or entrepreneur) head has been raised by 15%, an approximation of the greater degree of underestimation with respect to other income sources (Brandolini 1999).

Note that these three corrections do not aim at producing values that are comparable, in absolute terms, to the national accounts, but merely at conforming SHIW data to the «best» sample information available.

2.2 The saving profile over the life-cycle

Tab. 2.2 shows the results of the corrections on the original survey data, through the average rates of change between original and imputed data, by age of the reference person.

Tab. 2.2 Effects of the corrections on income and consumption

Age of the reference person	% change in income due to the correction of financial assets	% change in income due to the correction of self-employment incomes	% change in income	% change in consumption
<=24	0.6	5.2	5.8	-2.6
25-29	1.0	3.8	4.8	14.3
30-34	1.2	4.2	5.4	14.6
35-39	1.2	3.9	5.4	23.5
40-44	2.1	3.9	6.0	24.3
45-49	2.9	4.1	7.0	14.2
50-54	4.0	4.7	8.7	8.3
55-59	5.3	4.5	9.8	2.2
60-64	7.2	3.2	10.4	3.2
65-69	9.7	2.3	12.0	3.8
70-74	11.9	0.8	12.7	5.8
75-79	13.9	0.5	14.4	1.3
>=80	16.8	0.1	16.9	6.4
Total	4.8	3.6	8.4	11.5

The adjustments do not have a uniform effect, across age classes, either on income or on consumption; for income, the effect is clearly more intense among the elderly, apparently due to their greater reticence in declaring their stocks of assets (cf. par. 2.3), while the increase for younger classes is mainly attributable to the correction of self-employment income. In the case of consumption, however, the changes have an opposite direction, resulting in a strong increase for those households under the age of 50. Combining these two effects, the saving ratio rises for old households and falls for young ones. The high propensity to save of the elderly traditionally found in the SHIW cannot therefore be attributed to the bad quality of the consumption data, which are very close to the ISTAT levels, while on the contrary it is the young who tend to understate, in the SHIW, their consumption levels. The elderly may have more customary consumption behaviour, easier to remember and declare.

Fig. 2.1 shows the evolution of the average saving rate in the SHIW, for both original and adjusted income and consumption, computed by using the coefficients from a regression on the cohort means for the 5 surveys, on a fourth-order polynomial on household age; the effects of the adjustment are clear and depict a significantly steeper age profile.

Fig. 2.2 describes the age profiles of the average values of adjusted income and consumption for the various cohorts, identified by the numbers on the curves. Values are expressed in thousands of 1995 Lire. The level of saving is also shown, through not the original data but those made smooth after a regression of saving on two fourth-order polynomials on age and the cohort index. Both income and consumption show a hump-shaped behaviour with a peak around age 50. Only after the age of 35-40 can one observe significant saving flows, which remain positive even in the oldest ages[3]. Against this evidence, one could object that the survey data, both ISTAT and SHIW, in any case underestimate national accounts averages and therefore would not provide a realistic description of these phenomena; a further adjustment could consist in the adjustment to national account values, but this, provided that relative differences across the various age classes have been correctly reproduced in our data, would have only a scale effect, without altering the life-cycle profile of the variables[4].

A more in-depth analysis of Fig. 2.2 would also require considering separately the age, period and cohort effects on saving. In this respect, we can note the following two facts: i) the sign of the cohort effects is, in the income case, opposite to what might be expected, because they reduce the resources available for the younger generations: when two curves overlap, that of the younger cohort is, particularly in the first stage of the life-cycle, always below the other. The effect is less intense for consumption, so that in the case of saving younger generations appear to save less than those who preceded them, at each age. ii) the profile of the level of total saving is negatively sloped for some cohorts. This is probably due to the peculiar character of the (short) time span here examined, with low growth rates of current disposable income, at least in the 1990s, to which households may have reacted with a less than proportional reduction in consumption, if the latter depends also on permanent income considerations.

The subdivision of the temporal profile of a variable into its three components of age, cohort and year represents the major difficulty inherent in the use of a pseudo-panel, since each of them is the linear combination of the two other effects: if we define with a the age of the head (i.e. of the household) in year t, and with c its year of birth, then $t=a+c$. In the estimation stage, in order to separately identify the three effects it is therefore necessary to impose a restriction on them, however arbitrary, by which choice the results will necessarily be influenced.

There are many possible restrictions, and each leads in principle to different conclusions about the relative importance and even the profile of the three effects. One of the most common restrictions in the literature, since Deaton and Paxson (1994), consists in imposing that the coefficients associated with the year dummies be orthogonal to a temporal trend and sum to zero (Attanasio 1998, Jappelli 1999). The logic of this restriction may be appreciated with a simple example, where a certain variable of interest, e.g. disposable income, grows every year by 2% for all individuals, irrespectively of the cohort. This growth can be alternatively attributed either to a pure period effect, without any age or cohort effect, or to a combination of an age and cohort effect of the same intensity (2%) and sign, if the cohorts are identified by the year of birth or by an index increasing in the year of birth as in our case. In this circumstance, it is more reasonable to attribute this change not to a period effect, but to the combination of the other two effects: each individual experiences an increase in his own welfare, and each generation is better off than the previous one.

[3] From this figure no conclusion about the validity of the life-cycle theory can be drawn, since we have considered neither the social security saving of the young nor the decumulation of social security wealth by the elderly.

[4] See also Appendix 1.

We have tried this restriction on our data, regressing the logarithms of income and consumption on two polynomials in age and cohort and on the year dummies restricted so as to fulfil the requisites of sum to zero of the coefficients and orthogonality to a time trend. Regressions have been carried out both on the micro-data, after dropping households with income or consumption lower than 1 million lire per year, and on the cohort means; since results are very close, in what follows we shall refer only to the analysis made on the pseudo-panel. We have also excluded from the sample those households whose head's age is lower than 25 or higher than 75: older households are not included to avoid the misspecification due to a possible inverse correlation between mortality and income at high ages, which could lead to an over-representation of rich households (with high saving rates) in the last phase of the life-cycle. Households younger than 25 have been excluded because they are present in the surveys with very low frequencies, and because rich households are likely to be over-represented, if high levels of income or wealth have a positive influence on the decision to form a new household. Since the saving rate can be approximated by the difference between the logarithm of income and that of consumption, age and cohort effects on saving can be obtained from the estimates run on this variable[5].

Fig. 2.3 describes the age and cohort effects so obtained (the constant in the regression has been inserted only in the age effect, so the imputed profile can be obtained as the sum of these two curves); their profiles are strongly pronounced and are difficult to interpret in the light of the evidence described in Fig. 2.1: they imply that the «true» age profile of the saving rate is always decreasing over the life-cycle, and that the younger cohorts save a share of income always lower than that saved by the older generations at the same age. These results do not depend on the choice of a particular restriction on the year effects, since similar profiles have been obtained also after regressions run without constraining the temporal coefficients, or ruling out completely the year dummies (as in Borsch-Supan 1995). The presence of a strong decreasing trend in the propensity to save over the period, common to all demographic groups, influences both the age-profile and the inter-cohort differences: as the common and generalised growth of the variable of interest produces an increasing profile for the age and cohort effects, exactly opposite profiles are generated by a decreasing trend in the original data[6]. This trend common to all cohorts over the observation period is apparent from Fig. 2.4, which shows the average saving rate by age of the head and cohort.

This decomposition of the three effects does not therefore represent in this case a useful procedure to insulate the «true» age and cohort effects. Even if a steadily decreasing lifetime profile for saving is not fully inconsistent with the life-cycle theory, the dimensions of both effects are excessive and do not reflect the significantly positive saving rates observable for the elderly in all the Bank of Italy surveys. The presence of a strong period effect common to the whole population represents a case very similar to what has been studied by Paxson (1996) for the USA over the 1980s, when a significant fall in the overall private saving rate took place. Bosworth, Burtless and Sabelhaus (1991) for the USA and Jappelli and Pagano (1998) for Italy argue that the fall in the saving rate is a generalised phenomenon involving all generations and social classes. Cannari (1994), applying the same method of Bosworth, Burtless and Sabelhaus (1991), concludes that in Italy the reduction in the saving rate cannot be attributed to specific demographic factors or to the behaviour of certain population sub-groups. Other studies, however, indicate a particular responsibility of specific cohorts: according to Kotlikoff et al. (1996), the elderly significantly increased their consumption levels, particularly in medical expenditures, while, still for the USA, Attanasio (1998) notices

[5] Substantially identical results are obtained by using in the pseudo-panel, in place of the difference between the log of income and consumption, the ratio between saving and income.

[6] If we sum age and cohort effects, we obtain a profile for imputed saving always decreasing for each cohort, which resembles those already seen, in levels, in Fig. 2.1. The same computations on the original SHIW data for income and consumption produce analogous results.

that the saving rate was particularly low, in the 1980s, for the generation which preceded that of the baby boom, i.e. for the households with reference persons born between 1935 and 1949, perhaps owing to the perception of a greater generosity by the social security system.

In the light of the dominant influence of this trend, the alternative suggested by Paxson (1996) consists in the estimation of the saving rate on a polynomial in age and on unrestricted year dummies, omitting the cohort variables, under the hypothesis that the cohort effects are the same for both income and consumption and therefore do not influence the saving rate profile. It is possible to provide a theoretical justification for this restriction: if consumption is proportional to lifetime resources, its profile should be common to different cohorts, apart from possible inter-cohort changes in the propensity to leave bequests. This solution enables the profile represented in Fig. 2.5 to be obtained. The level of the saving ratio recoverable from the estimated coefficients depends on which year dummy has been eliminated from the regression: we have dropped the 1995 dummy, so the estimated profile corresponds to the averages of the last available survey.

The decreasing shape in the first part of life is probably due to the order of the polynomial, and to the effect on household expenditures of the presence of small children; it has, however, a negligible aggregate impact since the share of households with head younger than 30 is very low. In the specification without cohort effects, which actually reproduces the cross-sectional shape of original data, the age profile of the saving rate is first increasing and then, starting from 60 years onwards, remains substantially constant in the last part of life. The saving rates of the elderly are therefore significantly positive.

As well as Fig. 2.3, Fig. 2.5 was obtained with the help of a very strong identification assumption, even if perhaps more appropriate to the context, about the relationship among age, year and cohort effects, since we have assumed that the latter are actually absent: the level of the saving pattern would therefore be unique and common to all generations (its form is by definition always common, depending only on the age polynomial).

It is always possible, however, to impose alternative restrictions, and to check how the life cycle of saving is consequently affected. Given the characteristics of the data shown above, a particularly intuitive restriction consists in the hypothesis that, over the period covered by the surveys, the propensity to save of all cohorts has been affected, with approximately similar intensity, by a decreasing trend. There are many possible reasons for this reduction, which we do not investigate, for example structural changes in the economic environment, e.g. an easier access to bank credits, or changes in the lifestyle, or the effects of alternative theories of saving, e.g. the existence of a positive relationship between the growth rate of income and the saving rate, due to the slow adjustment of consumption to income, or the dependence of consumption, in periods of low income growth, on permanent income.

A simple way to formalise the restriction of a common trend consists in detrending the original data, through a regression of saving on a time polynomial, for example $s(t) = a0 + a1*year+a2*year2 + u$, (where *year2* is the squared year index), whose residuals can be used to obtain the shapes of the age and cohort profiles. This is equivalent to assuming that the trend effect is additive and constant for all cohorts, as in

$$s(a,t,c) = s(a,c) + s(t)$$

where s is the mean cohort saving rate, a is the age index, c is the cohort index and t the period index. Using the residuals from a regression of s on t is equivalent to subtracting from the original saving rate the imputed saving rates obtained from the same regression[7]. The age

[7] The effect of the trend could alternatively be expressed in multiplicative terms, as in $s(a,t,c) = s(a,c)*s(t)$.
In this case the detrended series would be obtained as the ratio between the saving rate and its fitted value from a regression on the time trend, multiplied by the average saving rate of the reference period. We have verified that these two alternatives provide similar results.

profile computed using the residuals was then adjusted to the average values of the saving rate actually observed in 1995, adding the average saving rate for the age band 25-75.

Fig 2.6 compares the saving profile obtained considering the possible cohort effects with that of Fig. 2.5: the strongly negative trend of Fig. 2.3 (with orthogonality restrictions on the year effects) has disappeared, while the low mean level stems from the rescaling to the base 1995, the last available. The two curves on age effects show fairly similar shapes, even if the saving rate obtained from the residuals is steeper.

The most relevant advantage of this alternative is the possibility to recover information about the presence of cohort effects, which are supposed to be completely absent in the estimation of saving on the age polynomial and on unrestricted year dummies. Even after the imposition of a strong period effect common to all generations, the residuals preserve information about possible peculiarities of specific cohorts, and so it now becomes possible to separate the age from the cohort effects, and verify whether the saving rate of some cohorts has fallen, over the period studied, more or less than the average. Fig. 2.7 contains the cohort effects, computed both on the original and the adjusted SHIW data: households belonging to the oldest 7 cohorts have a higher saving rate than that shown, at the same age, by previous cohorts, while the reverse is true for younger generations. The similarity between the two curves also shows that even in the original data the same phenomenon is present. An inversion in the saving behaviour has therefore occurred: while oldest generations (more than 50 years old) save more than the preceding cohorts at the same age, the young save, at the same age, less than their predecessors. This information can also be recovered from Fig. 2.8, showing clearly that, beyond the sixth cohort, it is no longer true that the younger save more than previous generations, at the same age. This graph depicts the total saving profiles obtained by summing the age and cohort effects, and also compares the procedure based on the detrending with the profile already described in Fig. 2.5, i.e. without any differences across cohorts. We can thus notice that, the data being always rescaled so as to possess the same total average as the 1995 saving rate, the procedure based on the detrending is actually equivalent to decomposing the profile obtained without cohort effects into its two components, i.e. age and cohort.

These results seem therefore to indicate that the younger generations have decreased their saving rate by an amount greater than what would be implied by a time trend common to all cohorts. A simple and immediate confirmation comes from Fig. 2.9, which shows the changes in the saving rate by cohort, on the average values defined over the first and the last couple of surveys, in order to smooth possible outliers. The top curve refers to the period 1987-89, the other to the period 1993-95. Age classes born from the second half of the 1930s' to the end of the 1940s' appear to have changed their saving behaviour less than other cohorts, while younger cohorts present a more marked decline in their saving rate. This reduction is in conflict with what could be expected in the presence of a reform of the Italian social security system, that has markedly compressed the social security wealth of the currently young cohorts, without substantially affecting the position of the middle aged. Our sample period, however, ends in 1995, the same year of the main reform of the system, which therefore may still not have influenced the saving behaviour of the households interviewed.

The particular shape of the cohort effects may depend on many factors, among which it is difficult to discriminate. The slow economic growth of the 1987-95 period could have more intensely affected the younger cohorts, they may have changed their preferences, or the credit marked has become more efficient; further, cohort differences could be the effect of intergenerational public transfers favouring specific cohorts (Rossi and Visco 1995, Kotlikoff

et al. 1996): probably the observed cohort effects result from a combination of all these factors[8].

The fact that the saving rate does not decrease in the last part of life could be due to many factors as well: the bequest and precautionary motives, and an excessive intergenerational transfer, managed by the pre-reform pension system, in favour of the current pensioners, who may have turned out to benefit an amount of resources greater than the consumption needs of households getting older and older.

Using the detrended data, we are able to distinguish the behaviour of each cohort, and this information will be used in the production of forecasts in the last part of the paper: the saving profiles of different cohort have the same shape (the age effect), but different levels, depending on the cohort effect. Fig. 2.8 describes the two alternative profiles of life-cycle saving that will be used to work out forecasts about the effects of population ageing, i.e. with or without the cohort effects.

2.3 The life-cycle profile of private wealth.

In this section we estimate the age profile of financial and real household wealth. These cohort estimates, together with those referring to the saving rate, will be used in section 3 to study the effects of demographic ageing in connection to the reform in the social security system.

As already explained, the values of the stock of financial wealth in the SHIW are of very poor quality, and have here been replaced with the corrections made by Cannari and D'Alessio (1993). The effects of this adjustment are, as shown in Fig. 2.10, very significant: for each cohort, the substantially flat profile of original data is replaced by a clearly increasing one, even in old age. Moreover, the adjustment is not uniform across the various age groups, producing a greater increase in the stock in the second part of the life-cycle, confirming a greater reticence propensity by the elderly. Since no manipulation has been made on real wealth, Fig. 2.11 shows the behaviour of private household wealth, given by the sum of the real and financial component, before and after the adjustment on the latter[9]. While the profile for original data is decreasing for some of the older cohorts, the rate of growth of the stock of the adjusted values, even if consistently decreasing, remains positive over the whole life. On average, the move to adjusted data implies an increase in household wealth by 12% if the reference person's age is lower than 39, by 15% for the 40-59 age class, and by 23% for the over-59.

As in the case of the saving rate, also in the case of wealth the problem of identifying the «true» life-cycle profile arises, purging the raw data of the presence of cohort effects. A simple visual comparison between Fig. 2.4 and Fig. 2.11 shows that the presence of a trend is, for wealth, much less relevant; this should not come as a surprise, since wealth is a stock variable, and is confirmed by the clear distance separating the different cohorts. Given the irrelevance of the trend problem, we have applied two alternative restrictions. The first is the classical restriction à la Deaton and Paxson (1994) on year effects (sum to zero and orthogonality to a time trend), while the second consists in using an external source of information as a proxy of the cohort effects: following Alessie, Kaptein and Lusardi (1999), we have assumed that the differences in the cohort means for wealth are due to the different productivity level (and therefore income) of the various cohorts, which raises the ability of each generation, at any given age, to accumulate wealth. These differences in productivity

[8] The cohort profile of the saving rate is, by definition, the difference between the cohort effects of income and consumption: we have verified that both have a hump shape, more marked for income.

[9] Real wealth is the sum of the value of houses, unincorporated businesses, other buildings and land, less residual debts. Consistently with Jappelli and Modigliani (1999), private wealth is here defined as the sum of financial and real wealth, while total wealth is private wealth plus social security wealth.

have been summarised by the mean per-capita gross domestic product when the cohort's age was 25, i.e. at the moment of entry into the labour market[10].
Appendix 2 shows the results of the regression of the log of (adjusted) private wealth on a fourth-order polynomial in age, on the non-restricted year dummies, on the log of per-capita GDP, and on a vector of demographic control dummies. The coefficient of the productivity indicator is positive and significant; with this estimate it is also possible to compare, with a Wald test, the two alternative restrictions considered, imposing the already cited constraints on the year dummies: the value of the test is 105.6, and with one degree of freedom leads to reject the Deaton-Paxson restriction in favour of the use of the per-capita GDP. It is also possible to verify whether this variable is a sufficient indicator of the inter-cohort differences: including among the regressors both the log of GDP and the cohort dummies, an F test on the joint significance of these dummies leads to reject a residual role for them in determining the wealth profile. Fig. 2.12 describes the pure age pattern of the (log of) private wealth without cohort effects, and compares it with the cross-sectional cohort averages; the correction appears to be extremely significant, and produces a curve which never declines, unlike what may be concluded after observation of a single SHIW cross-section[11]. The same regression, carried out without the cohort-specific productivity indicator, produces an age profile implying a reduction in the stock of wealth by 50% between the ages of 60 and 80. One should also observe that the absence of a reduction in the stock of wealth has no implication for the validity of the life-cycle theory, since we have not taken account here of another basic component of total wealth, i.e. social security wealth, which by its very definition is decreasing during old age[12]. What is of interest, here, is the form of the private wealth profile — in particular what its level will be for each of the currently young cohorts when they reach retirement age. To obtain these projections, we have used the pure age profile and associated it with each of the currently living cohorts, so as to obtain a cohort-specific accumulation path which interpolates the adjusted SHIW data, in the interval for which they are actually available; the imputed profiles for each generation intersect the «true» data, but are not affected by the distortion implicit in the use of cross-sectional data[13].

3. The effects of demographic transition on saving formation

In this section we use the estimates of the age profiles of saving and wealth obtained from sample data to measure the impact of demographic ageing on the aggregate saving rate of Italian households over the period 2000-2050. The forecast is made first with a shift-share analysis, which measures the impact of the change in the age structure assuming that the inter-generational distribution of income and the parameters connecting saving to age will not change with respect to the base year. Then we rescale the age profile of saving for each generation according to the cohort effects. Finally, in the second part of this section, we estimate the effects on saving of the change in social security wealth, following the two

[10] The series of the gross domestic product and of the population are taken from Rossi et al. (1992). To make the GDP series less subject to transitory shocks, its five year moving average has been used.
[11] The application of the same method to the non adjusted values of total wealth would instead produce a slight decrease in the stock at old ages.
[12] Jappelli and Modigliani (1999).
[13] Venti and Wise (1993) obtain a cohort-specific life-cycle profile with a regression of total wealth on a polynomial in age and a vector of cohort dummies, getting always increasing paths for all ages; with the same estimate, on our data, too, similar results would be obtained. Always increasing profiles would be generated also by the Daton-Paxson restriction on year dummies, but this restriction has been, as already said, rejected by the data. This same restriction, if applied to the non-adjusted SHIW data, would instead produce a slightly (in log) decreasing profile in the last stage of life (Jappelli 1999).

pension reforms of 1992 and 1995; two scenarios are considered also in this case, with and without cohort effects.

The length of the forecast period, the sensitivity of the results to the demographic projections and the complexity of the interactions among economic agents not examined here suggest that the results that follow should be considered as simply indicative of possible future developments.

3.1 Shift share analysis and cohort effects.

The dynamics of the aggregate saving rate can be estimated applying the decomposition proposed by Bosworth, Burtless and Sabelhaus (1991). Household saving rate at time (t) is defined as the weighted average of the saving rates of the living cohorts. Weights are given by average frequency and income of each cohort divided by the corresponding averages computed on the whole population:

$$S_t = \Sigma_{i=1,..G} w_{it} y_{it} s_{it}$$

where S_t is total household saving rate at time t, w_{it} is the relative frequency of the households belonging to the i-th cohort at time t, y_{it} is the ratio between its average income and the average income of the whole population, s_{it} is the saving rate of the i-th cohort, and G is the number of cohorts.

This method has been used to study the causes of the fall in the aggregate saving rate which have characterised many advanced economies since the beginning of the 1980s'. The influence of the demographic factor on the change in the saving rate from time (t-n) to time (t) can be studied by comparing the actual saving rate of period (t) to the value that it would take using the age distribution of period (t-n). The difference between the two values shows, given behavioural parameters and income distribution, the impact of changes in the age structure on aggregate saving.

Previous research efforts applying this decomposition to Italy (Cannari 1994; Jappelli and Pagano 1998) conclude that changes in the age distribution during the last two decades have not been a relevant factor in explaining the fall in the saving rate during the same period, which seems common to all generations. The same result has been found here, in the form of a negative time trend dominating the shape of the saving profile for all cohorts.

The expected change in the age structure of the population is however much more intense than that observed in the recent past, and involves a longer time span. Further, the reforms of the pension system so far enacted imply a lower guarantee of future consumption through social security, and this could have crucial effects on the consumption and saving choices of living and future cohorts.

In the first sub-section of this part of the paper, we examine whether the demographic factor will have a greater importance on saving formation, in the second one we try to provide a first evaluation of the effect of the recent pension reforms on future aggregate saving.

We have considered separately age and cohort effects in forecasting the saving rate: from the analysis of the previous section, cohorts born before 1939 have a greater saving propensity than the previous ones at the same age, while the contrary is true for younger cohorts. We confine ourselves here to assuming that these cohorts will retain the same behaviour in the future. While the age profile is common, each age class has a specific cohort effect along its whole life. For those cohorts who are not yet born in 1995, we have applied the same coefficients of the youngest cohort in the sample. The following table shows the forecasts that result with and without considering cohort effects: the first column comes from using only the age effect obtained following the same method as Paxson (1996), the second

uses the detrended series and allows for different cohort effects.[14] The simulation is carried out for the period 2000-2050. The age distribution of the population is obtained from the ISTAT official projections of the resident population by age, sex and region (ISTAT 1997), using the central hypothesis about the demographic evolution, but the adoption of the «high» or «low» hypothesis, while changing the total amounts of saving, leaves practically unaltered the ratio of saving to GDP[15]. The demographic projections are provided by ISTAT at the individual level; to make them consistent with the measured saving rate, which refers to households, we have computed the average number of household heads for each age class in the SHIW. This parameter, assumed constant over the whole forecasting period, has been multiplied in each year by the number of individuals in each age class. Lastly, income means for the various cohorts have been obtained from the last SHIW, and have been increased by a yearly rate constant for all cohorts and equal to 1.5%.

Tab.3.1: Forecast of the household saving rate, with and without the cohort effect, 2000-2050.

Year	*Saving rate without cohort effects*	*Saving rate with cohort effects*
1995	16,3%	16,3%
2000	16,3%	16,0%
2005	16,4%	15,5%
2010	16,7%	15,3%
2015	17,3%	15,1%
2020	18,0%	15,1%
2025	18,6%	15,1%
2030	19,0%	14,9%
2035	19,0%	14,6%
2040	18,9%	14,2%
2045	18,8%	13,8%
2050	18,8%	13,7%

The table prompts two remarks:

1) *The consideration of cohort effects is very important to evaluate the impact of the demographic transition on the saving rate.* Without these effects, the saving rate in the following decades should increase by about 15%. Population ageing, contrary to what could be expected on the basis of the standard version of the life-cycle hypothesis, would raise the aggregate saving rate, owing to the high saving rate of the elderly. However, after the imputation to each generation of a specific cohort effect, the sign of the results is reversed. During the forecasting period, the generations which gradually die, and are characterised by a higher saving rate than their predecessors, are replaced by cohorts which at any given age save less than the older ones. In this case the saving rate falls from 16.3% to 13,7%, a percentage reduction of about 16%.

2) Even after allowing different cohorts to have specific saving patterns, the impact of ageing on saving is not dramatic. The saving rate changes, but much less intensely than the change in the population structure. The cause for this limited sensibility of the saving rate to population ageing lies in the high saving rates of the oldest cohorts, over the whole period observed.

[14] Results obtainable by using the non-adjusted SHIW data are not significantly different from those of Tab. 3.1.

[15] The three demographic projections (high, median and low) differ in terms of the paths of the fertility and mortality rates assumed for the future.

3.2 *Social security reform, inter-generational transfers and the saving rate.*

The low elasticity of the saving rate to population ageing seems inconsistent with the available macroeconomic empirical evidence and the predictions of the life-cycle hypothesis. Within this framework, the demographic transition produces a fall in the saving rate because the running down of wealth by those individuals who are in the last stage of the life-cycle is not compensated by wealth accumulation by the young. Evidence from the SHIW shows, however, that the elderly do not decumulate a significant portion of their wealth. The lack of wealth decumulation in the final part of life could be due to many possible reasons, for example the presence of a bequest motive, precautionary behaviour, the uncertainty about the length of life, or finally the presence of PAYGO pension systems. In this last respect, Jappelli and Modigliani (1998) show that when contributions are interpreted as a form of compulsory saving and pensions as a rent, the age profile of wealth becomes very close to the shape predicted by the life-cycle theory. In what follows, we make use of this intuition to provide an interpretation for the shape of the saving profile estimated on sample data. If, for an individual, total saving is the sum of private saving (disposable income minus consumption) and social security saving (contributions) — i.e. if contributions are considered as accumulation of rights to future consumption — then the substantial constancy of private saving in the later stage of life may depend on the characteristics of the social security system. More precisely, the growth, since the beginning of the 1970s, of a PAYGO pension system providing generous transfers to the elderly could have realised a significant inter-generational transfer of resources in favour of the generations who retired between the end of the 1960s and the end of the 1980s[16] (Castellino 1995). If the cohorts who have been favoured did not perfectly anticipate the effects of these policies on their lifetime income, their (private) saving behaviour may not have significantly changed. In this case *those who benefited from the generosity of the pension policies could have accumulated an amount of financial and real wealth greater than what would be enough to finance consumption when old*. How this wealth will be used in the future becomes of crucial importance in explaining the dynamics of private saving.

To provide an example, Fig. 3.1 shows the different profiles of real and financial wealth for a representative individual in the absence of a PAYGO system, and if it is introduced during the active phase of life. The profiles are obtained from a simple model describing the consumption and saving choices of an agent who lives for 50 years and works during the first 35. At the beginning of each period s/he decides the level of consumption on the basis of available information, preferring a constant level of consumption over time. If there is no social security system, the wealth profile has the traditional shape envisaged by the life-cycle theory, increasing during working years and then falling to zero at the moment of death. If a pure PAYGO system is introduced in the 21st year with a 15% contribution rate, the dynamics of wealth accumulation changes: private saving falls immediately after the introduction of the pension system, and the running down of private wealth during retirement is slower. The agent anticipates the greater lifetime income arising from the participation in a new pension system, which will provide more benefits than the actuarially fair amount, since the system has not yet become a regime[17].

In the graph we have distinguished two situations: i) the agent increases her/his own consumption after the introduction of the pension system: wealth goes to zero at the end of

[16] A particularly important role has been played by the introduction of the institute of old-age pensions and by the evolution of the indexation mechanisms.

[17] Situations such as that described in the graph arise after the introduction of pay-as-you-go pension systems for those generations who benefit from transfers without having paid contributions in the past, and every time the increase in pension provision is financed form contributions paid by younger cohorts.

life; ii) the agent does not consume the whole increase in lifetime income: wealth remains positive even at the end of the lifespan.

Those cohorts who are currently in retirement could be in a position similar to the last described: for many of those who are now pensioners, contributions paid during working years are a very profitable investment (Gronchi 1994), both in absolute terms and with respect to the returns available in financial markets, thanks to the generosity of the rules for the computation of contributions and benefits, and to the fact that many of them started to pay contributions in an advanced phase of their working career. If these agents did not substantially change their consumption profiles, they now turn out to have positive saving rates even in advanced ages. Thus, *the dynamics of financial and real wealth over the life-cycle depends also on the dimension of pension wealth.*

To sum up, the positive and flat saving profile in the last stage of life for those cohorts currently retired may have been caused by two factors: the generosity of pension policies during the last 30 years and the fact that the greater lifetime income transferred to the elderly was not transformed into a consumption increase of corresponding amount by the same cohorts. Further, in this case a share of the greater lifetime income can take the form of intergenerational transfers.

What could be the effect of the pension reforms of 1992 and 1995 on the saving of the various cohorts, those currently retired and those now working? In other words, what will be the effect of the reduction in pension wealth on the age profile of financial and real wealth? The reduction in future pension promises should, for a given level of contributions, determine an increase in private saving, particularly from younger cohorts, more severely hit by the pension reforms[18]. If this reaction does actually take place, we should expect an increase in the saving rate by these cohorts in the next few decades, and a reduction in accumulated saving after 2030. The reaction of those who are already retired or close to retirement should be less relevant, since the reforms have lesser consequences for them.

There are, however, some elements that may make it difficult for this scenario to take place. First, the degree of substitutability between private and social security wealth is probably low: empirical studies trying to measure it have estimated coefficients around 20%-30% (Jappelli 1995, Rossi and Visco 1995). Others (Attanasio and Brugiavini 1995; Grant, Miniaci and Weber 1998) find a greater sensitivity of saving and/or consumption to the 1992 reform, but the many peculiarities of that period suggest this evidence should be taken with caution[19]. Second, given the estimates of the stock of wealth currently owned by those who now are 55-60 or more years old, it is likely that they will end their life-cycle with significant amounts of wealth. The same cohort effects estimated in section 2.1 can be interpreted as evidence that the high social security transfers in favour of those who are now 55-60 years old have not been transformed into greater consumption but have been saved, and are now available for transfers to the younger generations: part of the contributions paid by the working generations will be, at least in part, given back to the same generations, under the form of *inter vivos* transfers or bequests.

The existence of a widespread net of inter-generational solidarity is indeed the only way to make compatible the various pieces of evidence shown in section 2 — that is, for the elderly, positive saving rates and a substantially constant private wealth profile. These two phenomena can coexist only if *inter vivos* transfers take place; further, a non-decreasing private wealth profile is compatible only with the presence of significant bequests.

[18] The effects of the pension reform are markedly different according to the year of birth of workers; in particular, there is a drastic difference among those workers who had more or less than 18 years of tenure in 1995.

[19] During 1993 there was a strong recession over the whole European continent, and in Italy a particularly heavy series of measures to correct public deficit. The fall in household consumption in that year could be more easily explained by these factors than by the first significant pension reform of the 1990s.

The effect of intergenerational transfers can be particularly strong on the currently young cohorts, since the demographic transition determines a reduction in the number of the potential beneficiaries, for each member of the old generation, of future transfers (Weil 1994). Population ageing could induce an increase in the average amount of bequests, with a consequent decline in the saving of those currently young.

Direct evidence on intergenerational transfers from the SHIW is scarce, essentially limited to a section of the 1991 survey, leading to conclusions about their importance which are opposite to one can infer from saving and wealth accumulation behaviours. We argue, however, that the available evidence on income, consumption and wealth is, particularly after the adjustments, superior in quality and quantity. A possible indication of the importance of intergenerational transfers may be deduced from an estimate where one of the explanatory variables of consumption is the fact that at least one parent of the household head is still alive. A positive sign for this variable can be interpreted as an indirect signal of the presence of expectations of future transfers giving rise to greater current consumption, or alternatively as an indication of *inter vivos* transfers, which raise the consumption of the receiving family. Using the 1995 SHIW, the coefficient of this regressor turned out to be positive and significant, even after controlling the effects of the education level of the father of the reference person (which influenced both the amount of the possible bequest and the education level of the son, and thus his permanent income) and a wide series of economic and demographic variables. Households whose head has at least one parent alive consume, on the basis of this regression, about 1 million lire more per year than the others (results in Appendix).

The uncertainty about the sensitivity of the saving rate to changes in pension wealth and the role of intergenerational transfers make it difficult to evaluate which scenario is more likely to emerge following the joint occurrence of the pension reform and the process of population ageing. We therefore provide here a series of forecasts, distinguishing two basic cases, i.e. with and without a reaction from younger generations to the fall in their pension wealth. Both cases are further examined with and without cohort effects. In the scenario with a behavioural reaction, we assume that the sensitivity of private wealth to changes in pension wealth is positive, but lower than one; in particular, we adopt as a measure of this elasticity the value of 30%, corresponding to the upper limit found by Jappelli (1995). To measure the impact of pension reform on saving in the following decades we have used the cohort-specific wealth profiles, estimated in section 2.3, and estimates of their pension wealth, before and after the two reforms of 1992 and 1995[20]. Assuming that the household has the aim of maintaining the same consumption level before and after the reforms, the constant pension benefit corresponding to the stock of pension wealth has been compared to the annual consumption flow estimated on sample data, corrected for economic growth. In each period, the difference between these two variables (plus the flow of financial income) represents annual saving. The average of the saving rates for the whole retirement period has been, for each cohort, compared with the average saving rate that would have taken place without the reform. The change in the two saving rates represents a measure of the reduction in the average saving rate for all cohorts which will retire until 2050. If S_t, $A_{i,t}$, $P_{i,t}$ [21] and $C_{i,t}$ are respectively saving, the estimated level of financial and real wealth, pension income and consumption in year t, and r is the constant interest rate, then

[20] Estimates of pension wealth and of its changes following the reform have been computed by Fornero and Ferraresi (1999). They are obtained starting from lifetime profiles of employment income, to which the pre- and post-reform pension rules have been applied. The computation routine also takes into account survival probabilities and the presence of survivor's pensions, and assumes a constant growth rate for GDP of 1.5%.

[21] The P_{it} term is obtained as the pension benefit that enables the present value of pension wealth at the moment of retirement to be reconstructed.

$$S_{it} = r A_{i,t-1} + P_{it} - C_{i,t}$$

Social security wealth (and thus P_{it}) is therefore, in this simulation, the only variable which changes following pension reforms, while variations in saving allow the household to keep consumption at the same pre-reform level. The inter-generational distribution of the costs of the pension reforms has not been uniform, particularly among those workers with 15 or more contribution years in 1995. Pension wealth falls by 30% for those cohorts born in the 1940s, and by more than 50% for those born in the 1960s. While for the oldest cohorts of workers the only effects are linked to the changes in indexation rules, for the others there is also a fall in the average value of the first instalment of pension.

On the basis of the described hypotheses and methodology, we simulated the impact of the reduction in pension wealth on saving during the period of population ageing. Results that do not consider the presence of behavioural reactions in saving are contained in Tab. 3.2.

Tab. 3.2: Demographic transition, pension reforms and saving formation (no behavioural reactions in saving)

Year	*Saving rate without cohort effects*	*Saving rate with cohort effects*
1995	16,3%	16,2%
2000	15,2%	14,7%
2005	14,5%	13,5%
2010	14,2%	12,2%
2015	14,2%	11,1%
2020	14,2%	10,9%
2025	14,2%	9,7%
2030	14,0%	9,0%
2035	13,3%	8,0%
2040	13,1%	7,5%
2045	13,2%	7,3%
2050	13,5%	7,4%

The effects of pension reforms are, in both cases, significant, and particularly strong, as before, when specific cohort effects are allowed for. In this case the saving rate halves at the end of the period. The reduction is particularly pronounced immediately after the reforms and until 2040. It then stabilises because the new pension system has reached full maturity. And pension wealth becomes the same for all cohorts. These saving profiles are constructed under the assumption that the young do not react to the changes in pension wealth, either because the elasticity of private wealth to pension wealth is actually zero, or because they rely on the inter-generational transfers implicit in the estimated age profiles of private wealth in order to keep a constant consumption level over the life-cycle. The projection in the second column of the table may thus be interpreted as a description of the case in which either private pension funds do not develop, or alternatively they develop, but other forms of saving accumulation are subject to a parallel contraction. Taking account of cohort differences, we describe a situation where active generations keep saving less than those who preceded them.

The possibility that households do react to the reduction in pension wealth with an increase in their private wealth is described in Tab. 3.3. The increase in private wealth is proportional to the fall in pension wealth, with a coefficient of 30%. Results show that, unlike the no-reaction case, the fall in the aggregate saving rate is consequently lower for all years.

In the simulation without cohort effects the saving rate falls by only one percentage point, and by seven points in the second case.

Tab. 3.3: Demographic transition, pension reforms and saving formation (with behavioural reactions in saving)

Year	*Saving rate without cohort effects*	*Saving rate with cohort effects*
1995	16,3%	16,3%
2000	15,6%	15,3%
2005	15,0%	14,2%
2010	14,9%	13,0%
2015	15,1%	12,1%
2020	15,2%	11.3%
2025	15,5%	10,9%
2030	15,3%	10,3%
2035	14,7%	9,4%
2040	14,5%	9,0%
2045	14,7%	9,2%
2050	15,0%	9,1%

4. Conclusions

This paper has studied some possible connections between population ageing and the formation of household saving. The main results can be summarised in the following points:

i) The saving rate of the elderly is always significantly positive, even after correction of the SHIW data with more reliable pieces of evidence about consumption (ISTAT survey) and the stock of financial wealth (BNL survey).

ii) In the observed period (1987-1995) the data show, for all cohorts, a strongly negative trend effect on the saving rate. For this reason the methods usually used to separate age, cohort and period effects turned out to be ineffective. Non-uniform cohort effects emerge after detrending the data: cohorts born before 1940 save, at each stage of the life-cycle, more than their predecessors, while the reverse is true for younger cohorts.

iii) Estimates of household wealth (financial and real) show a profile that increases up to the age of 60, and is thereafter substantially flat. Cohort effects are always positive. The lack of any decumulation in the stock of wealth for old ages suggests the presence of significant intergenerational linkages, which would also make compatible the age profiles of wealth and saving.

iv) In the estimation of the future dynamics of the private saving rate, the consideration of cohort effects turns out to be crucial. A simple shift-share projection produces an increase in the saving rate by 2 points of GDP owing to population ageing. On the contrary, taking account also of the cohort effects, household saving falls from almost 16% in 1995 to 13,5% in 2050.

v) Given the importance of cohort effects, we have studied the consequences on saving of the two pension reforms of 1992 and 1995, which have had different impacts on the social security wealth of the living generations. We have considered two scenarios: in the first the younger individuals (those hit harder by the reforms), do not react to the fall in their social security wealth by increasing their saving; in the second they actually increase their saving propensity to an extent consistent with the available empirical evidence about the elasticity of household saving to social security wealth. The first scenario can be justified with the ambiguous findings in the empirical literature about the relationship between saving and social security wealth, and with the likely presence of intergenerational transfers (point iii) aimed at compensating the intergenerational redistribution carried out by the pension reforms. Household saving falls in all these cases, in the worst case to 7% in 2050, and even in the case of an increase in the saving rate of young cohorts.

Appendix 1: National accounts and the life-cycle profile of saving

Against the procedure followed to adjust the original SHIW data, it could be objected that all surveys used here (SHIW, BNL, ISTAT) underestimate the corresponding national accounts averages. We then applied to the original SHIW and ISTAT data a series of coefficients to rescale the data to the national accounts. The coefficients applied to income are taken from Brandolini (1999, tab. 11), and are diversified by income source, while those for consumption stem from a simple comparison between average household consumption from the *Relazione Generale sulla Situazione Economica del paese* and the averages of the ISTAT survey, for each year. The aim is to check whether the resulting profile is different from Fig. 21. Results are shown in Fig. A1. Saving continues to be positive in the final part of the life-cycle. We repeated the analysis on these data, with very similar results in terms of age and cohort effects.

Appendix 2 : Estimation of private household wealth

Dependent variable log of private (financial (adjusted) plus real) household wealth.

	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
age	.7377468	.0425546	17.336	0.000	.6543384	.8211551
age2	-.0748451	.0148859	-5.028	0.000	-.1040219	-.0456684
age3	-.0397293	.0123047	-3.229	0.001	-.0638469	-.0156117
age4	.0068348	.0031048	2.201	0.028	.0007493	.0129203
dyear87	-.2528107	.0444104	-5.693	0.000	-.3398563	-.1657651
dyear89	-.0376791	.0372175	-1.012	0.311	-.1106264	.0352682
dyear91	-.033033	.0295545	-1.118	0.264	-.0909606	.0248947
dyear93	.0877461	.0240548	3.648	0.000	.0405979	.1348943
log(gdp)	.3912865	.1402126	2.791	0.005	.1164656	.6661074
n°child 0-5	-.033523	.0181955	-1.842	0.065	-.0691868	.0021407
n°child 6-10	-.0183062	.0176278	-1.038	0.299	-.0528572	.0162447
n°child 1117	.0164337	.0130625	1.258	0.208	-.0091693	.0420366
n°adults	.3599094	.0138715	25.946	0.000	.3327209	.387098
<=comp.educ.	-.6338396	.0171017	-37.063	0.000	-.6673593	-.6003198
degree	.476487	.0287882	16.551	0.000	.4200613	.5329127
north	.0566755	.0184741	3.068	0.002	.0204658	.0928853
south	-.3385615	.020062	-16.876	0.000	-.3778836	-.2992395
head female	-.3363148	.0202746	-16.588	0.000	-.3760536	-.296576
_cons	10.40912	.3685669	28.242	0.000	9.686722	11.13153

Number of obs = 36060; F(18, 36041) = 442.53; Prob > F = 0.0000
R-squared = 0.1810; Root MSE = 1.2985

Note: age = (age of the head – 40)/10.
In this regression year dummies are not constrained to zero.

Appendix 3: Effects of the presence of parents on children's consumption

In this last appendix we show briefly the results of an estimate of the log of household income in SHIW 1995 on a series of social and economic variables, on income and in particular on a dummy equal to 1 if at least one of the head's parents is still alive. This variable is assumed to be an indicator of possible *inter vivos* transfers or, alternatively or jointly, of the probability to receive a transfer in the future. Its sign is, as expected, positive, and implies that households with this characteristics consume on average 2.6% more than the others. The table shows only some of the coefficients. The regression was carried out with original SHIW consumption as the dependent variable because the adjustment we made is aimed at reconstructing new cohort

averages for consumption, and does not produce a satisfying correlation between income and consumption, since income was not used in the imputation. This is not a problem if we look at cohort averages, but it would become so if the aim was to study the relation between income and consumption among families belonging to the same cohort.

lc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
ly	.5487451	.0134576	40.776	0.000	.5223646	.5751255
age	.0298333	.0179288	1.664	0.096	-.0053118	.0649784
age2	-.0165541	.0117198	-1.412	0.158	-.039528	.0064199
age3	-.0004506	.011401	-0.040	0.968	-.0227996	.0218984
age4	-.0024188	.0047482	-0.509	0.610	-.0117265	.0068889
age5	.0005662	.000585	0.968	0.333	-.0005805	.0017129
genco	.0007911	.0129556	0.061	0.951	-.0246053	.0261874
gencf	.0263602	.0119489	2.206	0.027	.0029371	.0497833
educp1	-.0442523	.0243672	-1.816	0.069	-.0920184	.0035138
educp2	-.0340892	.024419	-1.396	0.163	-.0819569	.0137785
educp3	-.0169054	.0290067	-0.583	0.560	-.0737662	.0399554
educp4	.0246442	.0340908	0.723	0.470	-.0421828	.0914712
educp5	.0967304	.0404515	2.391	0.017	.0174347	.1760261
_cons	4.537307	.1421523	31.919	0.000	4.258651	4.815963

Number of obs = 7947; F(34, 7911) = 282.16; Prob > F = 0.0000
R-squared = 0.7257; Root MSE = .29393

ly = logarithm of disposable income (adjusted).
genco = 1 if at least one of the partner's parents is alive.
gencf = 1 if at least least one of the head's parents is alive.
educp1-educp5 : dummies for increasing levels of the head's father (alive or not).

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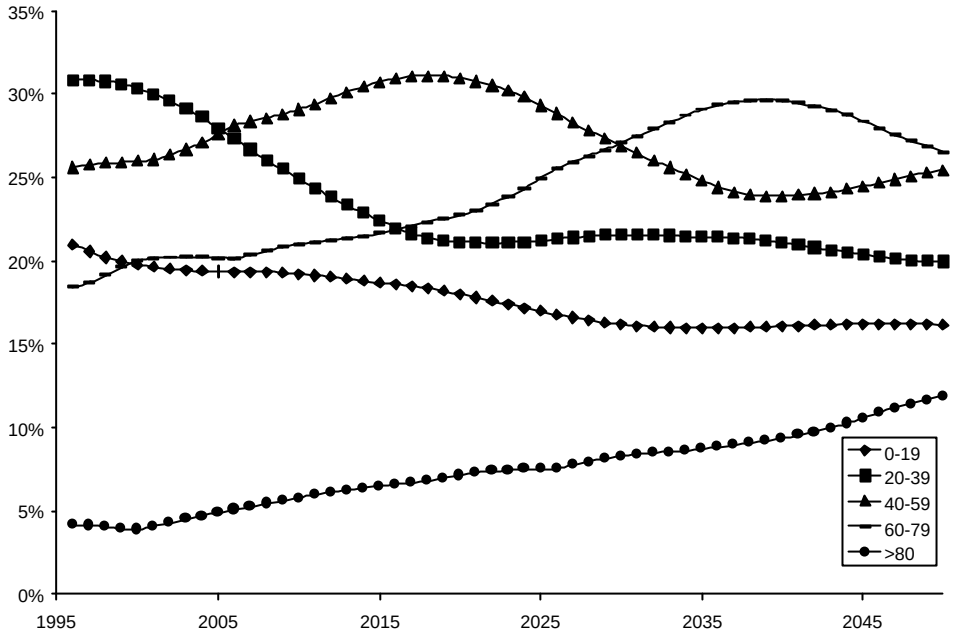

Fig. 1.1: Demographic transition and population shares

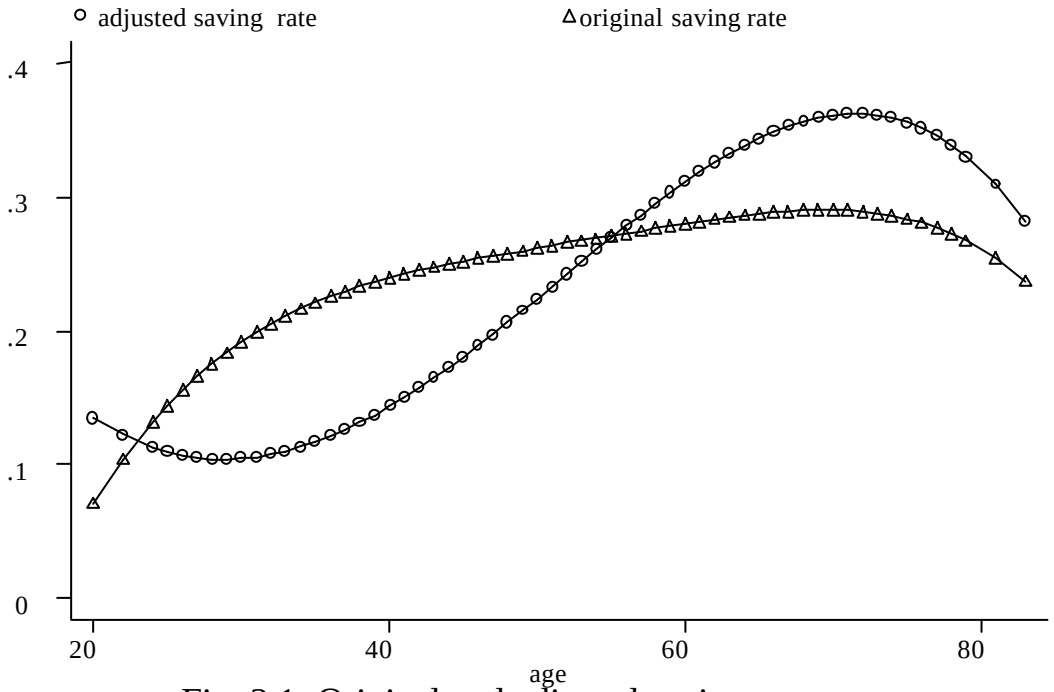

Fig. 2.1: Original and adjusted saving rate

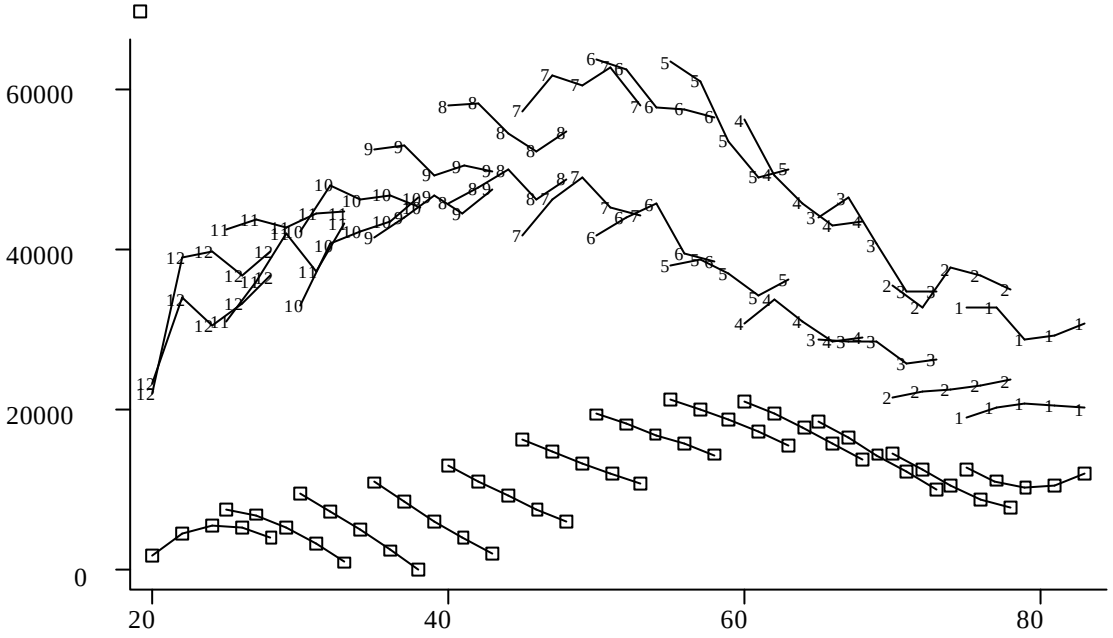

Fig.2.2: Average income, consumption and saving by cohorts

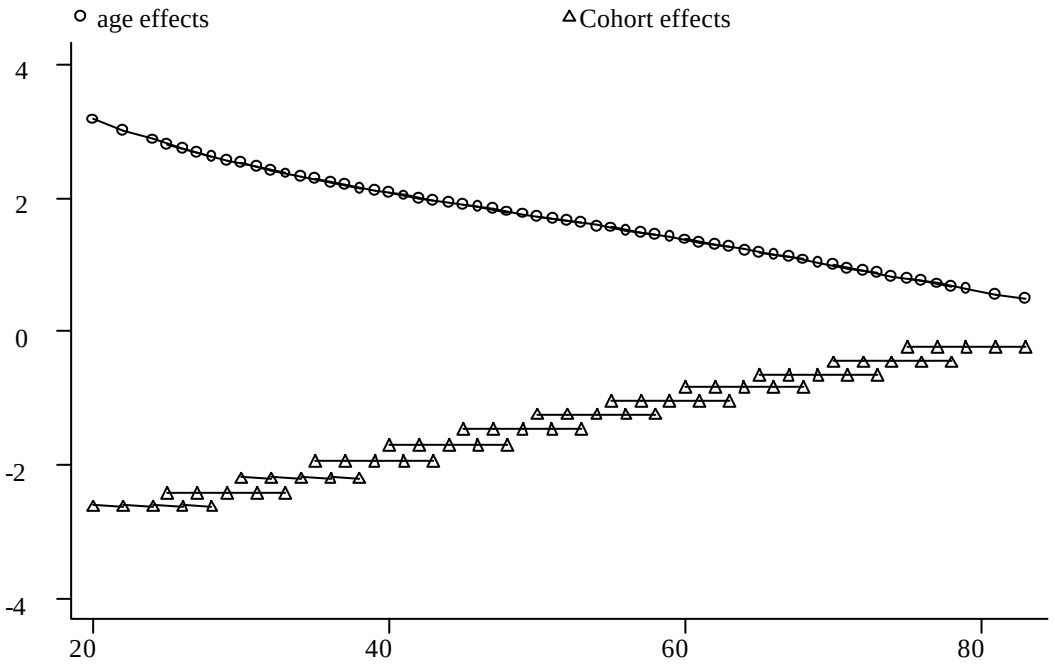

Fig.2.3: Age and cohort effects with restricted year dummies

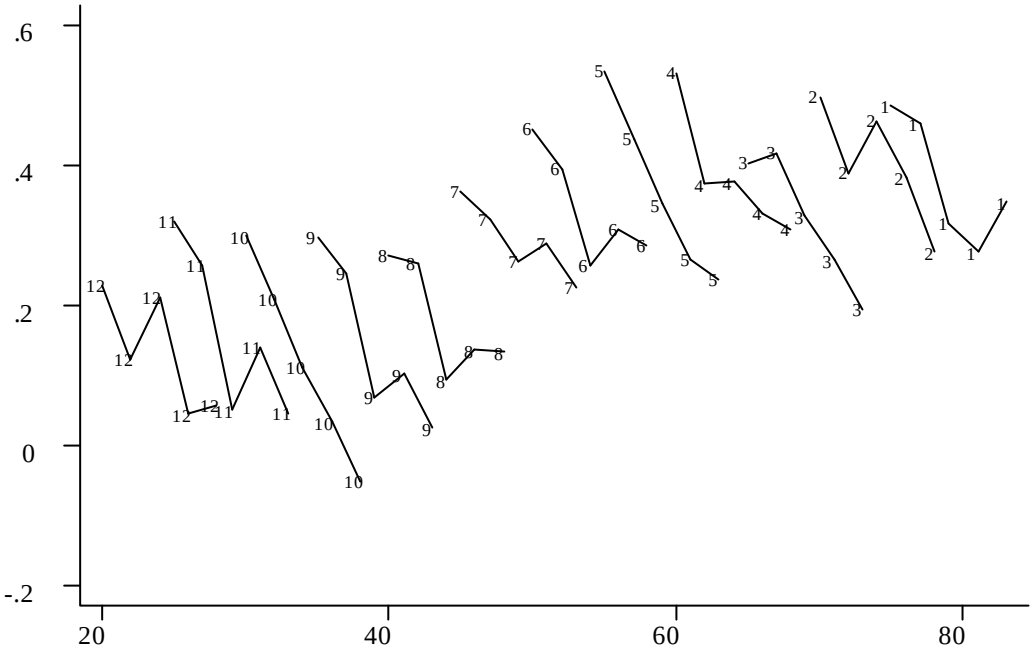

Fig.2.4: Saving rate by age and cohorts

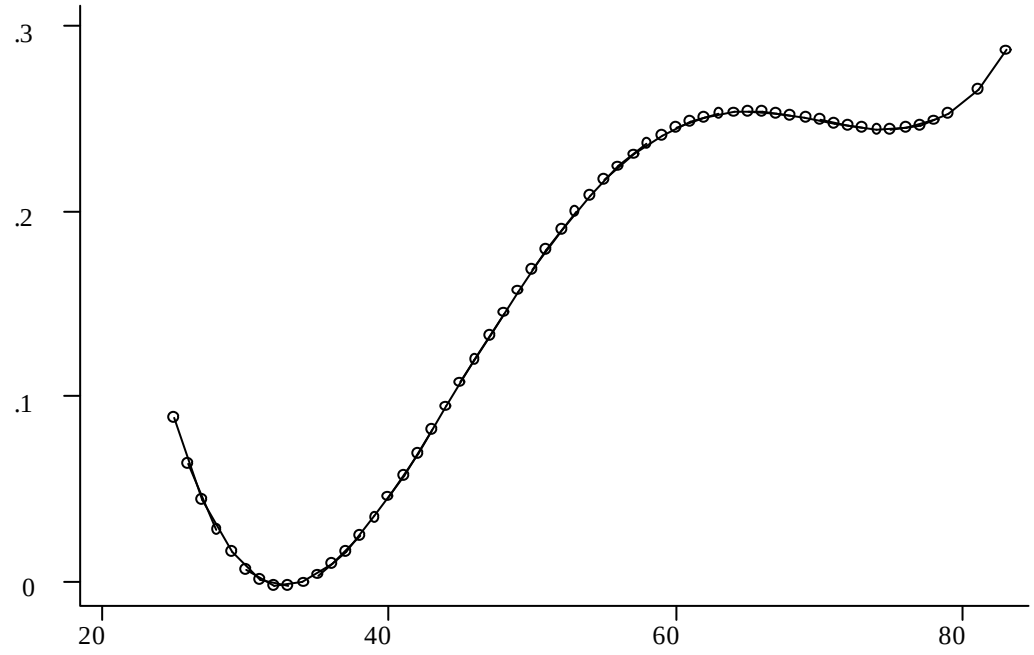

Fig.2.5: Saving rate without cohort dummies

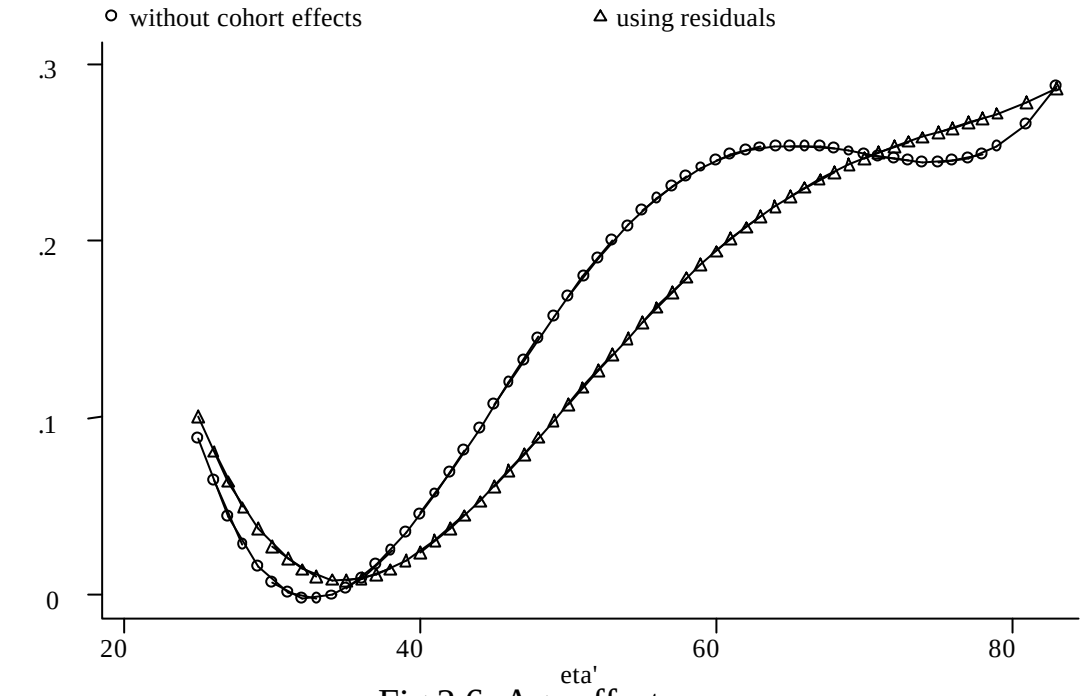

Fig.2.6: Age effects

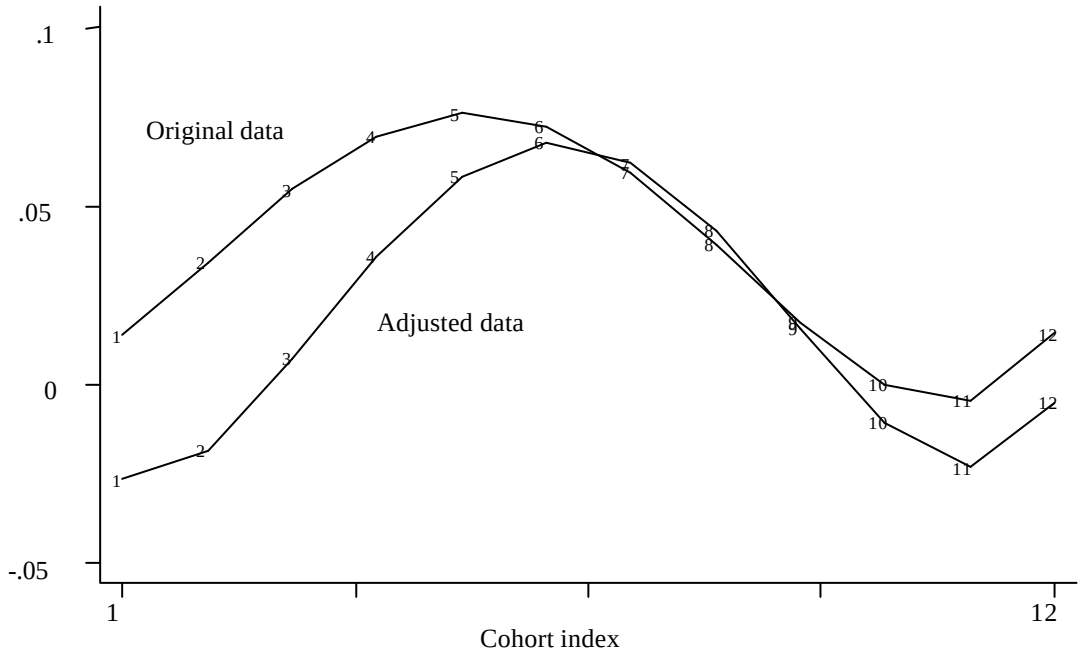

Fig.2.7: Cohort effects

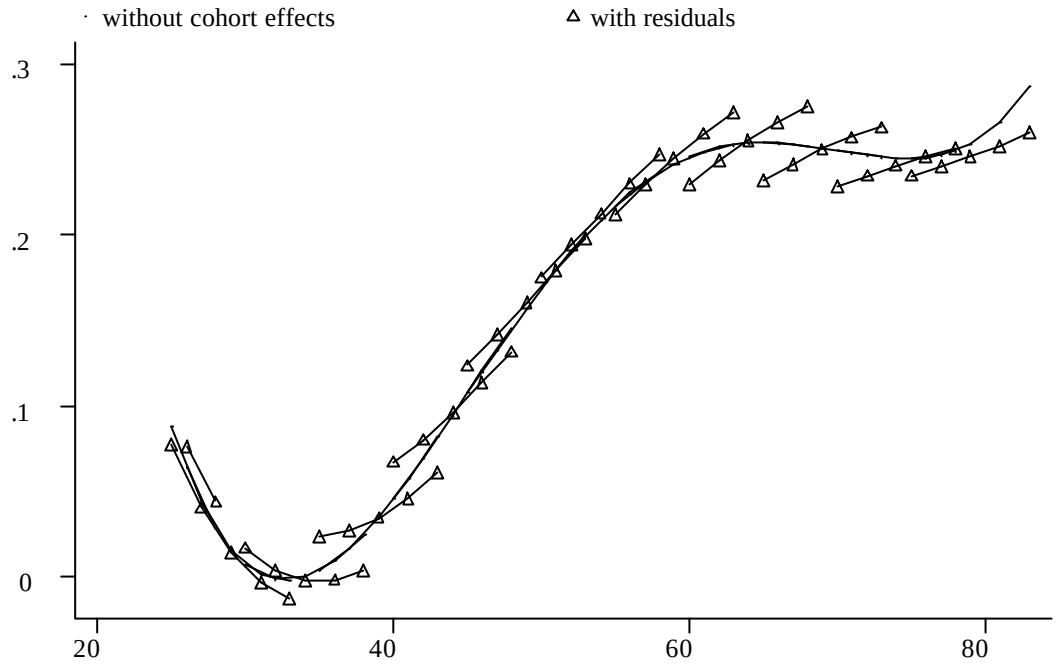

Fig.2.8: Life-cycle profile of the saving rate

Fig. 2.9: Variations in the saving rate by cohorts

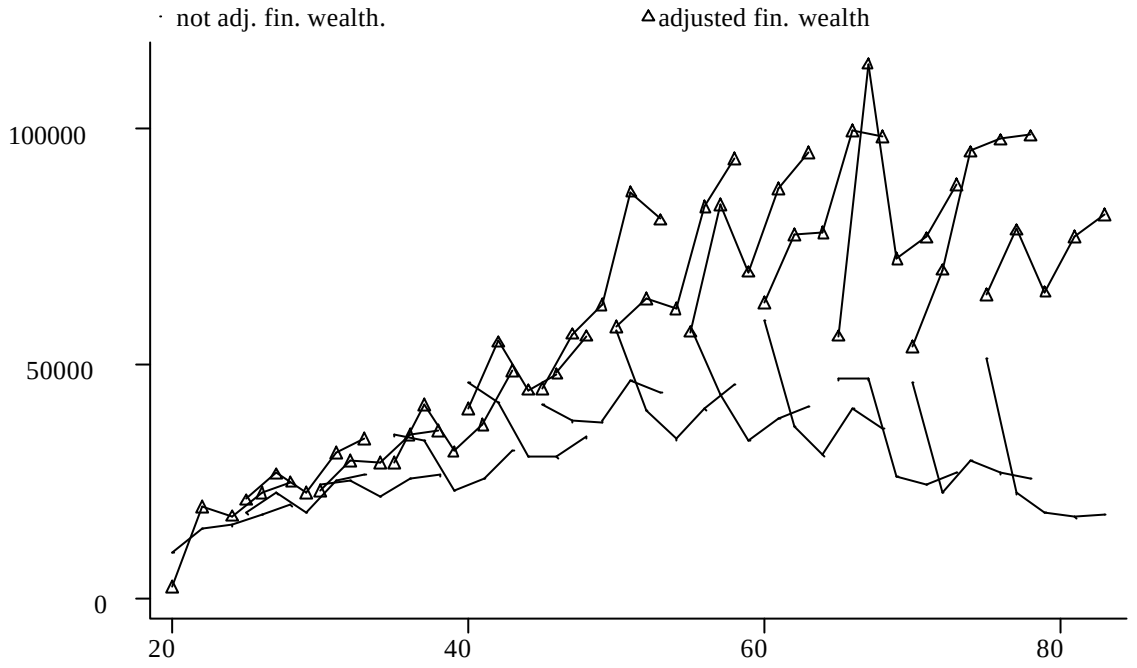

Fig. 2.10 Effects of the adjustment of financial wealth

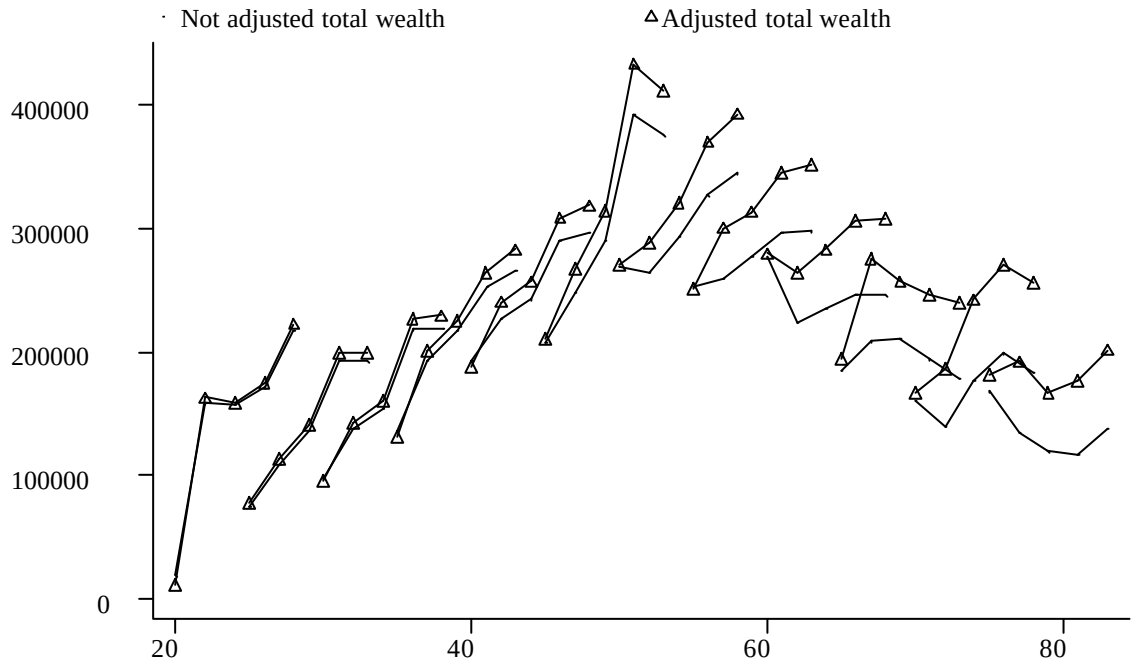

Fig. 2.11: Private Wealth

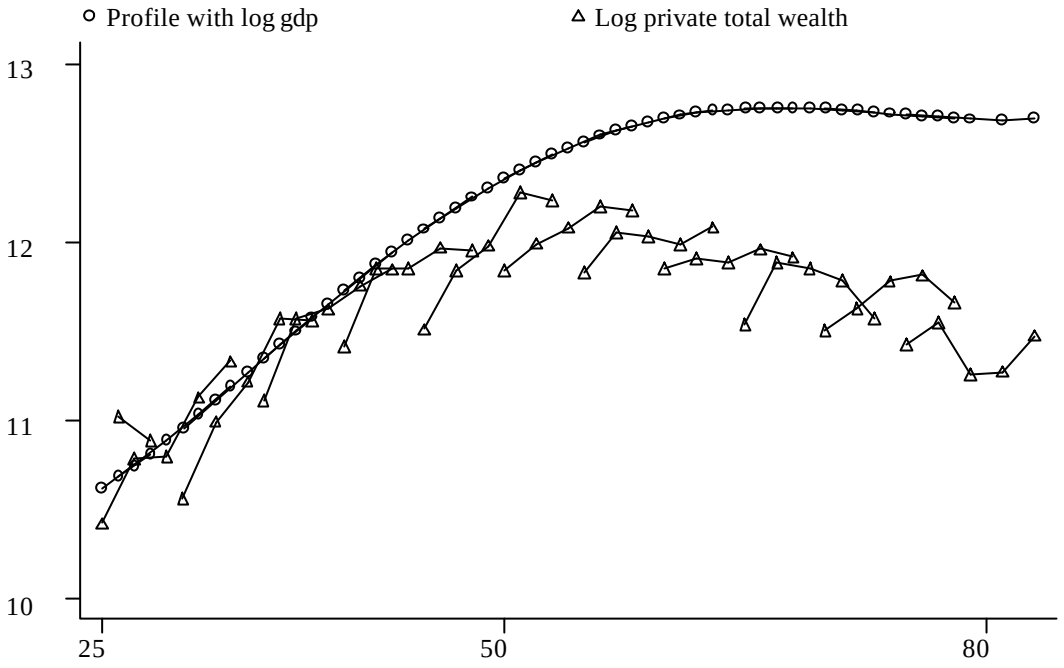

Fig. 2.12: Life-cycle profile of private wealth

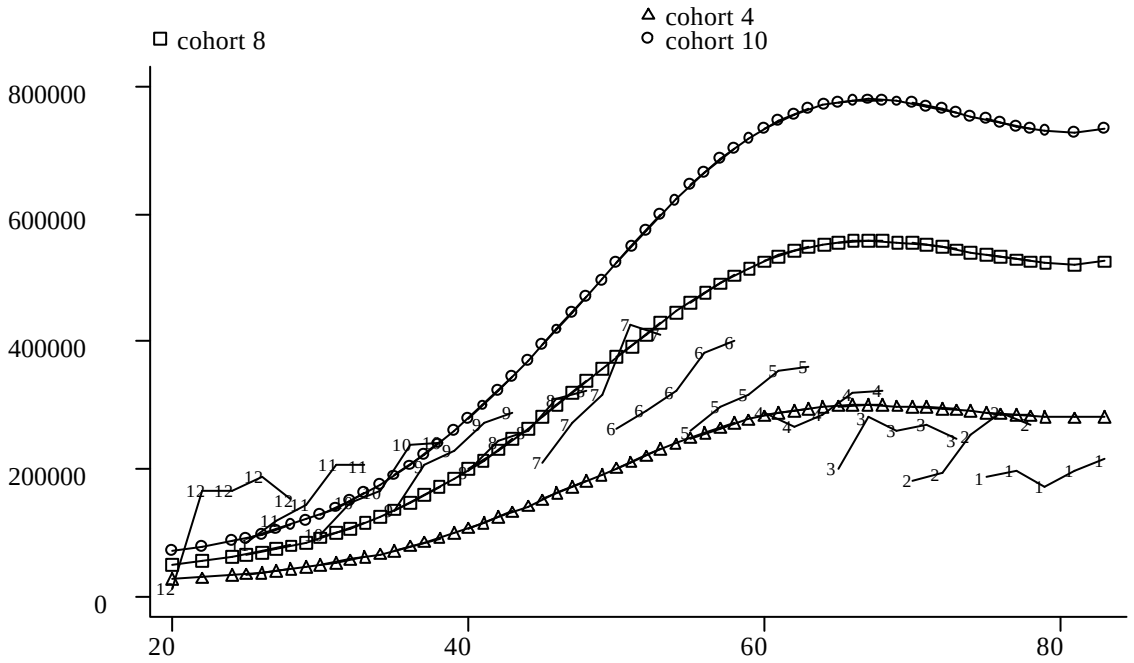

Fig. 2.13: Private wealth accumulation for some cohorts

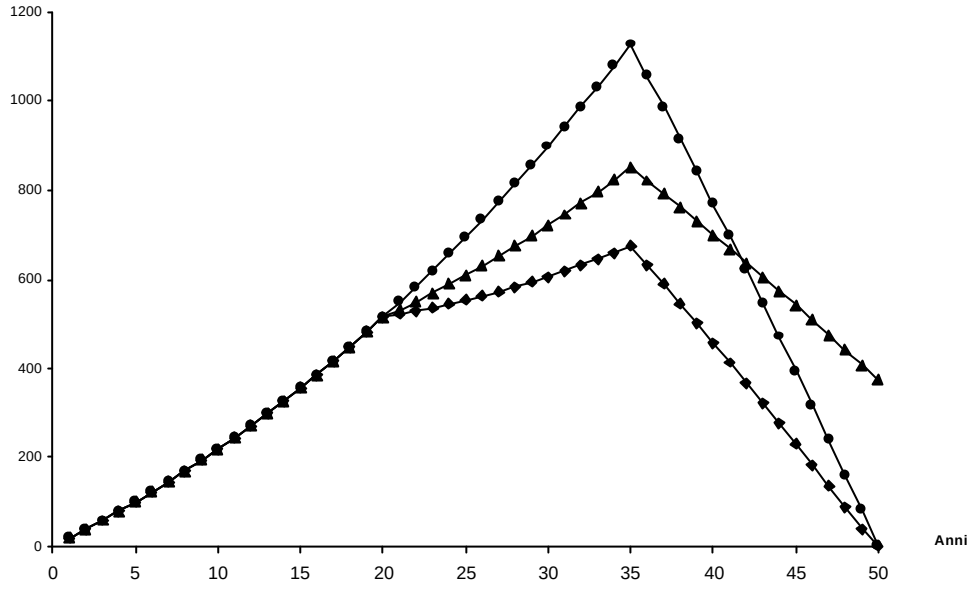

Fig. 3.1: Evolution of financial plus real wealth over the life-cycle

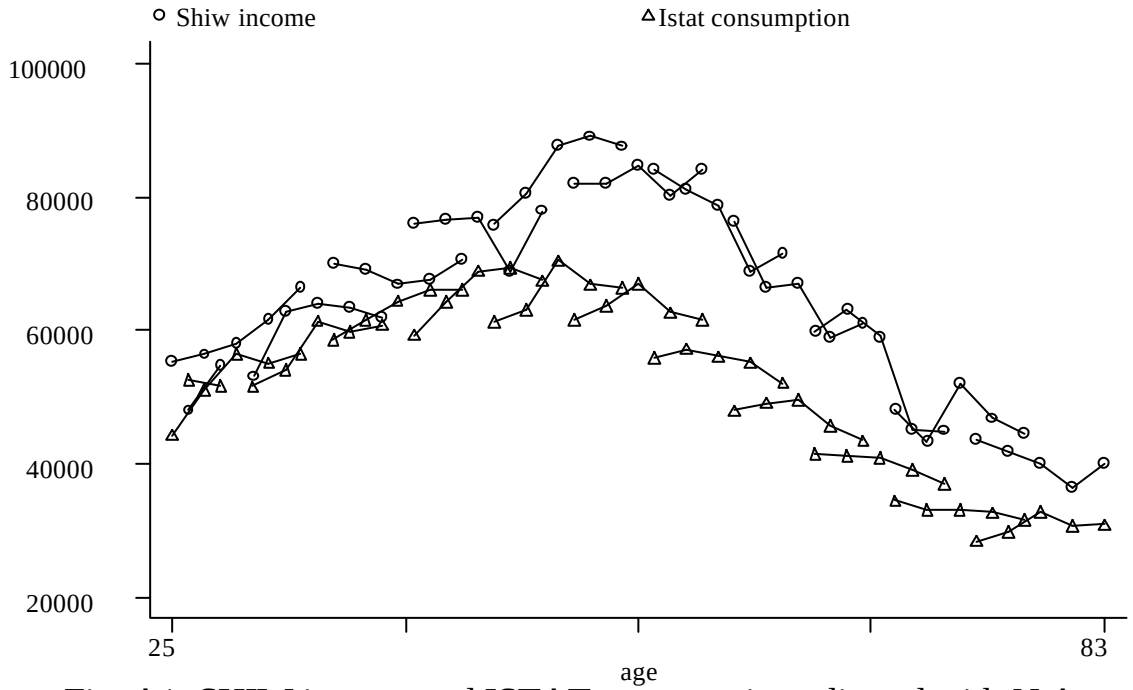

Fig. A1: SHIW income and ISTAT consumption adjusted with N.A.