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## *The Life-Cycle Hypothesis, Fiscal Policy, and Social Security*

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# *The Life-Cycle Hypothesis, Fiscal Policy, and Social Security*[*]

**Tullio Jappelli**[**]

**Abstract**

The paper reviews some of the most important results of the Life Cycle Hypothesis for understanding individual and aggregate saving behaviour. It then turns to the implications for fiscal policy and social security, highlighting Modigliani's seminal contributions. Over time competing theories have emerged, and some empirical findings are difficult to reconcile with LCH; chiefly aspects of inertia, myopia, and irrational behaviour documented by the recent behavioural literature. But the LCH is still the benchmark model to think about individual saving decisions, the aggregate evidence and policy issues.

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# Contents

## Introduction

Fifty years ago, Modigliani and Brumberg formalized the idea that people maximize utility of their future consumption, postulating 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. The LCH represented a fundamental shift in the economic debate of the post-war period and in the way of thinking about saving. Today it is still the reference framework for analyzing individual and aggregate saving.

In developing the LCH, Modigliani was influenced by the work of Irving Fisher (1930) and especially by Umberto Ricci (1926a; 1926b), a professor at the University of Rome and, as Modigliani, exiled during the fascist regime. But it reflected also his work on inventories. Inventories isolate production from seasonal variations in demand the same way as saving allows individuals to have a relatively constant consumption profile also when income is variable.

The LCH was developed three years before the publication of Friedman's theory of saving. The difference between LCH and Friedman's Permanent Income Hypothesis concerns the length of the planning period. For Friedman, this period is infinite, meaning that people save not only for themselves but also for their descendants. In the Modigliani-Brumberg version of the theory, the planning period is finite. In some cases, PIH and LCH share similar predictions about individual behaviour; for instance according to both theories transitory income shocks (transitory taxes and rebates) and capital gains or losses can be expected to have small effects on consumption.[1] But many implications of the LCH about individual and aggregate saving rates are unique, and differ sharply from the infinite horizon version of the model.

[1] In the Mattioli Lectures held in October 1977 at Bocconi University, Modigliani stated that: "*The PIH is quite similar in spirit except that it makes the approximation that life is of indefinitely long duration. Accordingly, the notion of life resources is replaced by that of permanent income, defined as the maximum consumption that could be sustained indefinitely. For many purposes, the assumption of an infinite planning horizon is an excellent approximation to a life-cycle horizon. Accordingly, the LCH and PIH turn out to have many implications in common – at least at the micro level – such as those that follow from the association of saving with transitory income*" (Modigliani, 1986b, pp. 128).

As for the microeconomic implications, the postulate of utility maximization implies that - according to LCH - consumption is evenly distributed over time and this, in turn, implies that the individual during his active period builds up a stock of wealth, which he consumes during his old age. Thus, wealth is hump-shaped. Infinite horizon models, buffer stock models of saving, models in which people save mainly for precautionary purposes, or models in which saving is driven by myopic or irrational behaviour do not share this implication.

The distinction between the LCH and infinite horizon models is more evident when one looks at the aggregate implications. Indeed, infinite horizon models have very few "aggregate" predictions, except perhaps that expected income growth should reduce national saving. The beauty of the LCH lies in the fact that aggregation is not nuisance, but part of the model itself, delivering some of the most interesting results. Indeed, Modigliani always explained that the LCH is a *theory about individual and aggregate wealth*, and that individual wealth and saving behave completely differently than the corresponding aggregate.

In the original LCH model the income profile of each generation is constant, and productivity growth is generation specific. This implies the fundamental proposition that an increase in productivity growth raises the income of those who save relative to those who dissave, and therefore the aggregate saving rate, a prediction that for Modigliani was absolutely central to LCH. But other implications are not less important. First, that the aggregate saving rate depends on the demographic structure of a nation and life expectancy, but is independent from per capita income. Second, that a country can accumulate a large amount of wealth even in the absence of any bequest motive. Third, that the parameter that controls the aggregate wealth-income ratio is the expected length of retirement.

For this capacity to explain individual and aggregate data the LCH has represented for decades the reference framework for analyzing intertemporal consumption decisions. For the same reason, it had a deep impact on the subsequent empirical literature. Many of the empirical implications of the Modigliani-Brumberg original work have been explored and validated in studies conducted by Modigliani and Albert Ando between 1957 and the early 1970s; and due to this life-long association in the study of saving the LCH has sometimes been termed the M-B-A model.

On the theoretical front, the original LCH provided the main inspiration for the development of finite live and overlapping generations models in macroeconomics. On the empirical front, the LCH provided the reference framework of empirical tests of the Keynesian structure. When macroeconomic models were popular tools of economic analysis and stabilization policies, the consumption function of large-scale econometric models was inspired by the LCH. Even today, the consumption function used by central banks and international institutions to forecast aggregate demand is clearly based on those contributions. Later on, when microeconomic data became available, the LCH has been the subject of countless empirical scrutiny.

The simplest formulation of the model – which Modigliani used to call the "stripped-down" and sometimes the "elementary" or "standard" version of LCH – has been extended to consider many other variables influencing saving decisions, such as changes in family size during the life-cycle, income and other risks, labour supply, habits, bequests, the interaction with insurance and credit markets. The LCH has proved to be a very flexible framework to import each of these additional features, without changing the basic insights.[2] Modigliani himself was part of this debate, through important contributions concerning the effect of changes in family size (Modigliani and Ando, 1957), intertemporal choice in the presence of interest and income risk (Drèze and Modigliani, 1974), the role of bequests and other intergenerational transfers (Modigliani, 1988).

The LCH is also a great framework to think about fiscal policy, for instance about the effect on national saving of taxes, expenditures and government debt (Modigliani, 1961), or about the effect on individual and national saving when people must contribute to funded or unfunded pension plans (Modigliani and Sterling, 1983). These are also the themes on which I have worked with him. Modigliani was always interested in the Italian economy and data. He was Italian, of course, but he also believed that the generosity of the Italian pension system

[2] "*The crucial aspect of the life-cycle model was that the observed life path of consumption reflected the preferred allocation of life resources and that the preferred consumption path was smoother than that of income, and, in particular, remained significantly above it, as income declined in the retirement period*." (Nobel Lecture, Modigliani, 1986b, p. 209).

and the large swings in growth and fiscal variables could be used to study the relation between saving, fiscal policy and social security.

I met Franco few years before he was awarded the Nobel Prize, in the Fall of 1982, when the LCH was being criticized on several fronts. Barro (1974) had proposed a theory of saving reconciling Friedman's infinite horizon model with an altruistic model of overlapping generations, giving rise to a long series of contributions on the neutrality of government financing and public debt. Kotlikoff and Summers (1981) had written a paper on the role of bequests in capital accumulation. Newly available microeconomic data, in particular the puzzling behaviour of Japanese saving uncovered by Alberto Ando and Fumio Hayashi, did not reveal the hump shape in wealth and dissaving in retirement that was implied by the standard LCH model. On some of these issues I had the honour to collaborate with him; today I have therefore decided to review some of the implications of the LCH for fiscal policy through some of our joint work.

## The effect of fiscal policy on national saving

The LCH affects our understanding of the working of the economy and of the effectiveness of fiscal and monetary policies. For instance, LCH provides a direct link between monetary policy, interest rate and consumption, because a change in the interest rate affects the market value of assets and therefore consumption. As for fiscal policy, LCH suggests that expenditures financed by deficit tend to be paid by future generations; those financed by taxes are paid by current generations (Modigliani, 1961). National debt is therefore a burden: it reduces the stock of private capital, which in turn reduces the flow of output, if capital is productive. Indeed, Modigliani (1966) provided the first test of this proposition using aggregate US wealth data.

Few years later, in a highly cited paper, Barro (1974) demonstrated that if agents have altruistic bequest motives, they behave as if they have infinite lives, and that models with altruistic consumers have sharply different implications concerning the relation between fiscal policy and national saving. Modigliani summarized that debate in his Nobel lecture:

*"The conclusion rests on the proposition that private saving being controlled by life-cycle considerations, should be (nearly) independent of the government budget stance, and therefore private wealth should be independent of the national debt. It follows that the national debt tends to crowd out an equal amount of private capital at a social cost equal to the return on the lost capital (which is approximately equal to the government interest bill). This conclusion stands in sharp contrast to that advocated by the so-called Ricardian Equivalence Proposition (Barro, 1974), which holds that whenever the government runs a deficit, the private sector will save more in order to offset the unfavorable effect of the deficit on future generations." (Modigliani, 1986a , pp. 313).*

The quantitative effect of deficits on saving depends on the length of the average planning horizon. If the horizon is infinite, as effectively postulated by proponents of the debt neutrality proposition, than taxes matter not at all, for given expenditure. This implies that budget deficits have no effect on national saving, and the same would be true of any transfer, including payment of interest on national debt. By contrast, if the planning horizon is of the order of the length of remaining life, as postulated by the LCH, then the effect of deficit on national saving will be large.

Working with US time series data, Modigliani and Sterling (1985) found that government spending and taxes have substantial effects on consumption. Later on, delivering the Frisch Lecture at the World Congress of the Econometric Society in Barcelona, Modigliani used international cross-country data as evidence that an increase in government deficits and a reduction in the rate of growth of income were the two factors responsible for the decline in national saving observed in the OECD between 1960 and 1980 (Modigliani, 1990).

In 1983 Marco Pagano and I presented to Modigliani historical figures of the Italian national saving rate and composition. Modigliani was fascinated by the large swings of the series. Figure 1 reports some of this data, updated from one of our previous joint works. Previously available statistics on aggregate saving ratios, mostly based on developed countries, had created the impression that the ratio is a relatively stable number, at least within a given

country. Indeed, Kuznets (1962) found that the ratio had fluctuated around a virtually constant level over a century or so in the United States.

But in the case of Italy, net national saving exhibited wild fluctuations, with extended periods of very little saving - as low as 3 percent of national income - while in other periods the rate hovered in the 17 to 20 percent range. At the same time, Italian fiscal policy exhibited large swings, from the virtuous fiscal stance of the early decade of the XX century and the 1950s, through war-induced deficits, to fiscal imbalances following the oil shocks.

In a series of joint papers, we used the LCH as an organizing framework to capture the correlations between national saving, the economic and population growth rates, and fiscal variables (Modigliani, Jappelli and Pagano, 1985; Modigliani and Jappelli, 1987 and 1990). Our conclusion was that the long swings in the saving ratio reflect primarily two forces - fiscal policies via expenditure and deficits, and variations in the growth rate of the economy. To illustrate, between 1936-39 and 1961-64, the Italian national saving ratio increased 16 percentage points - from 3 to 19. Within that change, we attributed 7 points to fiscal policy, and 7 to the overall growth rate effect.

As for the decline from the early 1960s to the mid-1980s of some 8 points, we found that, contrary to a widely held perception, the major cause of decline was not the seemingly huge and highly visible deficit. Indeed, when the deficit was correctly measured and adjusted for inflation, it appeared rather small even in the 1980s. Accordingly, fiscal policy accounts for less than half of the decline, and only half of that is due to the deficit itself. Furthermore the effect is not due to a substantial deficit in the 1980s but, rather, to a substantial surplus in the 1960s. The more important component of the decline in Italian savings is related instead to the sharp drop in the growth of the economy.

One result of that line of research is that while fiscal policy and deficit, in particular, are important determinants of national saving, their impact cannot be gauged from the behaviour of the current account deficit as conventionally measured, because this measure includes the nominal service of the debt. We found instead that what affects consumption, and hence the deficit relevant to the estimation of the crowding out effect, is the expected real interest

payment. This measure can be very much different from the nominal one under conditions of persistent, readily predictable inflation as those prevailing in Italy since the early 1970s.

A second implication is that what matters for national saving is current government deficit, not the difference between total government revenues and outlays. The two differ mainly for the expenditures on capital account. To the extent that public investment represents an increase in public capital and is correctly measured in the government account, it is current account government deficit that crowds out national saving. Accordingly, what matters is the deadweight debt, or the difference between the national debt and the value of capital, infrastructures and public buildings owned by the government. Thus, we claimed it is important to distinguish that part of government expenditure that is consumed in the current period, crowding out investment (public or private) and net exports, from the productive investment that merely substitutes public for private investment. Our analysis concluded that more reliable figures for public investment would contribute significantly to the design and public discussion of a sound fiscal policy.

## Social security and the age-profile of saving and wealth

The relation between LCH and social security 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. Modigliani took this point very seriously, and contributed to the debate providing international evidence that saving rates

where higher in countries with less generous pensions, controlling for the expected length of retirement (Modigliani and Sterling, 1983).

The presence of mandatory pension arrangements is also important in understanding to what extent people accumulate and decumulate wealth over the life cycle. A unique implication of LCH vis-à-vis the infinite horizon PIH or models in which people save mainly for precautionary purposes, is a hump-shape age-wealth profile. 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" (p. 7).

Modigliani's point to address this criticism is that most evidence on age-saving and age-wealth profiles is based on a concept of disposable income that does not take into account the role of mandated saving through pension systems. Indeed, conventional disposable income treats pension contributions as taxes, and pension benefits as transfers. But since contributions entitle the payer to receive a pension after retirement, they should be regarded as a (compulsory) component of life cycle saving and hence added back to income. On the other hand, pension benefits accruing to the retired do not represent income produced, but rather a drawing from the pension wealth accumulated up to retirement. The greater the amount of mandatory saving, the greater is the difference between earned income and disposable income. Where mandatory contributions are sizable (as in all developed economies), large swings in total life cycle saving are almost completely eliminated if one uses the conventional definition of disposable income and saving. One could even imagine a situation in which mandatory contributions exactly equal the saving that people would have chosen otherwise. But it would be a mistake to conclude that a saving rate of zero through life contrasts with the predictions of LCH, while under such circumstances consumers in fact follows exactly that model!

In countries where pension wealth is a major component of total wealth, the path of discretionary saving is a very poor indicator of saving targeted for retirement. This is shown

in Jappelli and Modigliani (1997) taking Italy as an example. 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 all developed countries, in particular in Western Europe.

In our application we construct two measures of income. Conventional disposable income is obtained directly from the respondent. Earned income is computed adding the mandated contribution to social security - taken as an approximation to mandated saving through public pensions - and subtracting pensions from disposable income. In Figure 2, we plot the age-profile of consumption and of the two income measures.[3] The moderate hump in consumption appears to reflect a similar hump in the age profile of family size, which mirrors the entrance and exit of children, an issue first explored in Ando and Modigliani (1957). The profile of earned income, in contrast to that of consumption, is very hump-shaped. It peaks around age 50, reflecting the very young age at which some pensions have been awarded in Italy. 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, much of which is accounted for by imputed rents on owner occupied housing.

A comparison of the graph of earned and disposable income reported in Figure 2 reveals how conspicuous subtractions from - and additions to - earned income for 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 difference between the two in Figure 2 is itself quite flat.

The shape of discretionary saving cannot be cited as evidence in favour of, or against, the LCH. It can be argued that because people cannot choose the amount of mandatory saving, they should be ignored when it comes to understanding behaviour. But since people can

[3] Each profile is obtained regressing median consumption and income in each age/year/cohort cell on a full set of age dummies, cohort dummies and restricted time dummies, following Deaton and Paxson (1994) approach. The smoothed coefficients of the age dummies are then plotted in Figure 2.

change discretionary saving in response to changes in mandatory saving, total saving is the relevant measure of the change in assets accumulated for retirement.

As for the age profile of discretionary saving, the data for Italy and other countries leave room for considerable doubt as to whether it declines in old age. Modigliani lately recognized that the decline of wealth during retirement is, at best, slow, which is consistent with non-negligible bequests (partly involuntary, resulting from precautionary motives). But even if one could obtain reliable estimate of the rate of discretionary 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. On the other hand, the amounts bequeathed or transferred include transfers by those that have already died or made transfers. It must also be remembered that the amount of bequests left and received cannot be identified with the accumulation dictated by the bequest motive. Given life uncertainty, risk-averse consumers will always find it optimal not to run their assets down to zero, so that part of bequests may constitute unintentional bequests, resulting from the holding of wealth for precautionary reasons.

## Testable theories and theory-guided empirical analysis

Modigliani was able to communicate a research method in which theory does not stand alone without verification, and applications always have theoretical frames, and theory and empirics have always gone hand-in-hand. The mixture of testable theory and theory-guided empirical analysis that Modigliani applied to each of his many research areas finds in the LCH his best example. The strength of his LCH model does not lie merely in its ability to explain individual saving behaviour, but also in providing a framework for a coherent interpretation of the most important macroeconomic variables, chiefly saving, growth, social security and government deficit. For his intuitions, capacity to learn from facts and economic data, distinguishing the essential from the redundant, Modigliani has been an economic giant.

The LCH is the best demonstration that Modigliani himself was a theorist and an empirical scientist. His passionate defence of the LCH was rooted in his very strong view that the LCH was superior to any competing theory. Indeed, many of the implications of the LCH have been shown to be robust with respect to new theoretical developments and new empirical evidence. Today, the widespread implementation of mandatory retirement plans can be interpreted as the social approval of schemes designed to ensure that people have adequate reserves to be spent during retirement; in essence, forcing people to behave like Modigliani and Brumberg suggested fifty years ago, accumulating resources during the working span, and drawing down assets after retirement.

Fifty years after the publication of the LCH, no single theory can explain the vast body of evidence on saving behaviour, and no comparable theory has emerged. Some competing theories have emerged, and many empirical findings are difficult to reconcile with LCH; chiefly aspects of inertia, myopia, and irrational behaviour documented by the recent behavioural literature. But even the findings of behavioural economics are considered "puzzles" precisely in comparison to the reference LCH: few would argue that people wouldn't be better off if they behaved as Modigliani suggested, even when they don't. For this reason, today the LCH is still the benchmark model to think about individual saving decisions, the aggregate evidence and policy issues. And it still delivers a universal lesson for all economists: aggregation must be taken seriously!

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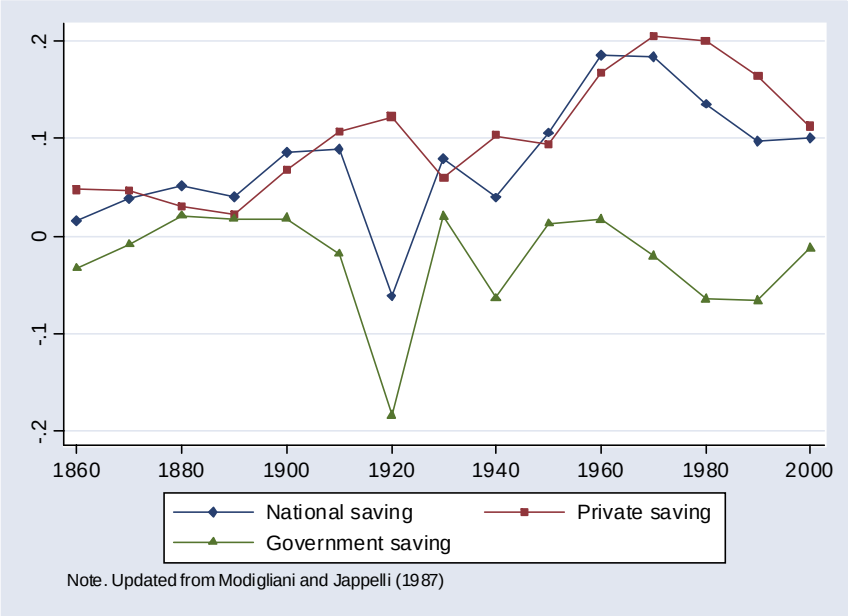
## Figure 1
## National saving components, 1861-2003

The figure reports decade averages of the ratio of net national saving to GDP and its two components, government and private saving. Source: updated from Modigliani and Jappelli (1987).



## Figure 2
## Age profile of consumption, disposable income and earned income

The age profiles of consumption and income are estimated from regressions of median income and consumption on a full set of age dummies, cohort dummies and restricted time dummies. The data are drawn from year/age/cohort data computed in the Bank of Italy Survey of Household Income and Wealth. Income and consumption are expressed in thousand euro. Source: Jappelli and Modigliani (1997).