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Tullio Jappelli* and Franco Modigliani**

Abstract

The Life-Cycle Hypothesis posits that saving should be positive for households in their working span and negative for the retired ones, and wealth therefore should be hump-shaped. Yet, if one looks at the microeconomic evidence on saving by age, dissaving by the elderly is limited or absent. The measures of saving generally used in previous tests are based on a concept of income that does not properly take into account the role of mandated public pension arrangements, to wit, disposable income. This measure treats pension contributions as taxes, and pension benefits as transfers. In reality, contributions represent an accumulation, or saving, designed to provide for post-retirement income in the form of a pension. That contribution should therefore be recognized as (mandatory) allocation of income to life cycle saving. Accordingly, pension contributions should be added back to disposable income and to discretionary life cycle saving. Similarly, pension benefits accruing to the retired do not represent income produced, but a drawing from the pension wealth accumulated up to retirement. We use Italian repeated cross-sectional data from 1989 to 2000 to show that when this adjustment is performed, saving and wealth over the life cycle exhibit the characteristic hump shape implied by LCH, and that the adjustment also contributes to an understanding of the saving behavior of the elderly.

Keywords: Keywords: Saving, Wealth accumulation, Life-Cycle Hypothesis
JEL classification: E21

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Table of contents

1. Introduction

The Life-Cycle Hypothesis posits that the main motivation for saving is to accumulate resources for later expenditure and in particular to support consumption at the habitual standard during retirement. According to the model, saving should be positive for households in their working span and negative for the retired ones, and wealth therefore should be hump-shaped (Modigliani, 1986). Yet, if one looks at the microeconomic evidence on household saving rates by age, dissaving by the elderly is seldom observed.

To take just one example, in the introductory essay of a collection of country studies on saving, Poterba (1994) reports that in virtually all nations the median saving rate is positive well beyond retirement, concluding that "the country studies provide very little evidence that supports the Life-Cycle model." Based on the country studies, Poterba also reports that the median saving rate in the age class 70-74 is 1.1 percent in the United States and 6 percent in Canada; and in Italy and Japan for those aged 65 and older it is even higher.

These figures are inconsistent not only with the elementary version of the LCH, but also with more elaborate versions. In its basic formulation, the LCH posits that saving behavior is forward looking and driven by the desire to prepare for future expenditures above later income throughout life. The main foreseeable event in one's life is old age and retirement. At this time earned income may be expected, on average to dwindle to a level well below active life consumption. This implies that an essential observable implication of the LCH is the existence of phases of life – notably during the retirement period – when consumption tends to exceed earned income financed by negative saving in the form of a reduction in wealth accumulated in the earning span. Refinement of the standard model, allowing for uncertainty, precautionary saving and accidental bequests may affect the age after which one should start observing wealth decumulation. It does not, however, affect the main implication of the theory that individual wealth should eventually tend to fall with age, with saving becoming prevailingly negative. Thus, the widely reported positive saving rates at old ages are interpreted as a strong contradiction of the LCH, and as consistent only with alternative behavioral models of saving. The following are some examples: models in which irrational consumers make no preparation for retirement and cannot draw on previously accumulated assets or do not need to draw thanks to a government handout; or models in which saving is driven by the widespread imperative to leave a large bequest.

In this paper we demonstrate why these tests throw no light whatsoever on the empirical relevance of the LCH, and are at best a test of a mockery of that hypothesis. A simple explanation for this error, is that individuals have forgotten that there are multiple ways of defining income and consumption, and hence numerous ways of measuring saving, which is essentially the difference between the two.

To illustrate, one may define income as total output, nominal or real, personal, private or national, gross or net of depreciation, gross or net of various kinds of government levies, and so on which produce a dozen measures of a country's saving. Surprisingly enough, the above authors have failed to ask themselves which of these many concepts are relevant for a test of the LCH. They have thus failed to realize that there is only one concept that is appropriate: anyone who understands the spirit of the LCH – consumption smoothing in the face of the life cycle of earned income – will agree that the appropriate concept of income is *earned family income (net of personal taxes) less family consumption.*

This is the measure of income (and saving) that will be used in our tests. In other words for testing the LCH, saving must be defined and measured to include any portion of current earned income that is not consumed, but is used to provide purchasing power for later expenditures, such as retired consumption. Therefore that part of the pay that is allocated to a pension plan – private or public, voluntary or mandated – and contributes to support later consumption must be included in saving in any test of the LCH. On the other hand pensions are not currently earned income but the counterpart for past income; they are paid out of accumulated past contributions and must be excluded from income in computing saving.

By contrast the authors we have criticized have routinely relied on the customary measure of saving used in the National Income Accounts, namely Disposable Income minus consumption, labeled Personal Saving. This definition differs from ours in that it endeavors to measure "cash income," and not income earned. It excludes from income and saving all contributions to Public Pension institutions. Although part of the workers pay, they are generally not received in the form of cash. Pensions, rather, are paid in cash and hence are included in disposable income and saving, although they are not part of the current pay, or income produced.

It is obvious that the concept of cash income is not only irrelevant, but also highly misleading. What comes to be subtracted and added from earned income to arrive at disposable income has the effect of "flattening out" the original path of the variables into an

NIA path, which *cuts off from the age profiles of earned income, saving and wealth*; *the very humps* the life cycle paradigm is all about.

In most developed countries, disposable and earned income can thus be expected to exhibit a quite different life path. Using Italy as an example, we will demonstrate these propositions. Italy is admittedly an extreme case with pension contributions in excess of 30 percent and inordinately high replacement rates. But the subtractions and additions are very large in developed countries, in particular in Western Europe. It is not surprising, then, that the other authors find little life cycle left in their NIA measure and that, using the correct measure of family earnings, saving and wealth, the bumps return with a vengeance.

2. Definitions, measurement and relation to earlier work

We implement appropriate definitions and measures of income and saving to Italian repeated cross-sectional data. In particular, income will be measured as earned income (labor plus property income) net of personal taxes. By subtracting consumption we get the relevant measure of total family accumulation, which we call *total* (*household*) *saving.* This quantity in turn can be broken down into two components:

- Contributions to pension plans less pensions received, which for practical purposes in Italy consist only in contributions to and from Social Security and are therefore referred to as *mandatory saving*.

- The difference between total and mandated saving, which we label personal or *discretionary saving.* This component coincides with the NIA "Personal Saving" and with the concept erroneously used in earlier tests.

Central to our analysis is the proposition that (net) contributions to pension plans are to be regarded as a component of total saving, because, like any other type of life cycle saving, they constitute a portion of current income that is not consumed, but used to build up reserves for later consumption. One might challenge this point of view on the ground that true saving should result in an increment in national wealth or capital. Yet, in many public pension systems – notably those that rely on pay-as-you-go financing – there is no connection

between contributions and national saving. To answer this objection one must understand the relation – and interaction – between various saving flows, private and public.

Consider first the relation between mandated saving, discretionary saving, and their sum, total saving. This interaction has been the subject of pioneering contributions of Munnell (1974) and Feldstein (1976) through the "extended life-cycle model." They pointed out that pension wealth should be counted as part of individuals' resources, and argued forcefully that the transition to a social security regime would affect discretionary saving. In fact, if the LCH is correct in asserting that total saving is controlled by a target accumulation to support retirement, one might conclude that social security and discretionary wealth (or saving) should largely offset each other. This offset is what the above authors call the substitution effect − pension saving crowding out discretionary saving. But they go on to point out that this effect might be well below one-for-one because of the induced retirement effect: the provision of social security pension facilitates earlier, longer retirement, which in turn tends to raise target wealth and saving.

Since these contributions, many authors have estimated pension wealth with microeconomic data and provided age-breakdowns; to name just a few, Blinder, Gordon and Wise (1983) and Gale (1998) for the US, King and Dycks-Mireaux (1982) for Canada, Alessie, Kapteyn, and Klijn (1997) for the Netherlands, and Jappelli (1995), Attanasio and Brugiavini (2003) and Jappelli, Padula and Bottazzi (2003) for Italy. Several studies also tried to estimate the impact of mandated wealth on discretionary wealth, and the prevailing conclusion is that the former does tend to reduce the latter, but the effect is well below one-for-one; in fact the reduction is generally less than 1/2. This result, however, may reflect not only the retirement induced effect, but also other effects, such as ignorance or concern that in the end the social security system may be unable to deliver on its promises. Whatever the reason, the implication is that social security contributions may well result in significant increase in total household wealth, and of retirement wealth in particular.

As for the relation between personal saving and national saving, the key point is that national saving is the sum of private and government saving and so the relation depends on what happens to government saving. That, in turn, largely depends on the way pensions are financed. If they are financed by the traditional *funded* system, then the total saving is invested directly or indirectly in productive capital; thus the mandated contribution might well *increase* national saving by some fraction of the contribution. On the other hand, one can

readily verify that under an ideal pay-as-you go system the social security contributions will have no effect on national saving. This is because while they increase private saving and wealth, they are offset by an equal government deficit. The situation is similar to what happens when the private sector uses some of its saving to buy newly issued government debt, and the proceeds are then used to cover a current account deficit.

The exercise we perform in this paper is related to the intergenerational accounting framework proposed by Auerbach, Gokhale and Kotlikoff (1991) who aim to measure how much existing generations can be expected to pay to the government over their remaining lifetimes. Generational accounts provide measures of cohort-specific receipts and payments that can be used to evaluate the intergenerational redistributive impact of fiscal policy. Our focus here is primarily the computation of cohort-adjusted mandatory saving age profiles implied by the current pension arrangements. Other kinds of transfers, such as medical payments, are of course important, but are neglected in the present analysis.

Some researchers have already recognized that total saving should be estimated as the accumulation of total wealth, including pension wealth.[1] The earliest attempt is Bosworth, Burtless and Sabelhaus (1991), who compute various saving definitions to data from the US Consumer Survey. In one of their calculations, they show that with the pension adjustment the saving rates of households aged 64 plus falls from 11 to −4 percent (their adjustment refers to private pension funds but excludes social security wealth).

More recently, Gokhale, Kotlikoff and Sabelhaus (1996) report US propensities to save out of two definitions of income. *Conventional* disposable income is the sum of labor income, capital income, and pension income less taxes. *Alternative* disposable income classifies social security contributions as loans to the government, and social security benefits as the repayment of principal plus interest on past social security loans, less an old age tax. They find that the propensity to save is negative in old age, and much lower when using the alternative definition (Figure 10, p. 346). They also stress that any test of the LCH should not rely on income flows, which are based on questionable definitions, but rather focus on the propensity to consume out of total resources (the sum of discretionary, pension and human

[1] When measuring the aggregate saving rate, defining saving as earned income minus consumption or as disposable income minus consumption does not make a great difference. Gale and Sabelhaus (1999, Table 2) adjust NIPA figures for the United States and point out that adding net saving in federal, state and government retirement plans raises the aggregate saving rate by less then 1.5 percentage points over the entire 1960-98 period. The reason is that government pension saving is fairly stable and that in the aggregate mandatory contributions largely offset mandatory benefits.

wealth). It is an implication of the LCH that the propensity to consume out of total resources should be increasing with age, an implication that is supported by their Figure 9 (p. 345).[2]

In Section 3 we present the dataset, which is drawn from the 1989-2000 Survey of Household Income and Wealth (SHIW), a total of six cross-sections, each of which is representative of the Italian population. These data contain information not only on flows of income, consumption, pension contributions, and pension benefits, but also on the stock of wealth held by the respondents. This enables us to construct age profile of measures of assets corresponding to the three saving flows. The survey provides direct information on the wealth accumulated through personal or discretionary saving, which we label *discretionary wealth*. We construct a measure of accumulation through social security (*mandated or pension wealth*) from statutory information about contributions, imputed rate of return (growth), replacement rates, retirement age, and life expectancy. Finally, by summing the two measures, we obtain our estimates of the life profile of total wealth.

The estimate of the life cycle of wealth and its component is of interest in terms of testing whether they are hump shaped. In addition they can be used for an interesting test of the internal consistency of saving and wealth data, based on the consideration that saving should result in a corresponding change in wealth. We can thus compare the life cycle path of each component of saving with the change in the corresponding stock.

In the next two sections we report the two independent estimates of the age-profile of saving implied by our cohort data. In Section 4, we first estimate the age-profile of discretionary wealth, pension wealth and total wealth. From these estimates we derive for each component an estimate of the age profile of saving by taking the increment in wealth from one age to the next. In Section 5, for each component we report the age-profile of saving measured, in the standard fashion, as the difference between the relevant measures of income and consumption flows. We find that for two concepts of saving – total and pension saving – the change in wealth and the flow measure are reasonably similar and consistent with the LCH. However, in the case of discretionary accumulation, the two measures show surprising discrepancies.

[2] It should be noted that their study is based on an unusual and questionable attribution of resources to individuals, not households, which is an approach that rests on a number of assumptions. First of all, that households are a veil for the individuals who live in them. Second, that there are no public goods within the family. Finally, that there are no economies of scale in consumption.

In Section 6, we discuss various reasons why saving estimated from flow data may differ from the change in wealth. By relying on previous studies and other cross-sectional data, we gain significant insight into the puzzle, although we fall short of a full understanding. In Section 7, we discuss the implications of the estimated age-saving profiles for the importance of bequest motives and for the evaluation of the research on the saving behavior of the elderly. Section 8 concludes.

3. The repeated cross-sectional data

It is well known that age profiles of individual variables like income, consumption, or wealth cannot be estimated using cross-sectional data in a developing economy. This is because in such data the age effect is confounded with "cohort" effects – older people come from an earlier cohort - and different cohorts frequently have different experiences and resources; e.g., with steady technological progress, older cohorts are life cycle poorer than younger ones.

It is only with panel data that one can track individual saving and wealth trajectories over time. But in Italy and many other countries this tracking is not feasible for lack of long panel data with data on assets, income and consumption. If they are available, repeated cross-sectional data can partly overcome their absence. Although the same individual is only observed once, a sample from the same cohort is observed in a later survey, so that one can track the income or consumption not of the same individual, but of a representative sample of individuals of the same cohort.

We use a time-series of cross-sections of Italian households spanning the 1989-2000 period to control for cohort effects, and to estimate age-profiles of consumption, income, saving and wealth. The noteworthy characteristic of our dataset is that it contains separate information on income and consumption flows and on wealth, from which alternative measures of saving can be constructed and compared.

The survey we use is the Bank of Italy SHIW (Survey of Household Income and Wealth). The purpose of this survey is to provide detailed data on demographics, consumption, income, and households' balance sheets. The data set used in this study includes seven independent cross-sections (1989, 1991, 1993, 1995, 1998 and 2000), for a

total of almost 50,000 observations. The Appendix describes the main features of the survey. Brandolini and Cannari (1994) and D'Alessio and Faiella (2002) report further details.

To gauge the quality of the data, it is useful to compare the SHIW measures of saving and wealth with the national accounts. Table 1 indicates that the SHIW measure of saving is substantially higher than the national account measure in all years. This is because income in the SHIW is more accurately reported than consumption. Furthermore, the national accounts saving rate declines substantially over time, while the saving rate estimated with microeconomic data is rather constant between 1989 and 2000.[3] Finally, the SHIW wealth-income ratio is generally higher than the national accounts estimate, although in this case the difference between the two is less systematic.

Brandolini and Cannari (1994) report that disposable income is under-reported by 25 percent with respect to the national accounts data, while consumption is under-reported by 30 percent. An identifiable measurement error can therefore partly reconcile the level of the aggregate saving rate with the one obtained from the microeconomic data. This should be kept in mind when evaluating the saving profiles in the next sections, especially when we compare the saving profiles obtained as the difference between income and consumption with those obtained by first differencing wealth.

Households headed by persons older than 80 or younger than 25 (regardless of year of birth) are excluded from our analysis. These exclusions are motivated by concern over two sources of potential sample bias. The first arises from the mortality problem. As a rule, surveys only elicit information from individuals who are alive at the time of the survey. Surveys therefore miss information on the fraction of the cohort that was alive at the time of one survey, but died before a later wave. The seriousness of this problem is demonstrated by the fact that we have no ground for believing that the survivors are an unbiased sample of those who were alive at the last interview. It is well known that survival probabilities tend to be positively correlated with wealth, which implies that the non-survivors will tend to have lower income and wealth than the survivor sample. The proportion of non -survivors rises

[3] The decline in the aggregate saving rate is not peculiar to the 1989-2000 period, but follows a trend starting just after the period of high and sustained growth of the fifties and sixties. In previous work (Modigliani and Jappelli, 1990) we emphasize that the reduction in productivity growth is the main factor explaining the trend decline in the Italian saving rate, particularly after the 1973 oil shock. Rossi and Visco (1995) argue that the accumulation of social security wealth due to the transition to a pay-as-you-go social security system and the increasing generosity of the system also explain a substantial portion of the fall in household saving. Other explanations focus on the reduced need for precautionary saving due to the increased availability of social insurance schemes.

with age: e.g., for Italy, between age 60 and 64, it reaches 5 percent for women and 11 percent for men. However, once we reach the age class 80-84 it rises to some 30-40 percent. Clearly the information obtainable from survivors over 80 cannot be regarded as representative.

The second source of potential bias is a correlation between wealth and young household heads peculiar to our sample. In Italy, young working adults with independent living arrangements tend to be wealthier than average, because most young working adults live with their parents.[4] For instance, the fraction of income recipients below 30 years of age is about 20 percent, while the fraction of household heads in that age bracket is less than 10 percent. Excluding observations whose data was missing for consumption, income or wealth, our final sample consists of 46,945 households.

We use the repeated cross-sections to sort the data by the year of birth of the head of the household. The first cohort includes all households whose head was born in 1910,. The second includes those born in 1911, and so on up to the last cohort, which includes those born in 1974. We then create 334 age/year/cohort cells. The average cell size is 136; the minimum is 21, and the maximum 218. As with other survey data, the saving and wealth distributions are skewed, and means may not adequately characterize the age-wealth or the age-saving profiles. We therefore rely on the median as measure of location and on median regressions for econometric analysis.

4. Estimates of saving age profiles with wealth data

Figure 1 offers fundamental insights into the process of wealth accumulation, plotting the median discretionary wealth of 11 cohorts. Discretionary wealth is the sum of financial and non-financial assets, net of liabilities. To make the graph more readable, we plot only the wealth of selected cohorts. The numbers in the graph refer to the year of birth, extending from 20 (individuals born in 1920) to 70 (individuals born in 1970). Except for the youngest and the oldest generations, each cohort is observed at six different points in times, one for each cross-section. The cross-sections run from 1989 to 2000. Thus, each generation is observed

[4] Reasons for such behavior include mortgage market imperfections, which prevent young households from borrowing (Guiso and Jappelli, 2002).

for 11 years with each line being broken (for instance, cohort 20 is sampled 6 times from age 69 to age 80).

Following retirement, median wealth falls for most cohorts. This fact is more evident in Figure 2, where we plot the wealth profile for cohorts sampled in old age (again, to make the graphs more readable, we consider only cohorts born in even years). Although some cohorts exhibit an increase in discretionary wealth between age 60 and 65, wealth declines considerably at the oldest ages.

Figures 1 and 2 also clearly show the presence of cohort effects (the broken lines for younger cohorts tend to lay above those of the older ones). Time effects also affect the data. For instance, the wealth of several cohorts increases in 2000, reflecting either measurement errors or common business cycle shocks.[5]

In the absence of uncertainty the LCH implies that the shape of the wealth profile depends on age, regardless of resources, while lifetime resources, regardless of age, set the position of the profile. Introducing a positive real interest rate or more realistic earnings profiles does not change this basic implication of the model.[6] Therefore, one way to combine the information contained in Figure 1 in a framework that is consistent with the LCH is to assume that the shape of the age-wealth profile is the same for each cohort, and that its level depends on cohort-specific intercepts, which primarily reflect differences in productivity across generations.

With uncertainty, macroeconomic shocks lead to revisions in households resources, and therefore in assets accumulation. Measurement errors can also generate disturbances to the wealth equation. However, it is well known that the separate effects of age, cohort, and time cannot be identified.

One possibility is to rule out uncertainty and measurement errors and eliminate all year dummies. Deaton and Paxson (1994) adopt a slightly less restrictive approach and assume that the year dummies sum to zero and are orthogonal to the time trend. This is equivalent to assuming that all trends in the data can be interpreted as a combination of age and cohort effects and are therefore, by definition, predictable. The time effects then reflect additive

[5] Two macroeconomic episodes characterize our sample period. The economy went into a recession in 1991-93. Afterwards the economy began a mild recovery, with the growth rate picking up in 2000.

[6] One should keep in mind that wealth accumulation also depends on households' preferences, the interest rate, the life-cycle variation in household size and composition, and the rules governing retirement. Additional control variables (such as education, gender or region of residence) do not change the qualitative results in the next sections.

macroeconomic shocks or the residual influence of non-systematic measurement error. It is important to keep in mind that this normalization of time effects rules out time-age or time-cohort interaction terms.

The wealth equation is estimated on 334 age/year/cohort cells. Given the structure of our sample, the regressors include 55 age dummies, 64 cohort dummies, a set of restricted time dummies, and a constant term. Under the assumptions described above, the estimated dummies can be interpreted as an individual age-wealth profile, purged from cohort effects, while the cohort dummies can be interpreted as the cohort (or generation) effect. All other estimates and profiles reported in the paper are constructed in similar fashion.

For illustrative purposes Figure 3 plots the estimated coefficients on each of the 55 age dummies and a smoothed profile obtained by fitting a third-order polynomial to the original coefficient estimates. In Figure 3 discretionary wealth rises until age 60, the peak retirement age in Italy. It then declines slowly, but remains substantial even in old age.

Figure 4 plots the estimated cohort effect in wealth - that is, the coefficients of the 64 cohort dummies. Even though the estimated coefficients exhibit some noise, the smoothed profile is remarkably stable, increasing by about 1 thousand euro per year of birth. The most natural explanation for the shape of the cohort effect is that it reflects the increase in productivity (and therefore resources) of each successive generation.

In Figure 5, we plot pension wealth and total wealth, the sum of discretionary and pension wealth. Pension wealth is the difference between the discounted values of social security benefits and contributions.[7] Constructing pension wealth thus requires assumptions about expected benefits and expected contributions, since they depend on projected income, demographic trends, and future legislation. The concave shape of pension wealth is not surprising, since the pension system collection and payment are designed to be an imitation of the LCH saving and dissaving.

Total wealth is also hump shaped, rising to a peak of around 250 thousand euro at age 60, and then declining during retirement. By taking first differences of the estimated wealth and of its components at successive ages we can obtain a picture of the age profile of the

[7] Since the fraction of Italian households that contributes to private pension funds is tiny, they can be safely neglected. The 1995 pension reform of the social security system implements gradual changes in eligibility rules, accrual rates and pension age. Our estimate of social security wealth abstracts from these institutional details. It provides a rough estimate of expected contributions and benefits whose main purpose is to obtain a benchmark indicator to be compared with discretionary wealth. The

accumulation of net worth through life, which is shown in Figure 6. In this figure, discretionary saving is computed as the change in discretionary wealth, and is similar for mandatory saving and pension wealth. Total saving corresponds to the change in total wealth. All three measures of saving derived from wealth are seen to conform to the implications of the LCH. They are positive during the work-span, and negative after the retirement age of 60.[8]

5. Estimates of saving with flow data.

In this section we present an alternative estimate of the age profile of saving based on income and consumption flows. We construct two measures of income. One is earned income, which we claim is the appropriate measure, and the other is the conventional disposable income that was used inappropriately in earlier tests. Consumption is the sum of expenditure on durable and non-durable goods and includes imputed rents on owner occupied housing.

Conventional disposable income is obtained directly from the respondent, but then adjusted for imputed rents. Earned income is obtained by adding the mandated contribution to social security, which is taken as an approximation to mandated saving through public pensions, and subtracting pensions, to disposable income. It should be recognized that social security contributions should be counted as part of income and saving to the extent to which contributions actually increase the stock of wealth. We approximate mandatory saving with the total amount of contributions actually paid by each worker less the total amount received as pension benefits. Since contributions are levied at a flat rate on gross earnings, we can estimate earned income by blowing up reported disposable income.[9]

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assumed replacement rate and contribution rates are, respectively, 70 and 25 percent. See the Appendix for details.

[8] Sabelhaus and Pence (1999) use a time series of cross-section wealth surveys to measure how wealth accumulation varies across age in the US. They apply a technique similar to ours to the 1989, 1992 and 1995 Survey of Consumer Finance and are therefore able to purge the age-wealth profile from cohort effects. They also compute the change in wealth as a percent of disposable income and find positive saving rates in the order of 20 percent until age 60, and negative saving afterwards, ranging from –20 percent at age 65 to –50 percent at age 75.

[9] For employees the contribution rate increases from 26 percent of gross earnings in 1989-93 to 27 percent in 1995-2000. The contributions are split between the employee and the employer. But clearly this is immaterial: in both cases it is the employee who actually bears the burden of paying the contributions (and finally receives the benefit). For the self-employed the contribution rates are set at 15 percent of gross earnings.

As it is estimated, the mandatory saving need not coincide with the change in pension wealth reported in Figure 6. There we take into account survival probabilities, and make explicit assumptions about the growth rate of the economy and the real interest rate. Here we simply impute the yearly contributions from net earnings and the benefits from the respondent. In practice we find that the two measures of mandatory saving are broadly consistent.

In Figure 7, we plot the age profile of consumption and of the two income measures. Each profile is obtained using the microeconomic data in the same fashion used for wealth. Median consumption and income in each age/year/cohort cell are regressed on a full set of age dummies, cohort dummies and restricted time dummies. The smoothed coefficients of the age dummies are then plotted in Figure 7.

As hypothesized by LCH, consumption is remarkably flat. The moderate hump appears to reflect a similar hump in the age profile of family size reported in Figure 8, which mirrors the entrance and exit of children (and one spouse) from the households. Since it is not essential to our basic argument, we forego any adjustment for family size.

In Figure 7, the profile of earned income, in contrast to that of consumption, is very hump-shaped. It peaks around age 50, which in some respects is surprisingly early. This peak may reflect the very young age at which some pensions have been awarded in Italy (so called baby pensions). It declines rapidly after age 55, a reflection of the increasing number of retired individuals belonging to older age groups. Retirement earned income consists mainly of capital income (the return to discretionary wealth), much of which is accounted for by imputed rents on owner occupied housing.

Figure 9 reports the life cycle of saving and its component, implied by Figure 7. The path of total or family savings is sharply humped, reflecting the hump path of earned income and the flat path of consumption. It becomes increasingly negative after the mid-fifties, which is a pattern largely consistent with the LCH. It is also largely consistent with the pattern implied by the change in total wealth in Figure 6.

A comparison of the graph of earned and disposable income reported in Figure 7 brings to light how conspicuous subtractions from, and additions to, earned income for Social Security contributions and pensions have the effect of largely smoothing and eliminating the humps in earned income (which is of course what they were designed for). As a result, the humped life cycle of earned income is turned into a remarkably flat path of disposable income, very similar to the life cycle of consumption. In fact disposable income and

consumption stay very close, so that the path of discretionary saving in Figure 9 is itself quite flat. What is surprising is that disposable income is consistently *above consumption*, which means that discretionary saving *remains positive* throughout the life cycle, or at least until the age of 80.

6. Tracking the sources of discrepancy between saving and wealth measures

The finding of a flat profile for discretionary saving is a somewhat surprising result. This is for two reasons. First, it is glaringly inconsistent with the reported behavior of discretionary wealth. The flat profile implies that discretionary saving never declines, even after retirement, whereas according to the wealth data in Figures 5 and 6 discretionary saving declines steadily from around age 60. The inconsistency is illustrated in Figure 10. Here, the graph compares the two alternative estimates of the life cycle of discretionary saving. Not only do they have opposite signs at advanced ages (after 60), but also at the youngest ages (below 30). Indeed the two paths look like mirror images of each other! In addition, the absence of negative saving has implications for the role of bequests, which we discuss below.

To search for the explanations for the discrepancy between saving and wealth measures, we begin by examining the possible role of factors primarily connected with the Italian data or institutions. We then turn to evidence for other countries, and for conceptual differences between saving and changes in wealth.

6.1. Sources idiosyncratic to Italy

The role of smoothing

We began by considering the possibility that the finding of positive saving, even at an advanced age, might be the result of *distortions* induced by smoothing the life cycles of consumption and income by polynomials in age. On the basis of Figure 11, which shows a plot of the original (not smoothed) data of discretionary saving by age and cohort, we promptly dismiss this hypothesis. Clearly saving is humped, but even by age 80, though it is smaller than at any other age, it is unmistakably positive. This is once again confirmed by the smoothed graph of discretionary saving, exhibited in Figure 12. Regression analysis – not

reported for brevity – indicates that income, wealth, homeownership, education, self-employment and family size are positively correlated with saving at advanced age. But the most noteworthy feature of saving is that less than 20 percent of the aged households report negative saving, and that this proportion does not increase with age, even conditioning for employment status, education, homeownership, or other household characteristics.

Measurement error

Next, we have examined a possible role of measurement error, whose presence was already suggested by the comparison of microeconomic data with national accounts data carried on in Table 1. Cannari and D'Alessio (1994) and D'Alessio and Faiella (2002) report that in comparison with national account data, the SHIW consumption is underestimated by 30 percent, while income is underestimated by 25 percent. For the purposes of this paper we are not so much concerned with bias in the level of income and consumption as we are with whether the *age profile* of saving is systematically biased.[10] For this reason we cannot rely on a comparison with macroeconomic data, and must turn to the only other Italian survey that contains data on family income and consumption, namely a 1991 ISTAT Survey of Household Budgets. This survey represents a large cross-section and contains detailed information on consumption, but has limited income data. We find that the two surveys are generally mutually consistent. Both indicate that saving is rather flat and that there is no negative saving in old age.

The role of severance pay

A third possibility we considered is that the difference between the two measures of saving could be related to one very unique feature of the Italian system: namely, a mandated large severance pay. Each year the employer withholds one months' wage, to be returned to the worker at the time of termination of employment.[11] Such *severance pay* is not included in our definition of income (either disposable or earned). Because survey information on severance pay is scant, we impute contributions paid in the severance fund pay, grossing up

[10] One could thus compute discretionary saving by "blowing up" disposable income by 25 percent, and consumption by 30 percent. This adjustment reduces discretionary saving at all ages, but does not change the shape of the age-consumption profile, and therefore that of the age-saving profile. In particular, discretionary saving is again flat over the life cycle.

labor income in proportion to the contribution rate. The result is that mandatory saving and pension wealth are correspondingly higher before retirement. After the severance pay fund is liquidated, generally at retirement, it should appear as an increment in discretionary wealth without changing discretionary saving. This should generate an increase in discretionary wealth around retirement that is greater than discretionary saving; the opposite of what we see in the data.

6.2. Evidence from other countries and explanations

The international evidence

We looked to evidence from other countries to see whether it might confirm or reject the findings for Italy. In particular, we were concerned with the apparent inconsistencies between flows and stocks. With respect to discretionary saving, we found that age profiles flat and *uniformly positive* were reported by several studies for those countries where the amount of mandatory saving is substantial. To take just a few recent examples, Poterba (1994) summarizes evidence to this effect for the group of most industrialized countries, Alessie et al. (1997; 1999) for the Netherlands, and Paxson (1996) for the US and the UK.[12]

At the same time, the decline in wealth at advanced ages is also confirmed by earlier studies. For instance, Diamond and Hausman (1984) find rates of dissaving after retirement of about 5 percent per year in the National Longitudinal Survey of Mature Men. Using the Retirement History Survey, Hurd (1987) finds decumulation rates of about 1.5 percent per year (3 percent excluding housing in the definition of wealth). Furthermore, the inconsistency has been reported in other studies for which both saving and wealth data were available.

Widespread evidence pointing to the apparent inconsistency between stock and flow measures suggests the need to reexamine possible conceptual discrepancies between saving and the change in the value of assets in a given period, as measured in the survey. The search resulted in identifying multiple sources of discrepancies, which fall into two quite distinct types. The first type arises from *conceptual differences* between saving in a period and the

[11] Initially, in Italy severance pay was intended to insure the employee against the risk of dismissal, but it gradually evolved into a form of deferred compensation, irrespective of the cause of termination of employment. The employee is entitled to it whether he or she retires, is laid off, or quits.

[12] This latter study also presents flat age-saving profiles in Taiwan and Thailand, in which the amount of mandatory saving is much more limited. The evidence in these countries is therefore much less favorable to the LCH than in other developed countries.

change in the value of assets during the period, as measured in standard surveys. The second type results from the fact that as a cohort ages, the individual composing it keeps changing, with young people joining (becoming household heads) at different ages and others exiting (because of disability or death).

Conceptual differences between saving and changes in wealth

The main conceptual discrepancies arise from the fact that wealth cannot only change through saving, but also through other channels. Two are of major interest: capital gain/losses and inter vivos transfers.

To what extent could capital gains explain the observed discrepancies? Because of formidable obstacles to the estimation of a time series of gains, we cannot offer a precise answer. The best we can do is to estimate the capital gains and losses on *nominal net* assets resulting from the widespread incidence of inflation, especially in the early years. Since in this period the inflation resulted in net capital losses, the adjustment made the change in assets somewhat less negative, but not enough to turn it positive. As for the effect of other capital gains, even in the absence of detailed information we can be fairly certain that there were substantial real gains coming from residential real estate during the period covered. Hence, while one might have expected the increase in wealth to generally exceed saving, these inferences are not supported by the data in Figure 10. We must conclude that capital gains do not help to explain the discrepancy.

Ando et al. (1994) and Alessie et al. (1999) have suggested a second possible source of conceptual discrepancy, namely inter vivos transfers. They speculated that the two measures of saving could be reconciled by the pattern of intergenerational *net* transfers. These transfers flow prevailingly from the old to the young, and are encouraged by the favorable taxation of gifts. If so, for the younger generations the increase in assets should tend to exceed saving (by net gifts received), while for the old it would tend to fall short (by the net gifts made).This is precisely the nature of the puzzling discrepancy in Figure 10.

Neither Ando nor Alessie provide direct evidence to support their hunch on the issue. We have been able to carry out a rough test of the hypothesis on the basis of information available in our survey. Unfortunately, the information in consistent form is only available for the years 1998 and 2000. Using the response for inter vivos transfers, we have computed the age profile of average net transfers received by the household.

Because we have only two year's worth of information, we cannot apply the method used for other variables to disentangle the age effect from the cohort effect. To bypass this issue, we simply compute average net transfer by age, and then fit to these values a third degree polynomial in age, in this way smoothing the result. The smoothed curve is reported in Figure 13. Because Figure 13 is derived from cross-sectional means and is not adjusted for cohort effects, this profile is not directly comparable with the life cycle of saving presented in Figure 10. However, the path of net transfers is amazingly similar to the difference between the two inconsistent measures of saving reported in Figure 10. For the young (who are the net receivers in Figure 13) the increase in discretionary wealth exceeds saving, whereas for the old, (who are the net givers) the increase in wealth is lower than discretionary saving. Thus the change in wealth tends to overestimate the saving of the young and to underestimate the saving of the old. Still, we are not in position to say whether the explanation is sufficient, or whether it can account for the observed decline in wealth even though saving is positive.

The effects of changing composition of the cohort

Despite its systematic and potentially important effect on the relationship between the two measures of accumulation, the membership of the cohort being sampled and the fact that it changes between surveys has gone all but unnoticed. One measure is the change in average wealth (W) between the surveys at age t and that at age t-1, say $W(t) - W(t\text{-}1)$, and the other is the (average) saving rate in the interval between the two surveys, say $S(t)$.

In order to concentrate on the above issue it will be convenient to assume that, for every *individual present,* the change in assets between the survey at time t and the previous one at t-1, is identical with his or her saving over the stated interval. We begin by classifying those living at t-1 into two sets, namely those that are alive and therefore respond at time t, the "survivors", and those dying during the interval, the "deceased". Since at time t only the survivors are responding, the average saving revealed by the survey will be precisely the average saving of the survivors, which we denote by S_s. Thus $S(t) = S_s(t)$, which in turn equals the change in the average wealth of the survivors, $W_s(t) - W_s(t\text{-}1)$. Thus:

$$S(t) = W_s(t) - W_s(t-1), \qquad (1)$$

gives $S(t)$ in terms of the change in the average wealth of the survivors. We want to express it in terms of the change in the average wealth of the cohort, i.e. $W(t)$-$W(t\text{-}1)$. Because the survivors are the only respondent at time t, we can conclude that $W_s(t)$ is the same as $W(t)$.

The remaining task is to establish the relation between $W_s(t\text{-l})$ and $W(t\text{-}1)$. That relation is easily secured by noting that $W(t\text{-}1)$, being average wealth at time t-1, is simply a weighted average of the average wealth of the survivors $W_s(t\text{-l})$, and of the deceased, $W_d(t\text{-}1)$, weighted by the share of survivors (N_s/N) and of the deceased N_d/N in the cohort at t-1, respectively.

We can use this relation to substitute in (1) for $W_s(t\text{-l})$ in terms of $W(t)$, and rearrange terms to get the following expression for the change in average assets:

$$W(t) - W(t-1) = S(t) + \left[W_s(t-1) - W_d(t-1)\right](N_d / N) \qquad (2)$$

The interpretation of (2) should be obvious: if the survivors are richer than the deceased, then the average wealth will rise more than the average saving because it will be boosted by the elimination of a segment poorer than the average. As seen, there exists only one case in which the change in assets coincides with saving; this is when the deceased happened to be, on average, as rich as the survivor.

Unfortunately (2) cannot be tested empirically since $W_s(t\text{-}1)$ could only be ascertained with a panel, and even with a panel, $W_d(t\text{-}1)$ could not be estimated because as a rule, a panel will only interview survivors. Therefore, it cannot provide information about the estate of the deceased. However as suggested earlier, it is well known that the probability of surviving is positively correlated with income and wealth, implying that on average the deceased are poorer than the survivors, i.e. $W_s(t\text{-}1) > W_d(t\text{-}1)$.

Currently, this conclusion is receiving further support. Through a novel and imaginative undertaking, Michael Hurd and his associates are endeavoring to secure information about the estate at the time of death of deceased members of a US Panel survey. From the information gathered from the Retirement History Survey, Hurd, McFadden and Merrill (2001) have constructed a table comparing the average wealth in the base year (1993) for the 75-79 age group of those who were still alive in 1995 – the survivors – with the wealth of those who subsequently died between 1993 and 1995. For males, the average 1993 wealth of the survivors in dollar thousand was 217, and the average estate of the deceased was 178, which

is 18 percent smaller. For females, the corresponding figures are 167 and 145, which is 13 percent smaller.

To the extent that these figures are representative, they suggest an appreciable discrepancy between *S* and the change in per capita wealth; indeed for the age group 75-79, the ratio of those dying in a year to the survivors can be placed at around 5 percent, and the difference $W_d(t\text{-}1)–W_s(t\text{-}1)$ at $0{,}85\times W_s(t\text{-}1)$, implying a discrepancy of about 4 percent of wealth, which is large compared with the saving rate (e.g., in Italy, the average wealth holding is not far from 20 times saving). Clearly the size of the correction would vary with age. What is disappointing is that the above reasoning implies that at advanced ages the increase in wealth should *exceed* saving, whereas Figure 10 shows the very opposite. Of course our deceased effect could be overpowered by others, like the inter vivos transfer effect.

With this background we can also deal quickly with the effect of new entrants in the cohort. Again, we classify those responding to the survey at time *t* into two sets, those who were present at time *t*-1 – the survivors – and those that entered after *t*-1, the entrants. The per capita saving *S* is the average, of the average saving of each group, weighted by their respective shares of the cohort population. Similarly, the average *terminal* wealth is the weighted average of the wealth of each group, while the average wealth at *t*-1, $W(t\text{-}1)$, is only the wealth of the survivors, $W_s(t\text{-}1)$. One can then readily verify that the change in average wealth is:

$$W(t)-W(t-1)=S(t)+\left[W_e(t-1)-W_s(t-1)\right](N_e/N) \qquad (3)$$

Thus, the growth of wealth will exceed average saving if the new entrants are wealthier than the survivors. Again, we have no direct (or indirect) information about the average initial wealth of the two groups; but in Figure 10 we observe that there is a large excess of asset growth over saving. We are lead to wonder whether it might reflect a not implausible, but relatively higher wealth of the entrants together with a high rate of entry.

7. Hump wealth, LCH and the bequest motive

The search for an explanation of the discrepancies between saving flows and changes in wealth has brought out a number of possible causes. With one exception, which is discussed

below, these causes do not seem to go very far in explaining the empirical discrepancies revealed by Figure 10. Indeed, some suggest a discrepancy opposite to that observed. The one possibly plausible explanation, which could be quantitatively large, is inter vivos transfers. It is substantiated by independent evidence on the timing and importance of intergenerational transfers.

When the two measures are in conflict, which of them provides more useful information? We suggest that there is no unique answer. The two measures focus on somewhat different things, thus which is best depends on what is to be measured. If one is interested in the life path of wealth, one should use the wealth measure and by the available evidence agree that wealth tends to decrease after retirement. If, on the other hand, one is interested in measuring the extent to which in old age, discretionary wealth continues to accumulate through saving - or is decumulated through consumption above income – than the appropriate measure of accumulation is saving. For the case of Italy we must conclude that discretionary saving remains positive, although small.

This conclusion does not have any direct implications for our test of LCH, but it is relevant for an understanding of bequest behavior, and of the relative contribution to National Saving of Life Cycle accumulation versus accumulation for intergenerational transfers. It should be remembered in this connection that, contrary to a common perception, some accumulation for bequests is not inconsistent with LCH. The distinctive feature of this model is not the absence of bequests, but rather that some portion of accumulated wealth is drawn down to support retired consumption, which essentially means that the age profile of wealth is hump shaped. In the case of Italy we have seen that this implication is amply verified both in terms of stocks (Figure 5) and flows (Figure 9).

The age-profile of discretionary wealth is relevant for bequest behavior because it is the only component of wealth that can be passed to future generations if it is not consumed before the termination of the household. In contrast, annuitized wealth, which includes all public pension rights, disappears when the retired dies: even though part of wealth is transferred through survivors' benefits, the survivors cannot transfer the capital to future generations.

Suppose one observes a hump in total wealth, but not in discretionary wealth, which keeps increasing after retirement. This must imply that part of pension wealth is used to increase discretionary wealth. If retirees continue to accumulate bequeathable wealth, the most natural interpretation is that they plan to leave a bequest.

Beyond this qualitative statement, the age profile of discretionary wealth cannot provide much guidance for estimating the quantitative importance of intergenerational transfers as a source of accumulation. There are several reasons for this conclusion. In the first place there is considerable uncertainty about the path of discretionary wealth in the retirement stretch; we recall that, where data concerning the behavior of wealth are available, they consistently show that it declines in the post retirement period. To be sure, saving estimates, which may conceptually provide a more reliable measure, do not support the decline but still leave room for some uncertainty, especially when one recalls that the survey responses tend to overestimate saving by well over 50 percent.

There is yet a more serious problem to consider, namely the likelihood that, at advanced ages, the saving estimates generated by the survey, may be seriously upward biased. It must be remembered that what we are interested in estimating is the average saving rate (disposable income – consumption) during a given age, say the 75^{th} year, for all those members of the cohort that have survived until age 75. What we can draw from the survey (or a panel) is the average saving of those who survived until the next survey, since they are the only ones that can respond as regards their activity in the past period (the 75^{th} year). The overall average we are seeking is clearly the weighted average of the saving rate of the survivors and of the deceased weighted by the size of the two groups. Unfortunately we have no available estimate of the saving rate of the deceased, for the simple reason that they cannot be interviewed. However, we can make some educated guesses about the unknown saving rate by recalling earlier references to a well-established negative correlation between mortality and wealth. It implies that on the average the deceased are poorer than the survivors and should tend to save less. But in addition, the saving of the deceased might be adversely affected by the occurrence of death.

This hypothesis receives some confirmation. Hurd and associates worked to secure information about the estate of deceased members of a panel. These findings make it possible to compare the wealth reported in the last survey preceding death with the estate ascertained as of the time of death; the difference, then, is an estimate of the saving during the interval. According to the figures reported in Hurd and Smith (2001), the average value of the estate at death (95 thousand dollars) was much smaller than that preceding death (130 thousand) by over ¼, implying a large rate of dissaving. Since the deceased constitute a rapidly rising share of those surviving, a substantial dissaving on their part, together with a small and dwindling saving rate of the survivors, could easily push the overall average into the negative territory.

In other words it is conceivable that the richer, recorded survivor may continue to save , but the poorer unrecorded deceased may dissave enough to push the whole cohort into spending more than income. Because of questions raised by authors regarding treatment of the value of the house in the estate of the surviving spouse, and because we have no idea as to the magnitude of inter vivos transfers, which again should be subtracted from the dissaving, the above estimate should be recognized as very uncertain.

Even if we could obtain a more reliable estimate of the rate of saving (positive or negative) in the retirement phase, it is unlikely that it would be of much help in establishing the quantitative importance of bequests, or even less of the bequest motive. On the one hand, the amount of wealth held at various ages does not represent bequests, and tells us little about them. Clearly bequests will be whatever remains after the survivor spouse dies (infra-family transfers should not be counted as bequests). On the other hand, the amounts bequeathed or transferred include transfers by those that have already died or made transfers.

Some evidence on the importance of bequests and gifts is available for Italy. A special section of the 1991 SHIW asks each member of the household to report the amount of bequests and gifts received in the past from parents or other relatives, and the year of receipt. This information is used in Guiso and Jappelli (2002) to compute the aggregate share of transfers in total wealth. On average, in 1991 each household received about 30,000 euro, 24.3 percent of discretionary wealth (20.2 percent bequests and 4.1 percent gifts). This figure is consistent with the results reported by Modigliani (1988) and Wolff (2002) for the United States, to the effect that the share of transfer wealth does not exceed one fourth. However, this information is available for recipients, and we have no information on how transfers affect the age saving and wealth profiles of donors.

In closing, it must also be remembered that the amount of bequests left and received cannot be identified with the accumulation dictated by the bequest motive. This is because part of bequests may constitute unintentional bequest resulting from the holding of wealth for precautionary reasons. Given life uncertainty, risk-averse consumers will always find it optimal not to run their assets down to zero.

8. Conclusions

Our analysis, which is based on Italian repeated cross-sectional data, supports the Life-Cycle Hypothesis of humped wealth, or saving turning negative after retirement, once mandated pension saving and pension wealth is duly taken into account. It can be argued that because people cannot choose the amount of mandatory saving, they should be ignored when it comes to understanding the household's behavior. But since people can change discretionary saving in response to changes in mandatory saving, total saving is the relevant measure of the change in assets accumulated for retirement. After all, the existence of mandatory saving programs and the widespread implementation of retirement plans should be interpreted as the social approval of schemes designed to ensure people with adequate reserves to be spend during retirement.

For these reasons, discretionary saving and discretionary wealth (obtained by subtracting mandatory saving and pension wealth, respectively from total saving and total wealth) are not relevant indicators of accumulation for retirement in societies in which a major source of provision for retirement is provided for by mandated pension programs. Thus the shape of one component of total saving, like discretionary saving, cannot be cited as evidence in favor of or against the LCH, as has been done in several writings cited earlier.

As for the age profile of discretionary wealth, the data for Italy (and other countries) leave room for considerable doubt as to whether it is humped shaped, once account is taken of the contribution of the growing number of deceased to the cohort saving. It must be recognized that the decline during retirement is at best slow, which is consistent with non-negligible bequests (partly involuntary, resulting from precautionary motives). Data separately collected by our SHIW survey has resulted in an estimate of transfer wealth of about ¼ of discretionary wealth, consistent with results for other countries.

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Appendix

THE SURVEY OF HOUSEHOLD INCOME AND WEALTH (SHIW) The data set includes the 1989, 1991, 1993, 1995, 1998 and 2000 SHIW. The survey is representative of the Italian population because probability selection is enforced at every stage of sampling. The unit of observation is the family, which is defined to include all persons residing in the same dwelling who are related by blood, marriage or adoption. Individuals selected as "partners or other common-law relationships" are also treated as families. The interviews are generally conducted between May and September of each year, thus flow variables refer to the previous calendar year, and stock variables are end-of period values. All statistics reported in this paper use sample weights. Nominal figures are deflated by the CPI and then converted in euro.

CONSUMPTION Sum of durable and non-durable consumption, including imputed rents on owner-occupied housing.

EARNED INCOME Sum of households earnings, transfers, capital income and income from financial assets, net of taxes. Earnings are the sum of wages and salaries, self-employment income, less income taxes. Wages and salaries include overtime bonuses, fringe benefits and payments in kind, and exclude withholding taxes. Self-employment income is net of taxes and includes income from unincorporated businesses, net of depreciation of physical assets. Capital income includes imputed rents on owner-occupied housing.

DISPOSABLE INCOME Earned income plus pension benefits less social security contributions.

DISCRETIONARY WEALTH Net financial assets and real assets less household debt (mortgage loans, consumer credit and other personal loans) and business debt. Real assets are the sum of real estate, unincorporated business holdings and the stock of durable goods

PENSION WEALTH Since in Italy very few workers hold private pension funds, pension wealth largely coincides with social security wealth. For current workers we compute pension wealth as the difference between the discounted value of benefits and the discounted value of contributions. Social security contributions are assumed to be a flat rate of 25 percent in all years. At each age, the stream of social security benefits depends on expected retirement, survival probabilities, the expected replacement rate, expected earnings at retirement, the rate of growth of pension benefits during retirement and the real rate of interest at which people discount future benefits. We do not distinguish between men and women and assume that the household retires at age 60, and that the replacement rate is 70 percent, about the level prevailing in the last decade. We use mortality tables for women to impute the survival probabilities. Expected earnings at retirement are estimated by the fitted value of a regression of log earnings on a fifth-order age polynomial, a set of cohort dummies and a set of restricted time dummies. Using the fitted values form this regression, we project for each age-year-cohort group the earnings at the assumed retirement age of 60. We also assume that the growth rate of earnings equals the real interest rate and that pensions are fully indexed to the cost of living. For the currently retired we compute the present discounted value of pension benefits, based on current pensions (including old age, social and disability pensions). Survival probabilities refer again to women.

Table 1
A comparison between measures of aggregate saving and wealth derived from national accounts and survey data

The national accounts saving rate and wealth-income ratio are drawn from the Annual Report of the Bank of Italy and the OECD Economic Outlook. The microeconomic estimates of the aggregate saving rate and of the aggregate wealth-income ratio are computed using the SHIW. The microeconomic estimates use sample weights and the entire data set for each survey year.

Year	*Household saving rate*		*Wealth-income ratio*		*Number of households*	
	National accounts	Survey data	Financial accounts	Survey data	Total	Used in the estimation
1989	16.7	26.4	4.41	4.34	8,297	7,938
1991	18.2	24.0	4.55	4.94	8,188	7,884
1993	15.8	25.0	5.09	5.93	8,089	7,908
1995	13.6	23.4	5.00	6.03	8,135	7,993
1998	14.7	28.6	5.15	5.92	7,147	7,061
2000	11.8	27.3	5.40	6.30	8,001	7,868

Figure 1
Discretionary wealth, by age and cohort

The figure plots median discretionary wealth, by age and cohort. Each number in the graph represents a different cohort, going from 20 (household heads born in 1920) to 70 (heads born in 1970). Wealth is expressed in thousand euro.

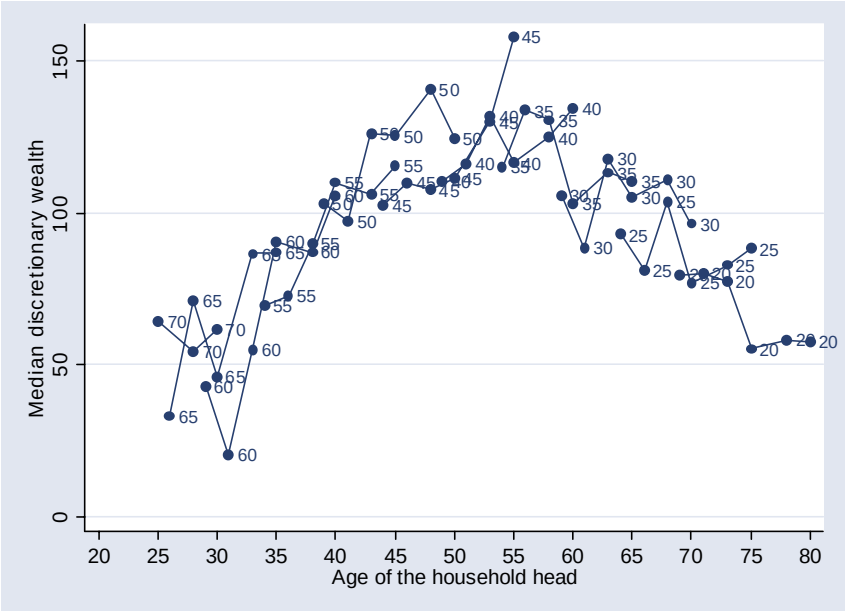

Figure 2
Discretionary wealth of older cohorts

The figure plots median discretionary wealth, by age and cohort. Each number in the graph represents a different cohort, going from 20 (household heads born in 1920) to 36 (heads born in 1936). Wealth is expressed in thousand euro.

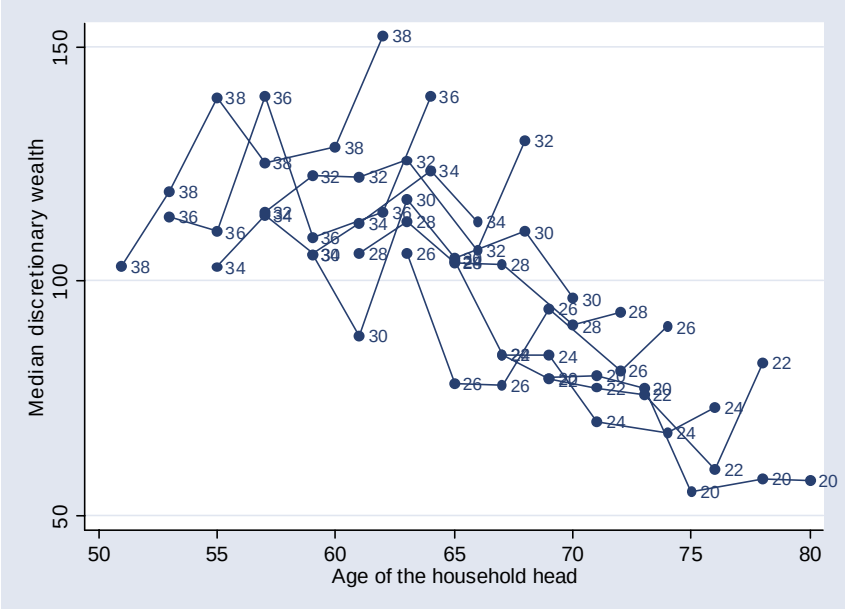

Figure 3
Age profile of discretionary wealth

The age dummies are obtained from a regression of median discretionary wealth on age dummies, cohort dummies and restricted time dummies. The smoothed profile is obtained by regressing the age dummies on a third order age polynomial. Wealth is expressed in thousand euro.

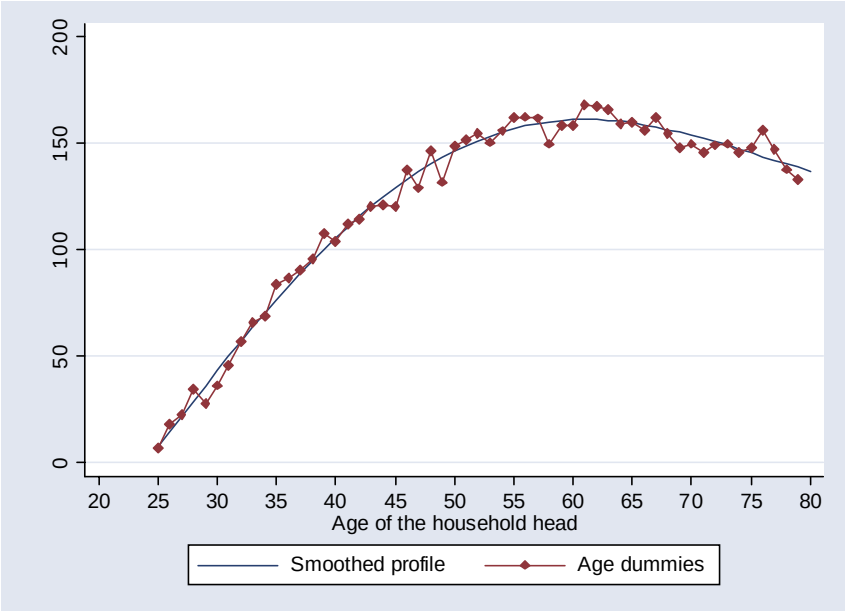

Figure 4
Cohort effect of discretionary wealth

The cohort dummies are obtained from a regression of discretionary wealth on age dummies, cohort dummies and restricted time dummies. The smoothed profile is obtained regressing the cohort dummies on a third order cohort polynomial. Wealth is expressed in thousand euro.

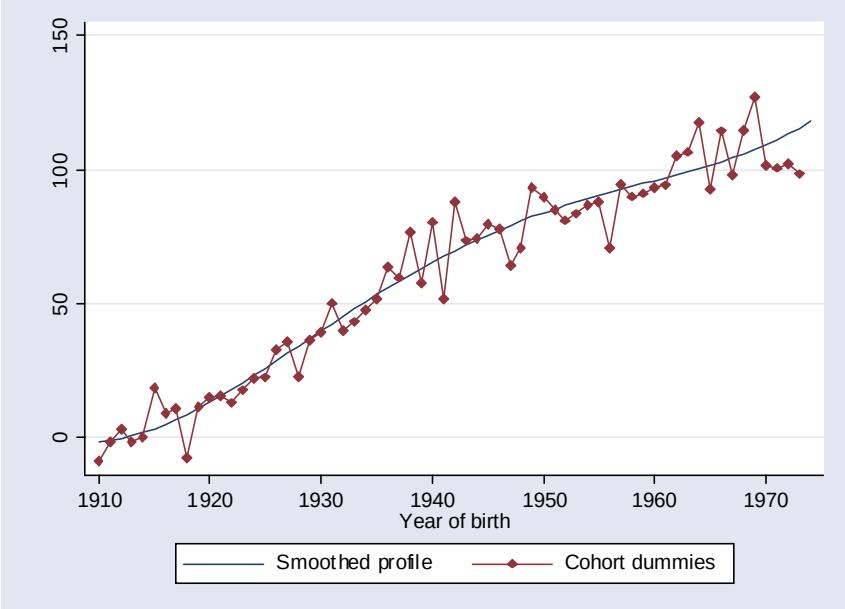

Figure 5
Age profile of discretionary, pension and total wealth

The lines in the figure represent the age dummies estimated from regressions of median discretionary wealth, pension wealth and total wealth on age dummies, cohort dummies and restricted time dummies. The age dummies are smoothed with a third order age polynomial. Wealth is expressed in thousand euro.

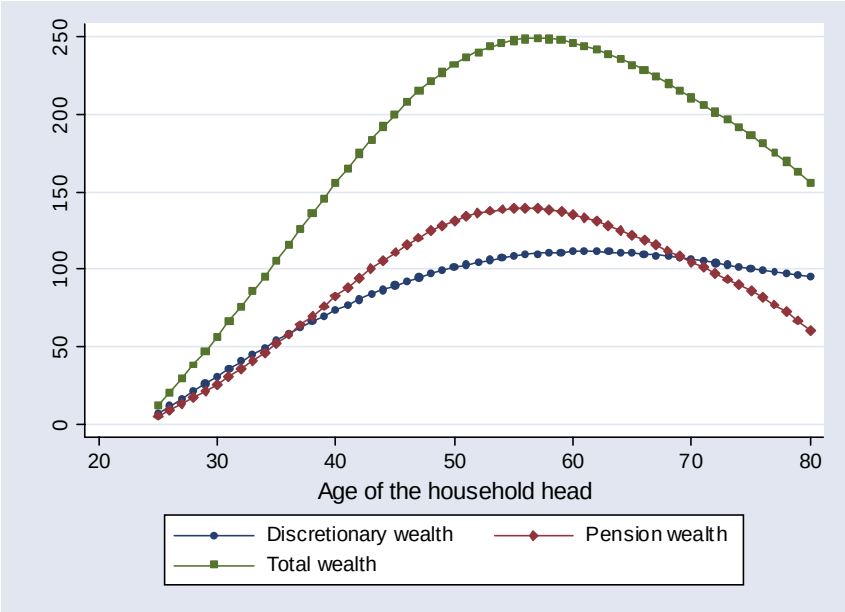

Figure 6
Age profile of change in wealth

The lines in the figure represent the increment from one age to the next of discretionary wealth, pension wealth, and total wealth in Figure 5. Data are expressed in thousand euro.

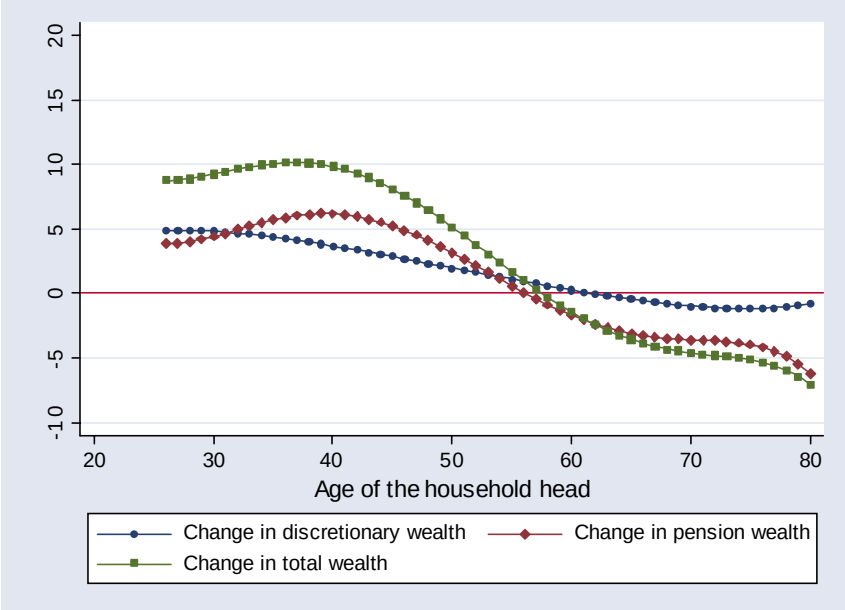

Figure 7
Age profile of consumption and income

The age dummies are estimated from regressions of median income and consumption on age dummies, cohort dummies and restricted time dummies. Income and consumption are expressed in thousand euro.

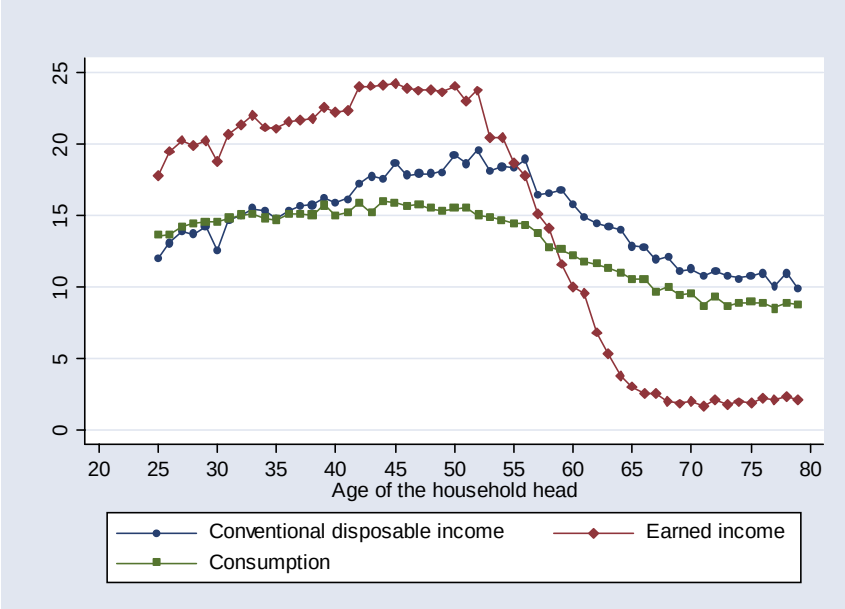

Figure 8
The life cycle of family size

The age dummies are obtained from a regression of family size on age dummies, cohort dummies and restricted time dummies.

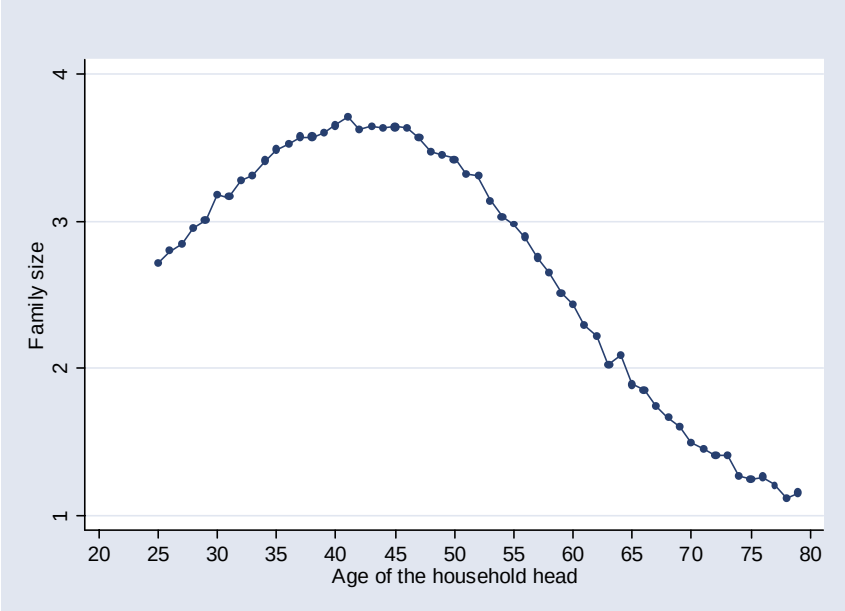

Figure 9
The age profile of discretionary, mandatory and total saving

The lines in the figure represent the age profiles of discretionary saving, mandatory saving and total saving. Discretionary saving is the difference between conventional disposable income and consumption; total saving is the difference between earned income and consumption; mandatory saving is the difference between total and discretionary saving. Each profile is estimated from regressions of saving on age dummies, cohort dummies and restricted time dummies. The age dummies are smoothed with a third order age polynomial. Saving is expressed in thousand euro.

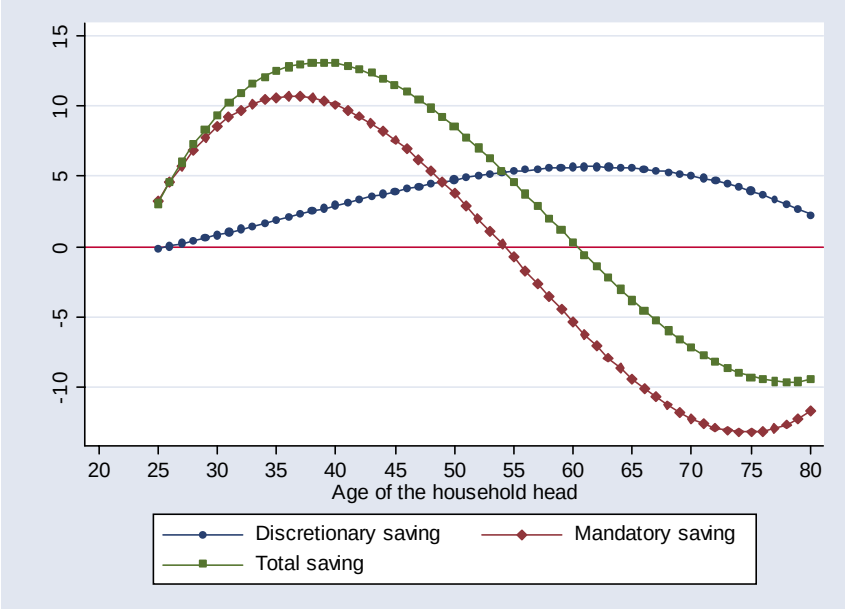

Figure 10
Age profile of discretionary saving and of increment in discretionary wealth

The lines in the figure represent the age profiles of the increment in discretionary wealth (from Figure 6) and of discretionary saving (from Figure 12). Saving is expressed in thousand euro.

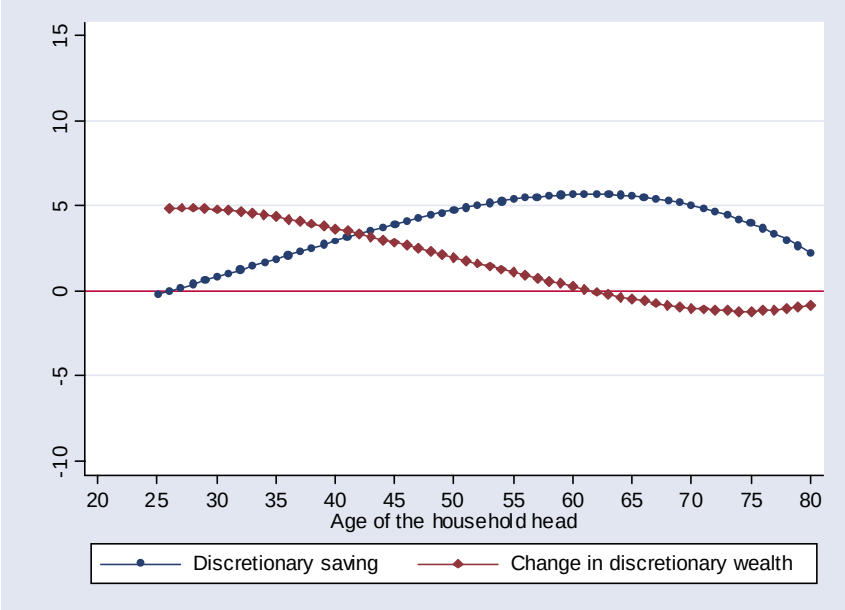

Figure 11
Discretionary saving, by age and cohort

The figure plots median discretionary saving, by age and cohort. Each number in the graph represents a different cohort, going from 20 (household heads born in 1920) to 70 (heads born in 1970). Saving is expressed in thousand euro.

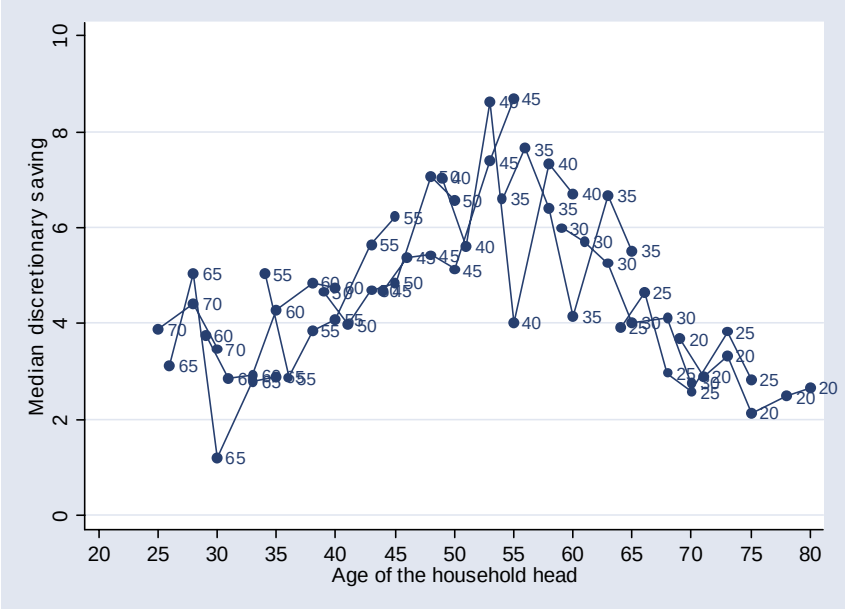

Figure 12
The age profile of discretionary saving

The age dummies are obtained from a regression of median discretionary saving on age dummies, cohort dummies and restricted time dummies. The smoothed profile is obtained by regressing the age dummies on a third order age polynomial. Saving is expressed in thousand euro.

Figure 13
Age profile of net inter vivos transfers received by the household

Average net transfers received by the household are the difference between transfers received and transfers given. The profile is obtained by regressing net transfers received on third order age polynomial using the pooled 1998-2000 sample. Transfers are expressed in thousand euro.